# 中华医学会放射学分会第十九届全国磁共振学术大会

# 论文汇编

# 大会发言

OR-01

# A free breathing cardiac magnetic resonance protocol at 3.0T in the diagnosis and prognosis of coronary heart disease in patients with breath holding limitation

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Background Conventional CMR imaging was performed under breath-holding (BH), which was adverse in these patients with BH restriction. PURPOSE To explore a free-breathing CMR (fCMR) protocol in the diagnosis and prognosis of coronary heart diseases (CHD) in patients with limited BH. STUDY TYPE Prospectively. POPULATION 311 selected patients with suspicious CHD and limited BH. FIELD STRENGTH /SEQUENCE A 3.0T, fCMR included compressed sensing (CS) accelerated, single-shot cine and motion-corrected (MOCO) single-shot LGE images. ASSESSMENT Image quality (IQ) of cine and LGE was evaluated based on a five-point Likert scale. The value of fMRI in the diagnosis and prognosis of CHD was assessed. STATISTICAL TESTS T test, Mann-Whitney test, Kappa test, Kaplan-Meier curves, Log-rank test, Cox proportional hazard regression analyses, Receiver operating characteristics curves. Results All the IQ of short axis CS-cine and MOCO LGE images no matter short or long axis was ≥ 3 points. 67 patients was diagnosed as CHD by DSA. The AUC for fCMR in the diagnosis of CHD was 0.857 with a sensitivity 89.6%, specificity 81.8%. Over a median follow-up of 31 months (range, 3.8 to 38.2), 25 major adverse cardiovascular event (MACE) occurred. Left ventricular ejection fractions (LVEF) [HR 0.952; 95% CI 0.930-0.974;P＜0.001],3D-Global peak longitudinal strain (3D-GPLS) [HR:1.200; 95% CI: 1.087 -1.324; P＜0.001]and infarction size (IS) (HR1.037; 95% CI 1.014-1.060; P=0.001) were significant multivariate predictors of the MACE when added to the significant clinical predictor. The optimal cutoff value for LVEF, 3D-GPLS, IS in the prediction of MACE was 34.2%, -5.65%, 26.1% respectively, with a sensitivity 90.5%, 64%, 96.0% respectively, and specificity 72%, 95.2%, 85.7% respectively. Conclusions The fCMR protocol could be used for the diagnosis and prognoses of CHD in patients with BH limitation.

OR-02

# A Multiphase Radial DENSE Sequence and Harmonic Motion based Compressed Sensing for Fast Magnetic Resonance Elastography

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Introduction

MR elastography (MRE) is a non-invasive method to estimate the mechanical properties of soft tissues. Recording multiple phases and directions of wave propagation are always desired. However, multiphase, multi-direction MRE usually comes with an extended scan time. Several EPI or spiral based MRE sequences have been developed for acceleration, along with reconstruction methods for fast MRE imaging. Recently, DENSE based encoding was used for multiphase MRE and it showed advantages in low frequency MRE with improved acquisition efficiency. In this study, we proposed a multiphase, radially sampled, DENSE based MRE

sequence (MRD-MRE) for fast MRE. A reconstruction algorithm using the feature of harmonic motion and compressed sensing (CS) was also proposed.

Methods and Materials

For the MRD-MRE sequence, the spatial modulation of magnetization (SPAMM) is applied only once after the trigger of the mechanical vibration. The initial position was encoded to the longitudinal magnetization by the encoding gradient in the SPAMM. The following motion was decoded by a decoding gradient (MDG) Gdn. Therefore, the initial phase offset could be controlled by adjusting the time interval between the trigger signal and the first motion decoding gradient Gd1. Arbitrary sampling intervals for the wave propagation recording could be set by TR and the position of Gdn. The radial spokes were continuously acquired with a golden angle apart based on a gradient-echo sequence. Every 4 radial spokes within one vibration period were considered as a group. Hence, the number of groups after one SPAMM modulation determined the undersampling rate, while the amount of SPAMM shots determined the acceleration factor of the sequence.

Inspired by the GRASP algorithm, we utilized the sparsity of harmonic motion. The acquired MRE data was rearranged and concatenated through the time axis to form a pseudo continuous wave. Then, we applied a temporal fast Fourier transform (FFT) and a modified temporal total variation (TV) transform as sparsifying transforms. By solving the objective function consisting of the data consistency term and modified regularization terms, all the undersampling phase images after were reconstructed simultaneously.

MRE images were acquired from gel phantoms and healthy volunteers. Results were compared with that from GRE and EPI based MRE using a 3T MRI scanner (uMR 790, United Imaging Healthcare, Shanghai, China). Stiffness was estimated using a local frequency estimation (LFE) algorithm. The proposed reconstruction results were compared with those from NUFFT and GRASP.

Results and Discussion

For the gel phantom with two inclusions, the recorded wavelength in the stiffer inclusion was longer. The MRD-MRE sequence performed better in the encoding accuracy, especially for low frequency actuation. For brain imaging, similar wave images were acquired from MRD-MRE. In addition, an acceleration factor of 4 could be achieved (25s vs. 104s).

A comparison of the reconstruction results showed the proposed reconstruction algorithm had better performance than NUFFT and GRASP, with fewer artifacts of the reconstructed waveforms. The peak signal-to-noise ratio (PSNR) and structure similarity index (SSIM) showed the proposed method had the best performance with different acceleration factors (R = 2, 4, 8). The acceleration up to 4 folds showed satisfactory PSNR and SSIM values.

Conclusion

In this study, we proposed an MRD-MRE sequence with a harmonic motion based compressed sensing for accelerated MRE. With the modified TV transform and temporal FFT, reconstruction utilizing the sparsity of harmonic motion and compressed sensing showed the potential of further acceleration. Both the phantom and brain imaging showed the efficiency and accuracy of the proposed method.

## OR-03

# Predicting Motor Outcome of Subthalamic Nucleus Deep Brain Stimulation for Parkinson's Disease Using Quantitative Susceptibility Mapping and Radiomics

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Background: Emerging evidence indicates that iron distribution is heterogeneous within the substantia nigra (SN) and it may reflect patient-specific trait of Parkinson's Disease (PD). We assume it could account for variability in motor outcome of subthalamic nucleus deep brain stimulation (STN-DBS) in PD.
Objective: To investigate whether SN susceptibility features derived from radiomics with machine learning (RA-ML) can predict motor outcome of STN-DBS in PD.
Methods: Thirty-three PD patients underwent bilateral STN-DBS were recruited. The bilateral SN were segmented based on preoperative quantitative susceptibility mapping to extract susceptibility features using RA-ML. MDS-UPDRS III scores were recorded 1-3 days before and 6 months after STN-DBS surgery. Finally, we constructed three predictive models (**Figure 1**) using logistic regression analyses: 1) the RA-ML model based on radiomics features, 2) the RA-ML+LCT (levodopa challenge test) response model which combined radiomics features with preoperative LCT response, 3) the LCT response model alone.
Results: For the predictive performances of global motor outcome, the RA-ML model had 82% accuracy (AUC=0.85), while the RA-ML+LCT response model had 74% accuracy (AUC=0.83), and the LCT response model alone had 58% accuracy (AUC=0.55). For the predictive performance of rigidity outcome, the accuracy of the RA-ML model was 80% (AUC=0.85), superior to those of the RA-ML+LCT response model (76% accuracy, AUC=0.82), and the LCT response model alone (58% accuracy, AUC=0.42).
Conclusion: Our findings demonstrated that SN susceptibility features from radiomics could predict global motor and rigidity outcomes of STN-DBS in PD. This RA-ML predictive model might provide a novel approach to counsel candidates for STN-DBS.

OR-04

# A novel technique: The total resection rate of glioma can be improved by the application of US-MRI fusion combined with contrast-enhanced ultrasound

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Objective: This study was performed to evaluate the diagnostic performance of ultrasound-magnetic resonance imaging (MRI) fusion combined with contrast-enhanced ultrasound and to explore its role in improving the total tumor resection rate.Methods:Between January 2018 and December 2018, 16 patients in the experimental group and 23 patients in the control group were enrolled in this study. The tumor depth and brain shift distance were analyzed, as well as the peak intensity and microvessel density of different grades of gliomas in the experimental group. Finally, we compared the difference in total resection rate between the experimental and control groups. Results: Using ultrasound during operations, we found a significant negative correlation between brain shift distance and tumor depth, with correlation coefficient r =-0.868($P<0.05$).In glioma, the peak intensity and microvessel density increased synchronously with glioma grade($r=0.806$, $P<0.05$). The total resection rate of lesions was significantly higher in the experimental group than in the control group ($P<0.05$).Conclusions: The application of ultrasound-MRI fusion combined with contrast-enhanced ultrasound can improve the total resection rate of lesions, thus playing an important role in clinical practice.

OR-05

# A prospective study on the value of applying the rapid monitoring sequence for bladder mpMRI

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OBJECTIVE: To prospectively explore the value of the rapid monitoring sequence(RM sequence) for quality control of interfering factors in bladder mpMRI. METHODS: Patients who applied for bladder mpMRI for bladder mass from July 2020 to April 2021 were prospectively included by approval of the hospital ethics committee. All patients underwent standardized bladder mpMRI on 3.0T MR scanners, including high-resolution T2WI (three directions), DWI/ADC (0/ 1000/1400 s/mm2), DCE. And a sagittal DWI sequence(0s/mm2, 18 seconds) was added as a RM sequence after the localization phase. Two readers performed artifact scoring of the bladder wall and lumen for the RM sequence, image quality scores of the bladder wall for T2WI, DWI/ADC, and DCE(the arterial phase), respectively, and qualitative diagnosis of bladder wall and lumen(e.g. hemorrhage, air)by mpMRI including T1WI. The diagnostic consistency of RM sequence artifacts and comprehensive diagnosis of mpMRI, diagnostic efficacy of RM sequence, correlation between image quality scores and artifact factors, and the difference of quality scores of each artifact factor group were statistically analyzed by SPSS 21.0. RESULTS: There was good agreement between the RM sequence artifacts and the mpMRI diagnosis (Kappa=0.897, P=0.000). The diagnostic sensitivity, specificity, PPV, NPV, and accuracy of the RM sequence for hemorrhage, air, and urine jet were 100%, 94.87%, 85.70%, 100.00%, and 96.08%, respectively. DWI/ADC and DCE quality scores were negatively correlated with artifact factors (r=-0.363, -0.320; P=0.009,0.022), while T2WI scores were not statistically correlated with artifacts (P=0.110). Grouped by different artifact factors, the differences were statistically significant in DWI/ADC and DCE (F=5.469, 4.893; P=0.001,0.002), and there were no group differences in T2WI (F=2.452, P=0.059). CONCLUSION: Using a short time-consuming and easy-to-observe rapid monitoring sequence(RM sequence), in addition to observing bladder distension, it can accurately indicate the factors that may interfere with mpMRI quality of bladder, such as hemorrhage, air, so as to ensure the VI-RADS score to judge the muscle invasion of bladder cancer accurately.Clinical Relevance/Application: It is recommended that the rapid monitoring sequence be performed routinely in bladder mpMRI to guarantee VI-RADS score accurately evaluate muscle invasion.

OR-06

# Accelerating Acquisition of RESOLVE-DWI with Simultaneous Multi-slice (SMS) Technique in Diagnosing Breast Lesions

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PURPOSE
Readout-segmented echo-planar imaging (RESOLVE) has demonstrated its high diagnostic performance in the breast with sharper Images, better lesion-background contrast, and higher

spatial resolution. However, long scan time (multi-shot strategy) may significantly decrease its clinical application due to possible motion artifacts and the limitation of more complex diffusion approaches. The simultaneous multi-slice (SMS) technique allows for rapid realization of breast MR imaging, which may serve as a superior alternative for the diagnosis of breast lesions. In the study, SMS was implemented into DWI to reduce the scan time by a factor of 2-4, while maintaining the same anatomic coverage and basic image quality. This study is aimed to investigate the feasibility and effectiveness of diffusion-weighted imaging (DWI) using Simultaneous Multi-slice readout-segmented echo-planar imaging (rs-EPI) to diagnose breast lesions.

METHODS
The IRB-approved study was performed on a 3T scanner with a dedicated 16-channel phased-array breast coil (MAGNETOM Skyra, Siemens Healthcare, Erlangen, Germany). 46 female patients (average age of 42.3 years; the range of 26-57 years) with 48 lesions (41 malignant and 7 benign) were enrolled in this study. Patients underwent bilateral breast MRI using a prototypical SMS rs-EPI sequence and a conventional rs-EPI sequence. T1-weighted MRI, T2-weighted MRI, and dynamic contrast-enhanced (DCE-MRI) were also conducted as references. The details of the imaging parameters of both DWI sequences were listed in Figure 1. ADC, MK, MD values were quantitatively calculated for each lesion on both sequences. In addition, all images were qualitatively analyzed by a blinded read using a 5-point scale (1 = poor, 5 = excellent). The difference and correlation of both quantitative and qualitative parameters between conventional rs-EPI and SMS rs-EPI data were statistically analyzed.

RESULTS
Compared to conventional rs-EPI, the acquisition time of SMS rs-EPI was markedly reduced (2:17 vs4:27 minutes). The Pearson's correlation showed an excellent linear relationship for each parameter between SMS rs-EPI and conventional rs-EPI (r = 0.935, 0.914 and 0.965 for MK, MD, and ADC respectively; P<0.01 for all, Fig.2). Furthermore, the ROC analysis demonstrated SMS rs-EPI had better diagnostic performance than conventional rs-EPI, however, the values didn't differ significantly (Fig.3). In blinded read, SMS rs-EPI showed comparable imaging quality with conventional rs-EPI (Fig.4&5), with moderate to good inter-rater reliability (ICC = 0.63-0.83 ).

CONCLUSION
Compared to conventional rs-EPI technique, SMS rs-EPI can markedly reduce the acquisition time and yield similar diagnostic accuracy and comparable image quality, which may be useful to expand the scope of its clinical application in breast imaging, and increase the patient throughout.

OR-07

# Altered voxel-level whole-brain functional connectivity in multiple system atrophy patients with depression symptoms

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**Background：** Depression is a common non-motor system symptom in patients with multiple system atrophy (MSA). Its pathogenesis is unknown. Multimodal functional magnetic resonance imaging (fMRI) is the main tool to explore the mechanism of pure depression and other diseases with depressive symptoms. Applications of fMRI on patients with MSA in accompanied with depressive symptoms is expected to reveal the difference to the MSA-involved depression

mechanism different to the pure depression-involved brain network. Our results found altered secondary network in MSA patients with depression and provided a new idea for determination on treatments to MSA with depression. This study provided neuroimaging evidence for a clinical understanding of non-pure depression and possible reference for treatment measures.
**Materials and Methods：** 62 patients with MSA with depression (N=32) and without depression (N=30) were included in this study. All patients underwent the resting state function magnetic resonance BOLD sequence and T1 structural image on 3.0T MRI scanner. The changes of degree centrality (DC) and functional connectivity (FC) network results were analyzed by DPABI software embedded in MATLAB. The relationship between these changes and the severity of depression was further analyzed. The severity of depression symptoms was evaluated by the 24 terms Hamilton Depression Scale (HAMD-24). A voxel-wise Pearson correlation analysis was used to identify brain regions significantly associated with clinical depression symptoms in MSA patients.
**Results：** The changes of degree centrality in the right anterior cingulate cortex (rACC) was the main manifestation of MSA patients with depression, which was positively correlated with the severity of depression. A secondary FC analysis based on the rACC as a seed revealed a decreased functional connectivity between the rACC and middle temporal cortex and thalamic network. In addition, only altered DC in the right ACC was found to significantly associate with HAMD-24 scores.
**Discussion :** MSA patients with depression mainly showed the changes of central hub and functional connectivity mainly occurred in temporal lobe and subcortical thalamic nuclei of MSA patients with depression compared to those only with MSA. In addition, the importance of rACC as a hub decreased and rACC-based FC network dysfunction in the right middle temporal lobe and right thalamus. The distinct network impairment between MSA patients with and without depression indicated different transmitter system dysfunctions were involved. The results of present study showed altered secondary network in MSA with depression and provided a new idea for determination on treatments to MSA patients with depression. This study provided neuroimaging evidence for a clinical understanding of non-pure depression and possible reference for treatment measures.

OR-08

# Amide Proton Transfer-Weighted (APTw) Predict early evaluation of pathological complete response to neoadjuvant chemotherapy in molecular subtyping of breast cancer

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Purpose
To explore the value of APTw MRI for early evaluation of pCR to neoadjuvant chemotherapy (NAC) in molecular subtyping of breast cancer.

Methods
In this prospective study, a total of 18 female breast cancer patients treated with NAC (49.58±9.73, range:34-68years) were enrolled and informed consent was acquired from each patient. All patients were imaged using a 3.0 T whole-body MR scanner (Philips Ingenia CX, Philips Healthcare, the Netherlands) before NAC, at the end of the first two cycles of NAC (T1) and four cycles of NAC (T2) therapy, with a dedicated seven-channel bilateral phase-array breast coil. All patients were confirmed by surgical histopathology after MR scanning.Specifically, group

1 included 7 patients with pCR status, and group 2 included 11 patients with non-pCR status. The region of interest (ROI) was obtained manually on the APTw MR images, DCE image was used to help drawing the ROIs, which corresponding with the most enhanced part of the lesion on DCE. The mean value of ROI measurements was used as the final APTw values of lesions and maximal lesion diameter as Dmax. The measured image parameters (△APTw values, △Dmax) achieved at T1 and T2 and age were compared between two groups. Receiver operating characteristic curves (ROC) were conducted to assess the predictive capability.

Results

There was no significant difference in age between two groups (p =0.075). The distribution in molecular subtyping of breast cancer of two groups is in Table1.There was no significant difference of △Dmax on T1 (p =0.346), while there was significant difference between the two groups (p =0.046) on T2.The APTw maps are shown as overlays on the anatomical images with the highest correspondence in 18 lesions. The intraclass correlation coefficients (ICC=0.993, 0.991, and for group 1 and 2, respectively) indicate a good inter-observer agreement of the measured △APTw values(Figure 1). △APTw values of pCR were significantly lower than those of non-pCR status on T1 (-0.091% &0.205 %, p <0.001), while there was no significant difference of △APTw values between two groups (p =0.078) on T2(Figure 2,3). Area under the curve (AUC) acquired by △APTw MRI on T1 with an optimal threshold of 0.667 (sensitivity of 100%, a specificity of 58.3 %, and an accuracy of 41.3%).

Conclusion

In this study, we have established the scan reproducibility of APTw imaging for observing different cycles of NAC in molecular subtyping of breast cancers, and presented initial data to show that high sensitivity performance can be achieved by △APTw values for early prediction of pCR status at the end of the first two NAC cycle, which might allow timely regimen refinement before definitive surgical treatment.

OR-09

# Application of Blood Oxygenation Level–Dependent Magnetic Resonance Imaging and diffusion tensor imaging to Assess Renal Pathophysiological Processes Induced by different doses of Iodixanol in Rabbit Model

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Abstract

Purpose

To determine the effect of the Iodixanol injection dose on intrarenal oxygenation and diffusion as measured by blood oxygenation level-dependent (BOLD) magnetic resonance imaging (MRI) and diffusion tensor imaging (DTI) in rabbit model.

Materials and Methods

Eighty-four rabbits were divided into four groups. Saline and iodixanol (1.0, 2.0, 3.0 g iodine / kg) were administered. BOLD-MRI and DTI were acquired longitudinally at 24 h prior to and 1, 24, 48 and 72 h after administration to assess R2*, apparent diffusion coefficient (ADC), and fractional anisotropy (FA) values respectively. The experiment evaluated serum creatinine, histological, and hypoxia-inducible factor-1α (HIF-1α) immunoexpression.

Results

At 24 h, each groups of the ADC and FA values dropped to the lowest, and the R2* value increased to the highest in cortex (CO), outer medulla (OM) and inner medulla (IM). As the injection dose increased, the changes in R2 *, ADC, and FA values increased. Changes in R2*, ADC and FA caused by 1.0 and 2.0 g iodine / kg returned to baseline within 72 hours. The change caused by 3.0 g iodine / kg was the largest and did not recover within 72 hours. Significant negative correlations were observed between ADC, FA, and R2* in CO, OM and IM (all $P < 0.001$, $r = -0.610–0.675$).
Conclusions
The effect of Iodixanol dose on intrarenal oxygenation and diffusion was dose-dependent, and was identified using BOLD-MRI and DTI. The maximum allowable contrast dose (MACD) should not exceed 3.0 g iodine / kg.

OR-10

# Assessment myocardial deformation at the early stage of return to the plains after short-term chronic exposure and long-term chronic exposure to high altitude in a spontaneous hypoxia rat model: a 7.0T MRI Study.

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Objective: The aims of the study were to identify ventricular function abnormalities and evaluate left ventricular (LV) and right ventricular (RV) strain parameters in rats with prolonged plateau exposure using cardiovascular magnetic resonance imaging tissue tracking (CMR- TT).
Materials and Methods: A total of 192 male SD rats aged 4 weeks were randomly divided into plain group and plateau group. Rats in the plain group were fed in the conventional laboratory of Chengdu (500m), and rats in the plateau group were sent from Chengdu to the laboratory of Qinghai-Tibet Plateau (4100 m) for short-term plateau exposure (2 months, n = 48) and long-term plateau exposure (8 months, n = 12). After that, the rats were transported back from the plateau. Once returned to Chengdu, tail vein blood collection was completed within a few hours and submitted for examination. 7.0T small animal CMR was performed immediately for 2 months short-term exposure (on the 1st week, 2nd week, 3rd week and 7th week) and 8 months long-term exposure. CMR- TT-derived RV and LV global radial (ErrSAX) and circumferential peak strains (EccSAX) from the short-axis cine-images and global radial strain (ErrLAX) and longitudinal peak strains (EllLAX) from the long-axis cine-images were obtained. The hearts were collected for histomathological examination (hematoxylin and eosin (HE) staining, Masson trichrome stain, Perls Blue stain). In addition, organ weights (n=24, each group) and mean pulmonary arterial pressure (n=12, each group) were completed supplemented as an experimental part.
Results: After short-term and long-term chronic plateau exposure, plateau rats showed reduced LV end-diastolic volume (EDV) and stroke volume (SV). After 8 months long-term plateau exposure, the RV ejection fraction (EF) of plateau group was decreased compared to the plain group. After 2 months short-term plateau exposure, the LV ErrLAX and EllLAX values of plateau rats were reduced on the 1st week after return the plain and the LV EllLAX values were not fully recovered until the third week back on the plains. Compared with the plain rats, LV ErrSAX, ErrLAX, EccSAX and EllLAX values of plateau rats significantly reduced after 8 months long-term exposure. The RV ErrSAX, EccSAX values of plateau rats showed increased on the 1st week

and recovered on the 2nd week after 2 months plateau hypoxia exposure. RV ErrSAX, EccSAX values of plateau rats were also significantly increased after 8 months plateau hypoxia exposure. After 8 months long-term chronic exposure, the myocardial fibrosis presented moderate correlation with LV ErrSAX, EccSAX, ErrLAX and EllLAX (r = -0.580, P = 0.048; r = 0.667, P =0.018; r=-0.685, P =0.017; r = 0.657， P =0.020). Prussian blue staining detected revealed spotty iron depositions in a few cases plateau rats' hearts, whereas iron deposition was absent in the plain rats.
Conclusion: In plateau rat model with hypoxia-associated myocardial injury after chronic plateau exposure, CMR-TT-derived strain parameters reveal LV suffer from systolic cardiac dysfunction, while the RV did not.

# OR-11

## Brain Glymphatic system is impaired in TBI found with MRI: The first human study

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Purpose
The pathology of neurodegeneration and dementia following the traumatic brain injury (TBI) is still unknown. Recently, a new brain waste clearance system, named 'glymphatic system', was proved to be damaged in TBI rodent studies. Herein, the functionality of human brain glymphatic system of TBI patients and related healthy controls was evaluated and compared using MRI.
Materials and Methods
The glymphatic function was assessed by T1W MRI scans with intrathecal gadolinium injection as tracer. Images were obtained from TBI patients (n = 16) and relatively healthy controls (n = 7) at 4 time points. Along the cerebrospinal fluid (CSF) drawing pathway, Fig.1, 4 predefined regions of interest (ROIs), were automatically generated using standard brain atlas. Each ROI was subsequently split into sub-ROIs including CSF and gray matter (GM) separately for analyzing the signal enhancement characteristics. The signal intensity on T1W images at 4 time points of each ROI was extracted and normalized. The percentage changes of signal enhancements were used for group comparisons.
Results
As shown in Fig.2, after 24-hour contrast agent injection, the percentage changes of T1 signal intensity were significantly higher in TBI patients than controls for CSF and GM, but not for WM in all ROIs (not show here). The CSF enhancement seems more pronounced than GM enhancement. The higher T1 signal in TBI patient at 24 h can be attributed to the reduced efficiency of the contrast agent clearance, which is the key function of glymphatic system.
Conclusion
The significantly delayed enhancements in CSF and GM in TBI group indicates that the brain glymphatic system is impaired in TBI patients. Glymphatic dysfunction may provide a new clue to understand its pathogenesis of the cognitive impairments along with TBI in the later life. What's more, this study reconfirmed the MRI scan with gadolinium intrathecal administration may hold a potential to explore the glymphatic function in human.

# OR-12

# Brain MRI Features of Anti-N-Methyl-D-aspartate(anti-NMDA) Receptor Encephalitis Secondary to Central Nervous System Infection in Adult Patients

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Purpose: Anti-N-Methyl-D-aspartate Receptor (anti-NMDAR) Encephalitis secondary to Central Nervous System (CNS) infection is a unique subtype of the autoimmune-mediated disease, of which the imaging features are unclear. We aim to compare the brain MR imaging features between the anti-NMDAR encephalitis secondary to CNS infection and that without initial infection.
Material and Methods: Seventy adult patients with anti-NMDAR encephalitis were retrospectively enrolled (24 in the post-infection group, 46 in the non-infection related group). Their clinical and imaging features (lesion distribution, lesion shape, enhancement pattern, and brain atrophy) were reviewed and summarized. Lesion distributions were compared between the two groups on lesion probability maps.
Results: The patients with normal brain MR images in the post-infection group were less than those in the non-infection related group (29% vs. 63%, p=0.0113). Visible lesions were shown at the anti-NMDAR encephalitis onset in 17 out of 24 patients in the post-infection group; lesion distribution was more diffuse than non-infection related group, showed higher lesion peak probabilities in the bilateral hippocampus, frontal lobe, temporal lobe, insula, and cingulate. The lesions with contrast enhancement were also more common in the post-infection group than the non-infection related group (7/13 vs. 2/10). Brain atrophy was observed in eight patients in the post-infection group and three in the non-infection group.
Conclusion: Anti-NMDAR encephalitis secondary to CNS infection has its imaging features, which could deepen the understanding of the pathophysiology and manifestation of the autoimmune encephalitis besides the classic type.

OR-13

# Cardiac magnetic resonance endogenous contrast T1 provide distinctive signatures in hypertrophic cardiomyopathy with HFpEF

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Background: We evaluated T1r-mapping technique to detect myocardial fibrosis in patients with hypertrophic cardiomyopathy (HCM) with different levels of myocardium thickness and different subtypes.
Methods: We recruited 32 adult HCM patients and eight volunteers. HCM patients were divided into hypertrophic obstructive cardiomyopathy (HOCM) and hypertrophic non-obstructive cardiomyopathy (HNCM) subtypes. All participants underwent cine (whole heart), T1ρ-mapping, and pre- and post-contrast T1-mapping imaging (three slices) using a 3T whole-body MRI system. Myocardial extracellular volume (ECV) maps were calculated using pre- and post-contrast T1-mapping. For these maps, three slices of myocardium were divided into 16 segments according to American Heart Association standards. Myocardial segments were classified as HCM with normal myocardial thickness (<15 mm) (HCM-N) or HCM with myocardial hypertrophy (HCM-H).

Results: T1ρ increased progressively and significantly from controls to HNCM and then to HOCM (38.1 ± 4.5 vs. 39.4 ± 3.7 vs. 41.8 ± 4.1; P = 0.001). The differences in T1ρ were all significant between controls and the two HCM groups (both P < 0.01) and between HNCM and HOCM (P < 0.001). T1ρ increased progressively from controls to HCM-N and then to HCM-H (38.1 ± 4.5 vs. 39.6 ± 5.0 vs. 41.7 ± 5.1; p = 0.001). The differences between healthy and HCM-N (P = 0.008) and between HCM-N and HCM-H (P < 0.001) were significant. There was no significant difference in the evaluation of T1ρ intragroup (38.1 ± 4.5 vs. 37.9 ± 4.0, p=0.256), and the consistency was high (r = 0.826, 95% CI 0.762 - 0.874).The ECV in the HOCM group was higher than in the HNCM group (34.2 ± 6.4 vs. 31.2 ± 5.5; p < 0.001). The ECV in the HCM-H group was significantly higher than in the HCM-N group (34.5 ± 5.9 vs. 32.9 ± 5.2, p = 0.005). There was a positive correlation between segmented ECV and T1ρ (r = 0.74). Using ECV of 25.9% as the cutoff for normal myocardial fibrosis, the sensitivity, specificity, and area under the curve of T1ρ relaxation times to detect myocardial fibrosis (T1ρ cutoff = 36.5 ms) were 83.7%, 91.3%, and 0.937, respectively.
Conclusion: T1ρ relaxation times detected myocardial fibrosis in patients with HCM with different subtypes, suggesting the potential to become an alternative, noncontrast approach for diagnosis of HCM in patients with severe renal insufficiency.

OR-14

# Correlation of the characteristics of symptomatic intracranial atherosclerotic plaques with stroke types and risk of stroke recurrence

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**Purpose**: To explore the relationship of the characteristics of symptomatic intracranial atherosclerotic plaques (ICAP) with stroke types and risk of stroke recurrence.
**Methods**: Patients with symptomatic intracranial atherosclerotic stenosis were prospectively enrolled. The vessel stenosis degree, plaque shape, plaque thickness, plaque burden, and plaque enhancement degree of all patients were assessed using high-resolution magnetic resonance imaging and statistically analyzed.
**Results**: In total, 206 patients (mean age (64±12) years; 141 males) were included in this study, 154 had acute ischemic stroke (AIS), 52 had transient ischemic attack (TIA), 124 had anterior circulation ischemic symptom (ACIS), and 82 had posterior circulation ischemic symptom (PCIS). AIS patients showed higher diastolic blood pressure (t=-2.605, *p*=0.011), total cholesterol (t=-2.470, *p*=0.014), apolipoprotein b (z=-2.411, *p*=0.016), apolipoprotein a/b (t=-2.865, *p*=0.006), LDL (t=-2.424, *p*=0.016), arteriosclerosis index (z=-2.256, *p*=0.024), stenosis degree (t=-3.317, *p*<0.001) but smaller luminal area at the plaque than TIA patients (t=2.539, *p*=0.013). In addition, 24 (13.6%) patients had stroke recurrence within 6 months. The proportion of patients with T1WI hyperintensity was higher in patients with recurrent stroke than in patients without recurrent stroke (RR=2.592 (1.091, 6.58); $\chi^2$=4.892; *p*=0.034). Patients with PCIS had greater plaque thickness (t=-4.205, *p*<0.001) and remaining luminal area (z=-4.127,*p*<0.001), significantly enhanced ICAP ($\chi^2$=9.681, *p*=0.003), more positive remodeling ($\chi^2$=5.661, *p*=0.015) and higher incidence of T1WI hyperintensity ($\chi^2$=16.472, *p*<0.001) than patients with ACIS. The prevalence of diabetes ($\chi^2$=9.038, *p*=0.004) in patients with PCIS is higher than that in patients with ACIS.
**Conclusions**: The degree of stenosis and the remaining luminal area of symptomatic ICAP are related to the type of stroke, and patients with T1WI hyperintense plaque had a higher risk of stroke recurrence within six months. Posterior circulation responsible plaque tends to have higher vulnerability, which may be related to metabolic factors secondary to diabetes.

OR-15

# Cortical microstructural alterations are more sensitive than morphology changes to cortical degeneration in Parkinson's disease with mild cognitive impairment

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Objective: To compare the sensitivity of detection cortical degenerative changes in patients with Parkinson's disease (PD) and mild cognitive impairment (MCI) between the diffusion magnetic resonance imaging (MRI) and structural MRI.
Background: Cognitive impairment is one of the most common and debilitating non-motor symptoms of PD. Early identifying PD-MCI, who are at higher risk with dementia, are clinical essential. Structural MRI reported regional cortical atrophy in PD-MCI with inconsistent results. Techniques sensitive to brain microstructure may be better suited to detect cortical changes linked to PD-MCI. Methods: A total of 108 subjects, including 38 patients with normal cognition (PD-CN), 38 PD-MCI, and 32 healthy controls (HC), were included. PD-MCI was diagnosed according to the MDS Task Force level 2 criteria. Cortical microstructural alterations were evaluated by using Neurite Orientation Dispersion and Density Imaging (NODDI) model with gray matter-based spatial statistics (GBSS) (Figure 1). Cortical thickness analyses were performed using the FreeSurfer software.Results：The demographic and clinical characteristics of all subjects are presented in Table 1. For cortical microstructural analyses, compared with HC, PD-CN showed lower orientation dispersion index (ODI) in bilateral cingulate and supplementary motor area; while PD-MCI showed widespread lower ODI throughout bilateral frontal, parietal, occipital and right temporal areas and regional lower neurite density index (NDI), predominantly in left frontal area and cingulate (Figure 2). No significant difference was found between the PD-MCI group and the PD-CN group for cortical microstructural alterations. For cortical thickness analyses, there were no group difference in any vertex in the between-group comparisons. The NDI values within the areas with lower NDI was associated with the global cognitive function Montreal Cognitive Assessment (MoCA) in the PD patients ($r = 0.240$, $p = 0.041$) ( Figure 3).Conclusions：Cortical microstructural alterations may be much more sensitive than morphology changes to cortical degeneration in PD-MCI.

OR-16

# Evaluation of Segmental Viable Myocardium in Rats with Myocardial Ischemia-Reperfusion Injury Using Low-dose Dobutamine Stress Cardiac MRI with Tissue Tracking

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Purpose:
To investigate the value of Cardiovascular Magnetic Resonance Tissue Tracking (CMR-TT) combined with low-dose dobutamine in detecting myocardial viability after acute myocardial ischemia and reperfusion in rats.
Methods and materials:
24 adult male SD rats were divided into experimental and sham operation group, with half in each group. The left anterior descending coronary artery was ligated in rats and released after 30 minutes of occlusion to induce a myocardial ischemia-reperfusion model in rats, the sham operation group was operated without ligation. On the 1st and 3rd days after modeling, the resting state and low dose dobutamine stress state [10 μg / (kg · min)] Cine sequence and LGE delayed enhancement sequence [Gd- DTPA (0.15 mmol/kg, 1 ml/s)] were performed by using 7.0T MR. CMR-TT used CVI42 software for myocardial strain analysis to obtain myocardial strain indicators and left ventricular function related indicators. Three and two-dimensional strain of anterior wall and anterior septum, include global peak longitudinal strain (GPLS), radial strain (GPRS), circumferential strain (GPCS), peak radial strain (PRS) and circumferential strain (PCS), were measured at baseline, after reperfusion and dobutamine stress. At the end of each scan, 6 rats were euthanized in each group, and the hearts were taken for pathological and TTC staining. The presence or absence of cardiomyocytes and neocapillary formation were observed in the experimental group. Quantitative data were compared between the two groups using an independent sample t test or a nonparametric test (Mann-Whitney U test).
Results：
During baseline, statistical significance of GPLS, GPRS, GPCS, PRS and PCS dose not present between viable and nonviable myocardium group ($p > 0.05$). Same as that observed after reperfusion except strain decrease without significant ($p > 0.05$). While low dose dobutamine stressing, PRS and PCS of viable myocardium group increased significantly compared with that detected after reperfusion ($p < 0.05$). Significant variances were presented between viable and nonviable myocardial group during stress. In addition, there was a significant difference between two-dimensional strain measured from cine-MR at rest and with stress. Strain variance of nonviable myocardium group during dobutamine stress dose not observe compared that detected after reperfusion ($p > 0.05$). The PRS of the myocardial segment corresponding to the LGE-enhanced region under stress was significantly lower than that at rest (18.2±3.9 VS 43.9±15.8; $P=0.045$), and PCS was significantly higher than the resting state (-12.7±1.9 VS -22.0±4.6; $P=0.03$), the difference was statistically significant.
Conclusion：
In addition to detecting myocardial dysfunction, strain measurements are helpful in the assessment of myocardial viability. The application of low-dose dobutamine stress cardiac MR with tissue tracking is an objective and accurate method to evaluate survived myocardium, which may provide a new strategy to estimate ischemic heart diseases.

OR-17

# Inversion-recovery prepared 3D oscillating gradient sequence improves diffusion-time dependency measurements in the human brain

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Introduction

Oscillating gradient (OG) has been used to assess diffusion at short diffusion-time (td), and to infer about the tissue microstructures. This technique is limited in the clinical application due to the low gradient strength on the human MRI system, which results in a long echo time (TE) and repetition time (TR) to reach a reasonable oscillating frequency and b-value. We recently proposed a 3D oscillating gradient-prepared gradient spin-echo (OGprep-GRASE) sequence to target these two problems. Moreover, we found that the td-dependency could be affected by CSF signals due to partial volume and point-spread-function effects, for tissues close to the ventricle and sulci, such as the hippocampus and cortical gray matter (GM).

The present study aimed to investigate the effect of CSF contamination by examining the td-dependency measured with or without an inversion recovery (IR) module in the OGprep-GRASE sequence. Moreover, we accelerated the OGprep-GRASE sequence with parallel imaging using the Generalized auto-calibrating Partial Parallel Acquisition (GRAPPA) method to further shorten the TE and readout duration. We tested the proposed 3D IR-OGprep-GRASE sequence with GRAPPA acceleration in measuring td-dependency in several GM and white matter (WM) regions of the human brain on a 3T system.

Methods

Pulse sequence: Figure 1 shows the 3D IR-OGprep-GRASE sequence, which consisted of four modules: the inversion recovery module, diffusion preparation module, fat saturation module, and GRASE readout module. An inversion recovery module with an inversion time (TI) of 2500 ms was added at the beginning of the sequence to null the CSF signal. GRAPPA acceleration was achieved in the EPI phase-encoding direction but not the turbo-echo direction.

Data acquisition: Six healthy volunteers were enrolled with IRB approval. All scans were performed on a 3T MAGNETOM Prisma scanner with a 64-channel head coil. dMRI data were acquired using the 3D OGprep-GRASE sequence with or without the IR module with a PG-encoding (△eff = 40ms, 0Hz) and OG-encodings at frequencies of 20 Hz (1 cycle), 40 Hz (2 cycles), and 60 Hz (3cycles) (effective td = 25, 12.5, and 8.3 ms). The other parameters were kept the same: FOV = 220 × 200 mm2, voxel size = 2 × 2 × 4 mm3, TR/TI/TE1 (TE of the diffusion module)/TE2 (TE of the GRASE module) = 9000/2500/103.46/31.94 ms, NEPI = 39, NTSE = 12, b = 420 s/mm2 with 6 directions and two averages, b = 0 with 4 averages, GRAPPA accelerated factor = 2.

Data analysis: The acquired K-space data were reconstructed by GRAPPA reconstruction with Tikhonov Regularization. Regions of interest (ROIs) including the hippocampal subfields (head, body, and tail), cortical GM, thalamus, posterior WM, and splenium of the corpus callosum (CC) were manually delineated on b0 images (Figure 2). The differences in ADC between the multi-frequency OG-dMRI and PG-dMRI data were assessed by ANOVA followed by post-hoc t-tests with Bonferroni correction. Besides, we estimated the apparent diffusion dispersion rate (Λ) and exponent (θ) based on the diffusion dispersion model: $D_{\omega} = \Lambda \cdot \omega^{\theta} + D_{\omega 0}$.

Results

Figure 2 shows the b0 and ADC images acquired with PG- and OG-dMRI at different frequencies. Pairwise comparisons of ADC at different td's are summarized in Figure 3, which demonstrated td-dependent changes in the thalamus and posterior WM regions ($p < 0.001$) using both IR-OGprep-GRASE and OGprep-GRASE sequences. However, in the hippocampus, cortical GM, and splenium of CC that are close to the CSF, td-dependent ADC changes were only clear with the IR module. Also, ADCs measured with the IR sequence was significantly lower than that of the non-IR sequence ($p < 0.001$).

Comparing the ADC values from different ROIs, we found ADCs in the hippocampal head were lower than that in the body or tail, and its td –dependent change was faster (from PG to OG-

20Hz) than the other two sub-regions (Figure 4A). For the other ROIs (Figure 4B), we found the td–dependency pattern of cortical GM was distinct compared to other GM and WM regions, with a slower change from PG to OG-20Hz.
The diffusion dispersion parameters Λ and θ are displayed in Figure 5. We found θ>1 in most GM ROIs except for the hippocampal head, and θ < 1 in all WM ROIs. Λ was considerably higher in the hippocampal head than that in the hippocampus body/tail and cortical GM. The other GM and WM regions showed an intermediate Λ.

Discussion and Conclusion
In this work, we proposed a 3D IR-OGprep-GRASE sequence to investigate td-dependent diffusivity in the human brain. Compared with the previously developed OGprep-GRASE sequence, the proposed sequence with IR preparation can effectively suppress the CSF signal, and therefore improve the td-dependency measurements in the hippocampus, cortical GM, and CC. Besides, the current sequence is equipped with parallel acceleration to reduce the TE and improve the PSF profile.
Based on IR-OGprep-GRASE measurements, we identified distinct td-dependency profiles in the human brain; moreover, sub-regions (head, body, and tail) of the hippocampus exhibited different td-dependency, possibly related to the different structural-functional organization of the sub-regions. The diffusion dispersion model showed the estimated θ < 1 in the splenium of CC, which was consistent with the recent report. Interestingly, θ of the GM was larger than in the WM regions, indicating different structural disorder between GM and WM.

OR-18

# Multiparametric Cardiovascular Magnetic Resonance in Acute Myocarditis: Validation of Lake Louise Criteria 2009 and 2018 with Endomyocardial Biopsy Confirmation

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Background CMR has been described to improve the diagnosis of myocarditis, but no systematic comparison of these techniques is available. The purpose of this study is to validate the 2009 Lake Louise Criteria (LLC) and the 2018 LLC for the diagnosis of acute myocarditis at 3 T MRI with endomyocardial biopsy (EMB) as a reference and provide the cutoff values for multiparametric cardiac magnetic resonance (CMR) techniques.
Methods Seventy-three patients (32±14 years, 71.2% men) with clinically suspected myocarditis undergoing EMB and CMR at 3.0 T were enrolled in the study. Patients were divided into two groups according to EMB results (EMB positive and EMB negative group). The CMR protocol consisted of cine-SSFP, T2 STIR, T2 mapping, early and late gadolinium enhancement (EGE) and pre- and post-contrast T1 mapping. Their potential diagnostic ability was assessed with receiver operating characteristic (ROC) curves.
Results Myocardial T1 and T2 relaxation times were significantly higher in EMB positive group than in EMB negative group. Optimal cutoff values were 1228ms for T1 relaxation times and 58.5ms for T2 relaxation times with sensitivities of 86.0% and 83.7%, specificities of 93.3% and 93.3%, respectively. The 2018 LLC had better diagnostic performance than the 2009 LLC regarding sensitivity, specificity, positive predictive value and negative predictive value. T1 mapping+T2 mapping had the largest area under curve (0.95) compared with other single or

combined parameters (2018 LLC:0.91; 2009 LLC: 0.76; T2 ratio:0.71; EGEr:0.67; LGE:0.73; 2018 LLC+EGEr:0.91; T2 ratio+LGE:0.76). For the diagnostic accuracy, the 2018 LLC was the highest (91.8%) followed by T1 mapping (89.0%) and T2 mapping (87.7%).
Conclusions Emerging technologies such as T1/ T2 mapping have significantly improved the diagnostic performance of CMR for the diagnosis of acute myocarditis. The 2018 LLC provides the overall best diagnostic performance in acute myocarditis compared with other single standard CMR parameters or combined parameters, but there is no significant gain when combined with the EGE sequence.

OR-19

# Myocardial Extracellular Volume Fraction Quantification in patients with non-ischemic heart failure Using Late Iodine enhancement from Dual-energy Computed Tomography：comparison with MRI T1 mapping

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Purpose：
To validate the quantification of myocardial extracellular volume fraction (ECV) by using late iodine enhancement (LIE) derived from dual-energy computed tomography (DECT), with the ECV based on cardiac MR (CMR) as the reference standard.
Methods and Materials：
22 patients with suspected heart failure (49±11years, 15 men) underwent both DECT (iQon Spectral CT ; Philips Healthcare, Best, the Netherlands ) and CMR (1.5T , Magnetom Avanto, siemens, best, Netherlands). 9 subjects (56±9 years, 4 men), who underwent DECT for chest pain and were found to have no coronary abnormalities with negative electrocardiogram and myocardial enzyme testing, were serve as a control group. CCTA was performed by intravenous injection of 0.9ml/kg of iopamidol to assess coronary arteries. LIE was acquired 7 minutes after iodine administration. Iodine images were reconstructed at 8mm slice thickness, 6 mm slice gap to the short-axis plane of the left ventricular (LV) myocardium and then the basal, mid and apical slices were extracted. CMR T1maps were obtained in short-axis at the basal, mid and apical slices of LV myocardium consistent with the LIE images before and 10 minutes after intravenous administration of 0.1mmol/kg of Gadobutrol via using the modified Look-Locker inversion recovery sequence. ROIs were manually drawn on myocardium using the AHA's 16-segment model of the LV and the LV blood pool (Fig.A). CT-ECV and CMR-ECV were calculated, respectively (Fig.B, C, D, E, F). Correlation between groups were evaluated with Pearson correlation analysis. Differences between groups were determined with test. The bias and the 95% limits of agreement was assessed with Bland-Altman analysis.
Results：
Among the 22 patients, 17 were diagnosed as nonischemic heart failure (NIHF) according to the results of CCTA and CMR, were enrolled in this study. The mean radiation dose of the DECT in NIHF and HCs has no statistic difference (10.35 mSv ± 1.67 vs 10.78 mSv ± 3.01 , P=0.699). In patients with NIHF, CT-ECV correlated with CMR-ECV (r= 0.856, P＜0.001) and there was no significant difference between the mean values of CT-ECV and CMR-ECV (33.57% ± 2.96 vs 33.16% ± 3.17, P=0.322). Bland-Altman analysis showed CT-ECV was comparable to CMR-ECV with small bias (95%CI: -11.2% to 8.6%, bias = -1.3%). The CT-ECV in patients with NIHF was significantly higher than that in HCs (33.57% ± 2.96 vs 27.06% ± 2.59, P＜0.0001 ).
Conclusions：

CT-ECV derived from LIE can serve as an excellent alternative to CMR-ECV in noninvasively quantifying diffused myocardial fibrosis. Furthermore, CT-ECV have the potential to be used for risk stratification in patients with heart failure.

## OR-20

# Plectin-1-targeted Superparamagnetic Iron Oxide Nanoparticles as Novel MRI Contrast Agents For Precise Imaging of Pancreatic Ductal Adenocarcinoma

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**Purpose**
Pancreatic ductal adenocarcinoma (PDAC) is currently the fourth cause of cancer-related death worldwide and shows the lowest 5-year relative survival rate of 9%. Therefore, accurate imaging for diagnosis and treatment monitoring is indispensable for improving therapeutic efficacy and patients' survival rate. Plectin-1 is highly expressed in PDAC and recognized as a specific biomarker to distinguish lesions. The aim of this study was to develop a novel Plectin-1-targeted MRI contrast agent for precise detection and qualitative diagnosis of PDAC in both orthotopic and subcutaneous PDAC xenografts.
**Methods**
Plectin-1-targeted superparamagnetic iron oxide nanoparticles (SPIONs) were synthesized using SPIONs and PTP (Plectin-1 Targeted Peptide). Subcutaneous and orthotopic PDAC mouse models were established. MRI was conducted for quantitative evaluation of tumors at different time points. Histology and immunohistochemical analysis were used as references for validation.
**Results**
We successfully developed PTP-$Fe_3O_4$ nanoparticles with targeting specificity of PDAC xenografts. The probe showed good imaging performance for MRI in vitro. In both subcutaneous and orthotopic PDAC xenograft models, the PTP-$Fe_3O_4$ nanoparticles showed better targeting specificity, uniform distribution and longer retention effects for 7 days compared with CON-$Fe_3O_4$ nanoparticles. MRI observations showed that PTP-$Fe_3O_4$ nanoparticles were distributed throughout the tumor and drew distinct periphery of tumors, while CON-$Fe_3O_4$ nanoparticles were confined to the injection site . Histology and immunohistochemical analysis were in accordance with the MRI observations.
**Conclusion**
PTP-$Fe_3O_4$ nanoparticles could allow precise detection of PDAC with high sensitivity and resolution for better diagnosis at anatomical and molecular levels, which may potentially benefit patients with PDAC for early and sensitive detection. The nanoparticles also possess intraoperative imaging and hyperthermia properties with great potential for guidance of precision therapy. Therefore, Plectin-1-targeted MRI contrast agent holds great promise for detecting PDAC in patients.

## OR-21

# MRI-based radiomics nomogram for selecting ovarian preservation treatment in patients with early-stage endometrial cancer

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**Objective** Ovarian preservation treatment (OPT) was recommended in premenopausal women with early-stage endometrial cancer. A radiomics nomogram was developed to assist radiologists in assessing the myometrial invasion (MI) and in selecting eligible patients for OPT.
**Methods** From Feb. 2014 to May 2021, 209 G1/2-EEC patients younger than 45 years old were included. Of them, 104 retrospective patients were enrolled in the primary group, and 105 prospective patients were enrolled in the validation group. The radiomics features were extracted based on magnetic resonance imaging and the LASSO was applied to reduce the dimensionality of the data and select the radiomics features that correlated with the depth of MI in G1/2-EEC patients. A radiomics nomogram was developed by combing the selected radiomics features and the cancer antigen 125. ROC curves were used to evaluate the diagnostic performance of the radiomics nomogram, and of radiologists without and with the aid of the radiomics nomogram.
**Results** In the primary group, the AUCs were 0.94 and 0.89 for the radiomics nomogram; were 0.80 and 0.92 for radiologists 1, and 0.86 and 0.94 for radiologist 2 without and with the aid of the nomogram, respectively. In the validation group, the AUCs were 0.94 and 0.94 for radiologists 1 and 2 with the aid of the nomogram, respectively.
**Conclusions** The radiomics nomogram outperformed radiologists and could help radiologists in assessing the MI and selecting eligible OPTs in G1/2-EEC patients.

OR-22

# Surface-based Amplitude of Low Frequency Fluctuation Alterations in Patients with Tinnitus Before and After Sound Therapy: A Resting-State fMRI Study

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Purpose: This study aimed to explore brain surface-based amplitude of low frequency fluctuation (ALFF) changes in patients with idiopathic tinnitus before and after 24 weeks of sound therapy.
Methods: In this prospective observational study, we recruited thirty-three tinnitus patients who had undergone 24 weeks of sound therapy and twenty-six matched healthy controls. For the two groups of subjects, ALFF, the indicator of local neural activity was analyzed at baseline and at the 24th week. For all participants, 3.0T magnetic resonance imaging (MRI) was acquired with a resting-state functional images of all participants using an echo-planar imaging (EPI) sequence. Functional image data preprocessing was performed using the DPABISurf toolbox. Tinnitus Handicap Inventory (THI) scores were used to assess the severity of tinnitus before and after treatment. Two-way mixed model analysis of variance (ANOVA) and Pearson's correlation analysis were used in the statistical analysis. Student-Newman-Keuls (SNK) tests were used in the post hoc analysis.
Results: Interaction effects between the two groups and the two scans in local neural activity as assessed by the amplitude of low-frequency fluctuation were observed in bilateral dorsal stream visual cortex (DSVC), bilateral posterior cingulate cortex(PCC), bilateral anterior cingulate and medial prefrontal cortex(ACC&MPC), left temporo-parieto-occipital junction(TPOJ), left orbital and polar frontal cortex(OPFC), left paracentral lobular and mid cingulate cortex (PCL&MCC),right insular and frontal opercular cortex(IFOC) and left early visual cortex(EVC). (Fig1&2) Importantly,

local functional activity in the left TPOJ, right PCC in the patient group were significantly lower than that in the healthy controls at baseline and was increased to relatively normal levels after treatment. The 24-week sound therapy tinnitus group demonstrated a significantly higher ALFF in the left TPOJ, right PCC than in the tinnitus baseline group；Compared with the HC baseline group and the HC 24-week group, the 24-week sound therapy tinnitus group demonstrated slightly lower or higher ALFF in the left TPOJ, right PCC, and there were no significant differences between the 24-week sound therapy tinnitus group and HC groups. (Fig 3)
Conclusions: Resting-state functional magnetic resonance imaging can provide surface based functional information to explain mechanism of tinnitus treatment and these brain regions could serve as potential targets for neuroimaging of sound therapy on the brain.

OR-23

# Tomoelastography Viscoelasticity Measurement of Focal Liver Lesions: Prospective assessment of correlation with ex vivo mechanical testing

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Purpose:
To investigate the reproducibility and reliability of tomoelastography viscoelasticity measurement of focal liver lesions with a paired ex vivo mechanical testing using surgical specimens.
Materials and methods:
This prospective study was approved by the institutional review board and local ethics committee. Written informed consent was obtained from all study participants. Between June and September 2020, a total of 66 patients were initially included in the study protocol and underwent multifrequency MRE. All imaging experiments were performed on a clinical 1.5 T unit. The multifrequency MRE using four drive frequencies from 30 to 60 Hz. Two independent readers (with 12 and one years of experience of abdominal imaging interpretation, respectively) measured the liver and tumor stiffness for each patient. Interobsever agreement were determined by using 95% Bland-Altman limits of agreement and intraclass correlation coefficients (ICCs). Finally, 28 patients(24 males; median age, 60 years; age range, 36-73 years; BMI: 22.84±2.71) underwent liver surgery. The resected fresh in vitro liver tumor specimen stiffness was measured using a biomechanical method (Indentation Test). The viscoelastic parameters (G0 and Ginf) were calculated by fitting the experimental curves by modeling. Pearson test was performed to determine the correlation of MRE-based stiffness and in vitro measurement.
Results:
28 lesions in 28 patients included 22 HCC, 2 ICC, 2 metastasis from colon cancer, 1 FNH, and 1 inflammatory pseudotumor. The mean diameter of the lesions was 47 mm（range, 20~120 mm）. The mean stiffness of different liver lesions were 2.696 kPa for HCC, 3.916 kPa for ICC, 3.841 kPa for Mets, 2.805 kPa for FNH, 2.961 kPa for inflammatory pseudotumor, respectively. There was no significant difference in the mean stiffness between two readers. The overall reproducibility of c value and φ value measurements were good (ICCs were 0.9466 (0.8858 to 0.9752) for c value; and 0.9274 (0.8446 to 0.9662) for φ value). The 95% limits of agreement ranged from 0.8858 to 0.9752 of c value, and 0.8446 to 0.9662 of φ value. In vitro study showed strong correlation between tomoelastography viscoelasticity stiffness measurement and ex vivo mechanical testing measurement.（c value-G0：r=0.713, ＜0.0001；φ-Ginf：r=0.493, p=0.0077）
Conclusion: Tomoelastography viscoelasticity measurement of focal liver lesions is reproducible and reliable.

OR-24

# T1 mapping on gadoxetic acid-enhanced MR imaging for preoperative prediction of microvascular invasion in hepatocellular carcinoma

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【Purpose】
The aim of our study was to explore the usefulness of T1 mapping on gadexetic acid-enhanced MR imaging in predicting MVI and early recurrence of HCC after curative resection.
【Methods】
79 patients with surgically confirmed HCC (27 MVI-positive lesions and 52 MVI-negative lesions) were prospectively examined and followed up for at least 1 year after resection. Freehand region of interests (ROIs) were outlined around the largest cross-sectional area of the tumor on pre-enhancement and hepatobiliary phase (HBP)T1 maps. Pre- and postcontrast T1 relaxation time, reduction rate of T1 relaxation time (△%), and radiologic findings (tumor margin, corona enhancement, peritumoral hyperintensity on HBP, and the signal intensity on HBP images) were then assessed. Univariate and multivariate logistic regression analyses were performed to identify the independent predictors of MVI and early recurrence. The diagnostic ability of these parameters was evaluated by receiver operation characteristic (ROC) analysis.
【Results】
27(34%) recurrences were confirmed by imaging follow up. Peritumoral hypointensity on HBP (Odds Ratio [OR]=0.308, 95% confidence interval [CI]: 0.094-1.016; p=0.053), pre-contrast T1 relaxation time (OR=1.048,95%CI: 1.001-1.070; p=0.032) and reduction rate of T1 relaxation time (OR=0.238,95%CI: 0.068-0.814; p=0.005) were independent risk factors for MVI. Reduction rate of T1 relaxation time demonstrated a higher area under the ROC curve (AUC) than pre-contrast T1 relaxation time and peritumoral hypointensity on HBP (AUC=0.702 vs. 0.678 and 0.639, respectively). Combining these independent factors, the AUC of 0.825 (95%CI: 0.727-0.923) was obtained, with sensitivity of 74.1% and specificity of 80.8%, for predicting MVI. For early recurrence, only corona enhancement (p=0.013) and signal intensity on HBP images (p=0.015) were identified as independent predictors.
【Conclusion】
Combing with the presence of peritumoral hypointensity on HBP, T1 mapping on gadoxetic acid enhanced MRI demonstrated an improved discriminative ability in the preoperative prediction of MVI and may guide the clinical-decision making to improve the therapeutic outcome and appropriate patient selection for both liver transplantation and hepatic resection.

OR-25

# The distinction of brain network topology and structural-functional connectivity coupling explain different outcomes in tinnitus patients treated with sound therapy

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This study was conducted to investigate whether tinnitus patients with different outcomes (effective group: EG or ineffective group: IG) after sound therapy have different topological alterations of structural connectivity (SC), functional connectivity (FC), and SC-FC coupling, as well as their correlations with patients' clinical performance.Resting-state functional magnetic resonance imaging (rs-fMRI) and diffusion tensor imaging (DTI) were prospectively acquired in 60 patients with idiopathic tinnitus (28 as EG and 32 as IG) and 57 healthy controls (HCs). Graph theoretical network analyses of SC and FC were performed. Associations between the clinical performance and graph-theoretical features were also analyzed.
For the FC, there were no differences in graph-theoretical features between the tinnitus patients (whether EG or IG) and HCs, whereas the EG showed higher local efficiency (Eloc) than the IG. For the SC, both the EG and IG displayed lower normalized characteristic path length (λ), Lp, and global efficiency (Eg) than the HCs, whereas no significant differences existed between the EG and IG. Importantly, the IG had a higher coupling than the HCs, whereas there was no difference in coupling between the EG and HCs. In addition, significant associations existed between the SC graph-theoretical features and clinical performance in EG patients.
Our findings demonstrate that EG and IG tinnitus patients show distinct network-level reorganization patterns, especially in SC and SC-FC coupling, which may help to better understand the anatomical-functional interaction mechanisms underlying tinnitus patients' different outcomes. This may provide useful information for individualized therapeutic strategies for tinnitus patients.

OR-26

# The reproducibility of exercise stress cardiac MR hyperemic myocardium native T1 and myocardial perfusion imaging using an MRI-compatible ergometer pedal exerciser

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TITLE:
The reproducibility of exercise stress cardiac MR hyperemic myocardium native T1 and myocardial perfusion imaging using an MRI-compatible ergometer pedal exerciser

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INTRODUCTION:
Detecting patients with underlying cardiovascular abnormalities that are not present under physical rest is challenging. Adenosine stress native T1 mapping and stress perfusion with cardiovascular magnetic resonance (CMR) may accurately detect obstructive CAD and microvascular dysfunction in the general population. This study assessed changes in myocardial native T1 values and myocardial blood flow (MBF) at rest and exercise stress in healthy subjects using a new custom-made MRI-compatible ergometer pedal exerciser, and determine the feasibility and reliability of exercise stress native T1 mapping MBF and myocardial perfusion reserve (MPR) measurements in patients at rest and during the exercise.

METHODS:
10 healthy volunteers underwent CMR scanning twice in a 3.0T MR scanner. Free-breathing myocardial native T1 mapping and MBF were performed by using shortened modified Look-Locker inversion recovery and dynamic sequence in the midventricular short-axis slice positions. Stress native T1 maps were acquired every one minute during the exercise stress and MBF was acquired on 4th minute (alternately depressing pedals for 4 minutes at 60 Hz) using a customer-made MRI-compatible ergometer pedal exerciser on the MR table (Figure.1). Global myocardial T1 at rest and various time points during the stress was measured with CMR 42 versions 5.10.1.MBF was quantified by a respiratory motion-corrected myocardial perfusion method with auto-mated perfusion mapping. The repeatability of the two tests was compared with the intra-group correlation coefficient (ICC) and coefficient of variation (CV). The consistency of the tests was analyzed by paired t-test and Bland-Altman method. All statistical analyses were performed using MedCalc 19.0.7.

RESULTS:
The mean exercise intensity was 15.6W, with an exercise duration of 4 minutes. Exercise-induced a 10.3 (7.4, 16.4) % increase in systolic blood pressure, a 59.7 (27.6, 71.2) % increase in heart rate, and a 65.4 ± 48.2% increase in the rate pressure product compared with resting values (all $p < 0.001$). Myocardial T1 values at the 1st minute were significantly lower [3.35(- 9.5 to 9.5)%] than those at the 2nd minute[5.99(- 15.6 to 18)%] and third mins[4.01(- 11.9 to 11.7)%]. It was demonstrated that T1 reactivity (ΔT1 values) had a moderate reliability (ICC=0.61) and an excellent repeatability (CV =3.4% < 5%). The stress T1 values for first, second and third mins were 1302 ± 70 ms, 1310 ± 84 ms, and 1311 ± 70 ms ($p<0.01$)， respectively, which were significantly larger than rest T1(1260 ± 44 ms, $p<0.05$), and ΔT1 values were 3.4 ± 5.3%, 4.1 ± 6.4% and 4.2 ± 5.5%, $p<0.05$. Mean global rest MBF, stress MBF and MPR were 0.9 ± 0.1, 1.6 ± 0.3 ml/min/100g and 1.8 ± 0.2, respectively. Test-retest reliability of global MPR was commonly [CoV 10.2, ICC 0.85 (0.53;0.96)]. Test-retest reliability of mid anterior and lateral segmental MPR during stress were good [ICC, 0.87 (0.57;0.97) and 0.89 (0.61;0.97), respectively].

CONCLUSION:
Excellent repeatability was shown in the assessment of native myocardial T1 value and global MPR using a custom-made MRI-compatible ergometer pedal exerciser. CMR stress/rest T1 mapping holds promise for myocardium ischemia detection without injecting gadolinium contrast agents and pharmacologic agents. Prospective studies should evaluate the relationship between this technique and established methods of CAD assessment and association with outcomes.

# OR-27

# The value of APTw imaging combined with IVIM to identify Prostate Cancer with or without Bone Metastasis

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Purpose
To explore the potential of APTw and IVIM for differential diagnoses of prostate cancers with and without bone metastasis.
Materials and Methods
A total of 30 pathology-proven prostate cancers and PET-CT-proven with or without bone metastasis patients (mean age 70.50±6.68years, range 58-84 years) were included in the analysis. The patients were categorized into two groups, Group A with bone metastasis and Group B without bone metastasis, and underwent MRI at 3.0T IngeniaCX (Philips Healthcare, the

Netherlands) with a 16-channel abdominal coil. Sequences: T2WI SPAIR, 3Damide-proton-transfer weighted imaging (3D-APT), and Intravoxel incoherent motion (IVIM) (parameters listed in Table 1). All data were interpreted independently by two radiologists (Changjun M and Lihua C, with 2 and 5 years of experiences respectively, blinded to the clinical information of the patients). Regions of interest (ROIs) were manually placed on the fused APTw and IVIM images on the slice showing the largest lesions to cover the whole lesion in the slice (Figure 1). The average APTw (MTRasym) and parameter values of IVIM were calculated to minimize measurement bias. Measurements consistency of all the values between two observers was tested using intra-class correlation coefficients (ICC) with SPSS (IBM). All the values were compared between Groups A and B using the t test. Logistic regression and ROC plot were used to evaluate the diagnostic efficiency of prostate cancers with bone metastasis. Delong test was used to compare the diagnostic efficacy. This study was approved by the local IRB.

Results

The measurement consistency between the two radiologists was good (ICC> 0.75, data not shown). APTw values in Group A was significant higher than in group B ($P<0.05$), and f-Bi values of IVIM in Group A was significant lower than in group B ($P<0.05$)(Table 2). As for ROC curves, the AUC values of APT and f-Bi values were all more than 0.7. The diagnostic efficiency of APT combining with f-Bi was higher than those of APT or f-Bi when used separately (Table 3, Figure 2).

Discussion and Conclusion

Prostate cancers with bone metastases were observed with significantly higher APTw and lower f-Bi values than those without bone metastasis, which might be attributed to higher proliferation rate, faster cancer cells metabolism, and more complicated structure in the cancers with metastasis. In addition, the diagnostic efficiency of APT combining with f-Bi was higher than those of APT or f-Bi when used separately. In conclusion, APTw imaging together with IVIM may provide a non-invasive tool to evaluate the metastasis potential of prostate cancers.

OR-28

# Visualizing the Deep Cerebellar Nuclei Using Quantitative Susceptibility Mapping in Healthy Controls and Parkinsons Disease and Essential Tremor Patients

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Introduction: The dentate nuclei (DN), interposed nuclei (IN (emboliform nuclei and globus nuclei)) and fastigial nuclei comprise the deep cerebellar nuclei (DCN) which play a vital role in motor function. With the exception of vestibular information, the DCN is the predominant source of output of the cerebellar circuitry1. The DN, for example, is one of the deep gray matter regions with the most abundant iron and the level of iron is closely related to the presence of neurodegenerative disease2. This study aimed to visualize all the DCN of healthy controls (HCs) and patients with Parkinson's disease (PD) and essential tremor (ET) using quantitative susceptibility mapping (QSM), and to investigate the potential differential diagnosis between ET and PD via volume and iron content of the DCN.

Materials and Method: We enrolled three age- and gender-matched groups (84 PD patients, 35 ET patients and 43 HCs). All subjects were scanned on a 3T Philips MRI system using 3D multi-echo strategically acquired gradient echo (STAGE) imaging. The imaging parameters were: an in-plane resolution = 0.67 mm × 1 mm, (interpolated to 0.67mm x 0.67mm), TE = 7.5ms, TR = 26.6ms, pixel bandwidth = 189Hz/pixel and slice thickness = 1.34mm. We visualized all DCN for

all participants clearly. All DCN were drawn manually on the QSM data using SPIN software (SpinTech MRI, Inc., Bingham Farms, MI, USA). Then we simultaneously measured the volume and the iron concentration of the DCN in three groups. Differences in the volume and the QSM values among the groups for each ROI were analyzed with ANOVA and Bonferroni correction was used for comparison between multiple groups (p-value threshold for significance, 0.05). The statistical analysis was performed using IBM SPSS Statistics (version 24; IBM Corp., Armonk, NY).

Results: Figure 1 shows the DCN of a PD patient from the QSM data. This set of images displays the DN, IN and FN in different orientations. Table l lists the volume and iron content (mean ± standard deviation) of the DCN in the HCs, PD patients and ET patients as well as the statistical results between the three groups. For the volume of the DCN, the results indicated that the volume of the bilateral DN in the HCs is higher than in either the PD or ET patients, however, the differences between groups showed no statistical significance. Similarly, the volume of the other DCN showed no significant differences between groups. The volume of the DN in the HCs (right: 914 ± 223 mm3; left: 917 ± 235 mm3) was concordant with previous research3, 4. In addition, we found there was a small age-dependent increase of volume in the bilateral DN in the HCs. However, there were no age-related changes either in PD or ET (Figure 2). As for the iron content, the differences between the three groups showed no statistically significance, in agreement with a recent study5. Apart from these two sites, the iron content of the FN in the three groups was comparable.

Discussion and Conclusion: The DCN were visible in all subjects. The first study using MRI to visualize the DCN was by Dimitrova et al6. They developed an atlas of the DCN using a single brain using long TE, low flip angel, gradient echo imaging. Another paper by Deoni et al4 used T1maps and spin density maps to differentiate the DCN. Contrast on these T1 images was poor, however, in our case QSM provides very good contrast-to-noise and it is much easier to see the different nuclei. Meanwhile, we compared the volume and iron content of all the DCN in HCs, PD patients and ET patients. At present, our findings show that there are no significant changes in volume and iron concentration between the groups, however, there is a downward trend in the volume for the DN in the patient groups when considering subjects 60 years and older. Previous researches have been unable to find common ground on the issue of iron deposition in the DCN of PD subjects7,8. In conclusion more data are needed to come to a clear conclusion about iron effects in PD.

OR-29

# Volumetric ADC histogram analysis as imaging biomarker for pretreatment prediction of response to fertility-sparing treatment in patients with endommetrial cancer

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Purpose: To investigate the value of volumetric apparent diffusion coefficient (ADC) histogram metrics for pretreatment predicting the response to fertility-sparing treatment in patients with endometrial cancer.
Materials and methods: Pretreatment data of 54 patients with endometrial cancer managed conservatively were retrospectively analyzed. ADC histogram metrics (tumor volume; minADC, maxADC and meanADC; 10th, 25th, 50th, 75th, and 90th percentiles of ADC; skewness; and kurtosis) were derived from the whole tumor with ROIs drawn on all slices of DWI images (b=0, 1000s/mm2). Treatment response in the second, third, and final follow-up were pathologically

evaluated. Univariate analysis was used to compare the difference in ADC histogram metrics and pretreatment clinical characteristics [patient's age, body mass index (BMI), serum CA125, HE4, tumor Ki67, estrogen receptor, and progesterone receptor status] between complete response (CR) and non-CR, presence and absence of two-consecutive CR, and recurrence and non-recurrence groups. ROC curve analysis was used to evaluate the performance of signal parameter or combine model in predicting the treatment response.
Results: Compared with non-CR patients, CR patients had significantly higher pretreatment minADC, and 10th, 25th percentiles of ADC in the second follow-up (P = 0.008, 0.039, and 0.034, respectively), and higher minADC, elder age, lower HE4 level, and higher overweight rate in the third follow-up (P = 0.001, 0.040, 0.021, and 0.004, respectively). Patients with two-consecutive CR had significantly higher pretreatment minADC than those without (P = 0.018). No significant difference was found between the recurrence and non-recurrence patients (all P > 0.05). Pretreatment minADC > $0.63 \times 10^{-3}mm^2/s$ and $0.57 \times 10^{-3}mm^2/s$ yielded the largest AUC of 0.688 and 0.753 in predicting CR in the second follow-up and the presence of two-consecutive CR in the final follow-up, respectively, with a sensitivity of 46.9% and 54.6%, specificity of 86.4% and 88.9%, and accuracy of 62.9% and 61.1%, respectively. The combination of minADC, age, and HE4 yielded the largest AUC of 0.786 in predicting CR in the third follow-up, with a sensitivity of 96.9%, a specificity of 52.4%, and an accuracy of 79.6%.
Conclusion: Pretreatment minADC could be served as a potential imaging biomarker for predicting the response to fertility-sparing treatment, but not for recurrence status. Clinical characteristics may have incremental value to minADC in the prediction of treatment response.

OR-30

# Whole-lesion Histogram and Texture Analysis of Diffusion- and T2-weighted Imaging in Distinguishing Prostate Cancer from Benign Prostatic Hyperplasia

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**Purpose**
To evaluate the value of whole-lesion histogram and texture analyses of apparent diffusion coefficient (ADC) maps and T2-weighted (T2W) images in distinguishing prostatic cancer (PCa) from benign prostatic hyperplasia (BPH) using histopathology as the reference.

**Materials and Methods**
Ninety patients with PCa and 112 patients with BPH were included in this retrospective study. Differences in whole-lesion histograms and texture parameters of ADC maps and T2W images between PCa and BPH patients were evaluated using the independent samples t-test. The diagnostic performance of ADC maps and T2W images in being able to differentiate PCa from BPH was assessed using receiver operating characteristic (ROC) curves.

**Results**
The mean, median, $5^{th}$, and $95^{th}$ percentiles of ADC values in images from PCa patients were significantly lower than those from BPH patients ($p<0.05$). Significant differences were observed in the means, standard deviations, medians, kurtosis, skewness, and $5^{th}$ percentile values of T2W image between PCa and BPH patients ($p<0.05$). The $ADC_{5th}$ showed the largest AUC (0.906) with a sensitivity of 83.3% and specificity of 89.3%. The diagnostic performance of the T2W image histogram and texture analyses was moderate and had the largest AUC of 0.634 for $T2W_{Kurtosis}$ with a sensitivity and specificity of 48.9% and 79.5%, respectively. The diagnostic

performance of the combined $ADC_{5th}$ & $T2W_{Kurtosis}$ parameters was also similar to that of the $ADC_{5th}$ & $ADC_{Diff\text{-}Variance}$.

**Conclusions**
Histogram and texture parameters derived from the ADC map and T2W images for entire prostatic lesions could be used as imaging biomarkers to differentiate PCa and BPH biologic characteristics, however, histogram parameters outperformed texture parameters in the diagnostic performance.

OR-31

# Two patterns of white matter connection in patients with multiple gliomas: evidence from probabilistic fiber tracking and cluster analysis

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Objectives: Multiple lesions are uncommon in brain gliomas, and their pathophysiology is poorly understood. Invasive growth along white matter tracts is an important clinicopathological characteristic of glioma, and a major factor in poor therapeutic outcome. Here we used probabilistic fiber tracking and cluster analysis to investigate the inter-focal connectivity relationships of multiple gliomas to seek inferential evidence of common origin.
Methods: MRI scans of 46 patients with multiple gliomas were retrospectively analyzed. Before surgery all patients underwent multimodal functional MR imaging including diffusion tensor imaging, enhanced 3D T1-weighted imaging, diffusion-weighted imaging, 1H MR spectroscopy and dynamic susceptibility contrast perfusion-weighted imaging. Probabilistic fiber tracking was used to quantify white matter connectivity between neoplastic foci. Hierarchical cluster analysis was performed to identify patterns of white matter connection（figure1）
Results: Cluster analysis revealed 2 patterns of connectivity, one with smaller and one with greater connectivity (2675±1098 versus 30432±22707, $p<0.0001$). The two subgroups showed significant differences in relative cerebral blood volume (2.31±0.95 versus 1.73±0.48, $p=0.002$) and lipid/creatine ratio (0.32±0.22 versus 0.060±0.051, $p=0.006$)（figure2-6）.
Conclusion: Two distinct patterns of white matter connection exist in multiple gliomas. Those with smaller connectivity tend to have independent origins and can be termed true multicentric glioma, whereas those with greater connectivity tend to share common origin and spread along white matter tracts. True multicentric gliomas have higher vascularity and more intratumoral necrosis. These findings may help to develop personalized therapeutic strategies for multiple gliomas.

OR-32

# Identification of the Ki67 Expression in HCC using a Combined Model of Deep Learning and Radiomics on Non-invasive MRI

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Objective

Ki67, as an indicator of tumor aggressiveness, is highly related to the activity of cell proliferation. Hepatocellular carcinoma (HCC) with higher Ki67 expression indicates faster growth, poorer prognosis and higher mortality. Preoperative MRI may serve as a non-invasive tool to predict the expression of Ki67. Several studies have applied texture analysis on MRI to detect the expression of Ki67 in HCCs.
The purpose of this study was 1) to combine deep learning models with radiomics analysis to improve the performance of Ki67 prediction; and 2) to compare the performances of different deep learning models.

Materials and Methods
This retrospective study was approved by the review board of Ruijin Hospital Affiliated to Shanghai Jiaotong University School of Medicine. A total of 103 participants were enrolled between September 2020 and January 2021, including 92 patients with high Ki67 expression (Ki67 ≤ 10%) and 11 patients with low Ki67 expression (Ki67 ≥ 10%) as determined by retrospective surgical evaluations. MRI was performed using a 3.0 T scanner (Ingenia CX, Philips Healthcare, Best, the Netherlands). Multi-phase dynamics contrast-enhanced (DCE) images were acquired for analysis. In the low Ki67 expression patients, 7 cases were grouped into the training set and the remaining 4 cases were grouped into the test set; while in the high Ki67 expression patients, 64 cases were grouped into the training set and 28 cases were grouped into the test set. Convolutional neural network (CNN) models as well as radiomics analysis were used to extract features from the delayed phase DCE images. Six network architectures were compared, including Inception-ResNet-v2, Inception-v3, Resnet50, VGG16, VGG19, and Xception. A total of 512 to 2048 features were extracted using the CNN models, combined with 1024 features extracted by the radiomics toolbox. The intraclass correlation coefficient (ICC) was used to reduce the dimensionality of the extracted features. A support vector machine (SVM) model was finally used to predict the expression of Ki67 by combining all the selected features. Receiver operator characteristic (ROC) analysis was conducted to evaluate the performances of all models.

Results
The Resnet50 achieved the best performance in terms of area under the ROC curve (AUC) (0.80) and accuracy (0.89), indicating the usefulness for Ki67 expression prediction. The performance of Xception was second only to the Resnet50 with AUC = 0.75 and accuracy = 0.81, followed by the Inception-V3 (AUC = 0.72 and accuracy = 0.80), Inception-Resnet-V2 (AUC = 0.65 and accuracy = 0.78), VGG16 (AUC = 0.64 and accuracy = 0.78), and VGG19 (AUC = 0.63 and accuracy = 0.77).

Conclusions
This study demonstrated that the combined deep learning and radiomics model was promising for the prediction of Ki67 expression, which may provide a non-invasive method to investigate the critical histopathology markers for HCCs.

OR-33

## Disrupted Small-world Brain Network of Patients with Hypercortisolemia Revealed by Multimodality Networks

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Objective: Cushing’s disease (CD) has received much attention in recent years since it can cause diverse physical and cognitive symptoms. Our objective was to use Cushing’s disease as a naturalist model to investigate the impact of chronic hypercortisolemia on the whole brain network

in patients with Cushing’s disease. We used functional magnetic resonance imaging, diffusion tensor imaging, and morphological magnetic resonance imaging techniques to construct each participant's functional, structural, and morphological networks to investigate the alterations of topology in the whole brain. In addition, we also aimed to determine whether there is a correlation between these changes and the clinical characteristics.

Patients and Methods: A total of 35 patients with Cushing’s disease and 27 healthy controls (HCs) matched for age, sex, and handedness were enrolled in this study. We constructed a resting-state functional connectivity network, white matter structure network and grey matter covariant network for every individual. The Cp, Lp, local efficiency, and global efficiency of the network were computed to determine its small-world properties. Between-group comparisons were performed using a two-sample t-test, and we analyzed the correlation between brain network parameters and 24-hour UFC in the patient group.

Results: Our study resulted in three major findings: (i)Both the CD group and healthy controls has exhibited small-world topology in all three kinds of network. ( $\lambda = L/Lrandom \sim 1$; $\gamma = C/Crandom \gg 1$; $\sigma = \gamma/\lambda > 1$). (ii)In the resting-state functional network, the CD group showed increased global efficiency ($P < 0.05$) and decreased local efficiency and clustering coefficient ($P < 0.05$). (iii)The CD patients showed a negative correlation between global efficiency and 24h-Urinary free cortisol (UFC), and a positive correlation between Lp.

Conclusion: Our findings suggest that the CD group still has the small-world attribute in their brain network and proved these three networks all have small-world tribute and provide unequivocal evidence of a topological disruption in the brain networks of patients with Cushing’s disease. Our findings support the hypothesis that there is disruption of brain networks in patients with CD. In addition, some parameters have strong correlations with clinical characteristics of patients with Cushing’s disease, which we believe can make a preliminary exploration of imaging indicators for the diagnosis and prognosis of CD patients in the future. Detection and evaluation of these alterations could facilitate the understanding of the pathophysiological mechanism as well as for evaluation of the severity of CD.

OR-34

# Assessment of Cystic Renal Cell Carcinoma with MRI Based on Bosniak Classification Version 2019

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Purpose：
To investigate the Bosniak classification of cystic renal cell carcinomas (cystic RCCs) based on the MRI Bosniak classification version 2019.
Materials and Methods:
We conducted a single center retrospective study that enrolled pathologically-confirmed cystic RCCs scanned on MRI from 2009 to 2020. Blinded to clinical and pathologic information, the Bosniak classification was assigned in consensus by two experienced genitourinary radiologists with Bosniak classification version 2019. Meanwhile, dichotomizing Bosniak classification I-IV into lower (I, II, IIF) and higher (III, IV) classes, radiologists analyze the class of cystic RCCs.
Results：
We enrolled 171 patients(132 males, 39 females, 49±11 years) with 173 cystic RCCs (37.6±20.1 mm), including 149 clear cell renal cell carcinomas, 3 papillary renal cell carcinomas, 2

chromophobe renal cell carcinomas, 3 clear cell papillary renal cell carcinoms, 1 oncocytic papillary renal cell carcinoma, 1 tubulocystic renal cell carcinoma，1 MiT family translocation carcinomas, 13 unclassified renal cell carcinomas) from January 2009 to August 2020. Cystic RCCs, of these, were classified into 3 category I (1.7%), 7 category II (4.0%), 8 category IIF (4.6%), 63 category III (36.4), 92 category IV (53.1%). 155 cystic RCCs (89.6%) were classified as higher class (III, IV) of Bosniak classification, while 18 cystic RCCs (10.3%) were classified as lower class (I, II, IIF) of Bosniak classification.
Conclusion:
Based on the Bosniak classification version 2019, most cystic RCCs were classified into higher class (89.5%), especially in Bosniak IV classification (53.1%), which will potentially facilitate the clinical decision of cystic RCC patients.

OR-35

# Characterizing language-related white matters in brain arteriovenous malformations with advanced diffusion MRI techniques

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Background and Objective: Brain arteriovenous malformations (AVMs) usually presumed to be congenital. A large portion of unruptured AVM niduses involve language areas, but the patients present no language dysfunction. It remains unclear whether these patients have distinct white matter organization from the healthy subjects. Diffusion tensor imaging (DTI) is a noninvasive magnetic resonance imaging (MRI) technique that measures water diffusion anisotropy in brain tissue. Based on the DTI acquisition, tract quantification has been proven to be powerful in assessing white matter integrity in various neurological disease models, but not yet in AVMs. The objective of this study was to investigate the mechanism of language reorganization in brain arteriovenous malformations (AVMs) through quantifying the language-related white matters.

Methods: Fourteen patients with AVMs involving language areas within frontal lobe were prospectively enrolled from December, 2017 to October, 2020. Fifteen age- and gender-matched healthy controls were enrolled as comparison. All subjects underwent MRI experiments on a 3-T Prisma-fit scanner (Siemens Healthcare, Erlangen, Germany) with a 20-element head-neck coil. A fully-sampled spin-echo echo planar imaging (EPI) was acquired for the diffusion dataset on each subject (1.5 mm isotropic resolution, repetition time = 8100 ms, echo time = 75 ms, matrix = 100×100×72). There were 3 volumes with b = 0 s/mm2 and 64 volumes along isotropically-distributed diffusion directions with b = 1000 s/mm2 for each subject. In addition, a T1-weighted magnetization-prepared rapid-acquisition gradient-echo (MP-RAGE) sequence was also applied (repetition time = 2530 ms, echo time = 3.37 ms, flip angle = 7°, field of view = 256 × 256 mm2, matrix = 256 × 256, voxel size = 1.0 ×1.0 × 1.0 $mm^3$, and number of slices = 176). After acquisition, the dataset was visually verified to ensure that the images were free from major artefacts. The DTI data preprocessing followed the pipeline which corrected for the image artefacts, such as eddy-current, subject head movement and field inhomogeneity effects. The automatic fiber quantification (AFQ) toolkit (https://github.com/yeatmanlab/AFQ) (version 1.2) were used to segment and quantify the language-related tracts ( the dorsal pathway), i.e. left arcuate fascicle (AF) and superior longitudinal fasciculus (SLF). The first step was to estimate the whole-brain deterministic fiber tractography. The seed points were placed within a WM mask which was defined by defined by voxels with FA values greater than 0.3. The tracking algorithm started from the seed points and traced the fibers along the principal diffusion vectors. The

termination criteria for tracing was when the FA value of the voxel was less than 0.2 or the minimum angle between the last path segment and next step was greater than 30 degrees. The second step was to segment the existing fiber tracts by using the waypoint region of interest procedure, followed by a fiber refinement. After tract identification, the fiber points of each tract were resampled to 30 equidistant points, and then the diffusion matrices of each subject were extracted along the language-related fiber tracts.

Results: Language functions were normal in all subjects according to Western Aphasia Battery (WAB) test. In frontal AVM group, fractional anisotropy (FA) value decreased in the left AF and increased in left SLF; significant lower axial diffusivity (AD) values were mainly observed in middle part of the left AF; and higher AD values were observed in most parts of left SLF; whereas, significant higher radial diffusivity (RD) values were mainly observed in posterior part of left AF.

Conclusions: This is the first study to characterize and quantify language-related white matters in brain AVMs with normal language function. Remodeling of language-related white matters may happen when traditional language areas are involved by AVM niduses, and its reorganization patterns were investigated in this study. It was found that the impairment of the dorsal language pathway may be compensated by itself. The AVM niduses mainly impaired the left AF and the reorganized SLF in the left hemisphere actively participate in the language network. Our study has limitations on recruiting patients with AVM occurring only in frontal lobe. The location of the nidus may influence the reorganization pattern which needs to be investigated further.

Acknowledgement: This study was funded by the Chinese National Natural Science Foundation (61901465，81701088，81870833, 31730039), Beijing talents project (2017000021469G211), the Ministry of Science and Technology of China grant (2020AAA0105601, 2019YFA0707103), and the Chinese Academy of Sciences grants (XDB32010300, ZDBS-LY-SM028).

Ethics approval: This study was approved by the Institutional Review Board of Beijing Tiantan hospital, Capital Medical University (number: KY2018-103-01).

# OR-36

# R2*联合 ITSS 自动定量分析技术鉴别临床显著性和非显著性前列腺癌

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目的：研究基于增强 T2*加权血管造影(ESWAN)的肿瘤内磁敏感信号强度(ITSS)与 R2*值在区分临床显著性前列腺癌（Cs PCa）和临床非显著性前列腺癌（Ci PCa）的诊断价值。
方法：入组 62 例在我院病理证实的前列腺癌患者，Gleason 评分分组：评分 4+3=7 及>7 分为 Cs PCa 组（n=37, (75.21±8.67)岁），评分<7 及 3+4=7 分为 Ci PCa 组(n=25, (72.19 ± 8. 42)岁）。所有患者术前行盆腔 3.0T MR 检查(Signa HDxt，GE 医学系统)，包括 T1WI，T2WI，DWI，ESWAN。MR 扫描参数细节见表 1。ESWAN 图像上传至 GE AW 4.6 工作站后处理，R2*值直接在工作站测量。相位图有带状伪影，见图 1a。去伪影流程见图 1。前列腺癌参考 T2WI 和 DWI 图像，在相位图上沿肿瘤边缘勾画感兴趣区域(ROIs)，见图 2。利用 AS 软件的插值标注工具，无需逐层勾画即可获得容积 ROIs。AS 软件能自动计算出相位图的 ITSS 比值。ITSS 比值定义是肿瘤 ITSS 信号占肿瘤容积的比值。利用 SPSS 25.0 软件进行数据分析。正态分布用 Shapiro-Wilks 检

验。组间相关系数(ICC)评价 2 名放射科医师测量 ITSS 值的一致性。组间 ITSS 值差异用 Mann-Whitney U 检验进行比较。采用受试者工作特征曲线(ROC)评估诊断效能。
结果：两名放射科医师测量的结果一致性良好(ICC>0.75，表 2)。Cs PCa 组 ITSS 值及 R2*值显著高于 Ci PCa 组（p<0.01）（见表 3），ITSS 值、R2*值及两者联合的 AUC 值分别为 0.715、0.792、0.811(见图 3)。
结论：R2*对鉴别临床显著或非显著性前列腺癌有良好的诊断效能，与 ITSS 联合提升不明显。

## OR-37

# 术前钆塞酸二钠增强磁共振瘤周膨胀卷积神经网络模型在肝细胞癌微血管侵犯分级及其预后上的应用

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目的：探讨术前钆塞酸二钠增强磁共振瘤周膨胀卷积神经网络（Convolutional neural network，CNN）在肝细胞癌微血管侵犯（Microvascular invasion，MVI）分级及其术后无复发生存（Recurrence-free survival，RFS）上的应用。
材料与方法：回顾收集 2012 年 3 月至 2020 年 8 月复旦大学附属中山医院 523 例肝细胞癌患者术前 EOB-MRI，以 7:3 随机分至训练或验证集。有序多分类逻辑回归构建临床影像（Clinicoradiologic，CR）模型。影像组学择最佳单序列 CNN 肿瘤边缘为基线，逐步向外生长并择优构建各单序列膨胀模型、最佳多序列深度学习（Deep learning，DL）模型，并融合 CR 独立危险因子获得综合模型（Comprehensive model，CM）。受试者工作特征曲线下面积（Area under curve，AUC）和概率校正曲线 Brier 评分共同量化模型效能，Kaplan-Meier 曲线可视化 MVI 分级在 RFS 上的差异。
结果：M0 级（未发现 MVI）、M1 级（MVI 低危组）、M2 级（高危组）患者占比分别为 72.85%（381/523）、17.78%（93/523）和 9.34%（49/523），截止至 2021 年 1 月其复发率依次为 32.29%（113/350）、54.55%（48/88）和 62.22%（28/45），中位 RFS 则为 74.3 月、35.0 月和 16.5 月（P <0.001）。有序多分类逻辑回归显示肿瘤长径、甲胎蛋白、瘤周强化、肿瘤边界和包膜强化情况是 MVI 分级的独立预测因素（P <0.05），其验证组预测 MVI 分级、M0 级、M1 级和 M2 级的 AUC 分别为 79.50%、97.00%、21.00%和 53.00%。联合肝胆特异期、平扫期和移行期的 1.5cm 瘤周膨胀法为最佳多序列 DL 模型，其验证组相应 AUC 依次为 78.00%、83.00%、25.00%和 71.00%，综合 CM 模型性能进一步提升（相应 AUC：82.60%、87.00%、36.00%和 71.00%）。Brier 评分及预后分析亦显示综合 CM 模型的分类效果最佳，校准幅度仅波动于 3.4-15.9%，且唯此模型的预估复发率及 RFS 基本等同于病理 MVI 分级。
结论：术前钆塞酸二钠增强磁共振瘤周膨胀 CNN 是肝细胞癌 MVI 分级及其预后的潜在指标。

## OR-38

# 磁共振左室应力可预测矫治术后法洛四联症患者在肺动脉瓣置换术之后的长期预后

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目的：肺动脉瓣置换术(PVR)对于法洛四联症矫治术后的患者(rTOF)有利于减少右心室容积、保留右心室功能。然而，PVR 术后的预后结果仍然好坏参半。决定 rTOF 患者 PVR 后结局的关键因素目前并没有结论。我们的研究旨在分析 rTOF 患者 PVR 术前的应力和应率是否与 PVR 后的长期预后相关。

方法：我们前瞻性地纳入了 41 名因中度或重度肺动脉返流而需要 PVR 的无症状 rTOF 患者。基于磁共振电影序列，使用特征跟踪技术测量 PVR 术前的应变参数。在随访中记录不良事件包括任何原因导致的死亡、心脏移植、心律失常引起的晕厥、再次进行 PVR、症状性心力衰竭和持续性室性心动过速。最后进行 ROC 分析，绘制 Kaplan-Meier 曲线，同时使用 log-rank 统计。

结果：平均随访 3.0±1.5 年后，共记录不良事件 10 例。术前径向应变(RS)＞23.87%的患者的 3 年无事件生存率为 63% (p<0.001)，术前周向应变(CS)<-15.55% (p<0.001)的患者的 3 年无事件生存率为 93%，术前纵向应变(LS)<-9.7% (p<0.001)患者的 3 年无事件生存率为 63%。对于应变率，术前收缩期径向应变率>1.53s-1 的患者 3 年无事件生存率为 68%(p=0.003)，术前舒张早期径向应变率(RSRe) <-1.73 s-1 的患者 3 年无事件生存率为 68% (p<0.001)，术前舒张早期纵向应变率(LSRe) >0.42 s-1 的患者 3 年无事件生存率为 59% (p<0.001)。经多因素校正后，LSRe 与不良结局显著相关(HR，95%置信区间:0.012(0-0.956))。

结论：PVR 术前的磁共振所得应力参数：RS, CS, LS, RSRs, RSRe, LSRe 是 rTOF 患者 PVR 术后发生不良事件的重要预测因子。早期识别这些因素可以帮助识别不良事件风险增加的患者并及时采取治疗措施。

# OR-39
# 动脉自旋标记 MR 技术预测颈动脉血运重建术后脑过度灌注的发生

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目的：在颈动脉狭窄患者中，探究术前动脉自旋标记（ASL）MR 图像上存在的动脉通过伪影是否可以预测颈动脉内膜剥脱术后脑过度灌注的发生。
材料与方法：连续纳入 2015 年 5 月至 2021 年 1 月期间因颈动脉狭窄接受颈动脉内膜剥脱术的患者。所有患者在术前 2 周内和术后 1 周内进行准连续 ASL-MR 成像，生成脑血流量图。脑过度灌注定义为与术前相比，术后局部脑血流量增加>100%。将患者分为过度灌注组和非过度灌注组。两名神经放射科医师在术前 ASL 图像上，对术侧的 10 个感兴趣区域（2 个大脑前动脉供血区，6 个大脑中动脉供血区和 2 个大脑后动脉供血区，与 ASPECTS 评分相对应）分别进行评分，具体如下：0 分，无/极低的 ASL 信号，不存在动脉通过伪影；1 分，少量/中等的 ASL 信号，存在动脉通过伪影；2 分：较高的 ASL 信号，存在动脉通过伪影；3 分：正常灌注，不存在动脉通过伪影（图 1）。将 10 个区域 ASL 评分相加，总分为 30 分。通过多元回归分析评估 ASL 评分在预测过度灌注中的作用。使用受试者工作特征曲线分析确定术前 ASL 评分预测术后脑过度灌注发生的最佳临界值。
结果：本研究最终纳入 73 例患者，18 名 (27.66%) 患者在颈动脉内膜剥脱术后出现脑过度灌注。与未发生术后脑过度灌注的患者相比，发生术后脑过度灌注的患者术前 ASL 评分更低（$p < 0.001$，图 2a）。在对其它潜在风险因素进行矫正后，术前基于动脉通过伪影的 ASL 评分仍与术后脑过度灌注的发生独立相关（OR=0.53，95%CI [0.37,0.74], $p < 0.001$）。术侧 ASL 评分≤23 分

是预测术后脑过度灌注发生的最佳临界值(灵敏度：88.9%，特异度：94.6%，阳性预测值：94.5%，阴性预测值：83.3%，图 2b）。
结论：在颈动脉狭窄患者中，ASL-MR 技术可以无创地预测血运重建术后脑过度灌注的发生。

## OR-40
# 高分辨定量磁化率图结合卷积神经网络自动分割中脑深部灰质核团

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目的
利用基于卷积神经网络（convolutional neural network，CNN）的方法自动分割高分辨定量磁化率图上中脑深部灰质核团。
材料与方法
75 名健康受试者在 3T 磁共振成像系统（西门子 Prisma）上采用 20 通道头颈联合线圈进行扫描。使用双极读出梯度的多回波梯度回波序列扫描获取模图和相位图，其体素大小为 0.8 mm×0.8 mm×0.8mm3。利用 MEDI toolbox 工具箱重建得到高分辨定量磁化率图像，在定量磁化率图像上，手动勾画出红核、黑质以及丘脑底核的核团边界。
基于 CNN 的核团自动分割流程为：首先，使用先前研究中的 100 名受试者磁化率图（体素大小为 0.6*0.6*2 mm3）的数据集对深度监督 2.5D Attention U-net 模型进行预训练，从而为目标网络提供初始权重；然后，采用迁移学习的方法将初始权重迁移到目标训练网络中。对测试集数据，分别计算自动分割与手动勾画得到的感兴趣区域的 Dice 系数以及磁化率、体积的定量数值，进而评价自动分割结果的准确性。
结果
自动分割方法可达到与人工勾画的感兴趣区域近似的分割效果，可准确分割出红核、黑质以及丘脑底核。在红核、黑质以及丘脑底核中的 Dice 得分分别为 0.88、0.86 和 0.78，其与研究者间的 Dice 评分无统计学差异，p 值分别为 0.897，0.237，0.987。自动分割方法提取的核团的总体磁化率（r=0.99，p<0.01）和体积（r=0.98，p<0.01）的定量数值与人工勾画所提取的相应数值之间显著相关。
结论
采用基于 CNN 的方法可以在高分辨定量磁化率图中准确分割中脑深部灰质核团。

## OR-41
# 浅表白质区域在脑小血管病中的异常及其对信息处理速度的影响

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背景与目的：脑小血管疾病（CSVD）是导致认知能力下降的最重要的血管因素。脑白质高信号（WMH）是 CSVD 在磁共振上的典型特征。脑白质微结构的异常被认为是 WMH 的重要表现，并且与 CSVD 中信息处理速度的下降有关。弥散磁共振成像是研究脑白质微结构的有利工具，而到目前为止，CSVD 的磁共振研究主要集中在深部白质区域，而忽略了与信息处理速度高度相关的浅

层白质区域。在这项研究中，我们使用弥散磁共振成像来评估浅层白质区域的微结构异常及其与信息处理速度的关系。

材料与方法: 研究纳入了 141 名脑小血管患者。每个患者采集了多模态磁共振数据并进行了认知评估。连线测试用以评估其信息处理速度。白质区域分为深部白质区域（DWM）和浅表白质区域（SWM）。利用 T2-FLAIR 对脑白质高信号（WMH）进行分割后，我们计算整体 WMH 体积、深部白质和浅表白质的区域 WMH 体积。利用弥散磁共振成像，我们分析了 5 个弥散指标，包括由常规弥散张量模型计算得到的各向异性分数（FA）和平均扩散率（MD），以及使用高阶自由水模型计算得到细胞外自由水成分（FW）和校正自由水之后的各向异性分数（FAt）和平均扩散率（MDt）。研究包括了三项分析。首先，为了评估 WMH 对白质微结构的影响，我们分别探究了 SWM 和 DWM 的五种弥散指标和整体 WMH 体积的相关性。第二，单因素和多因素回归用以分析信息处理速度与 SWM 和 DWM 区域的 WMH 体积、弥散指标之间的关系，并比较各个影像标记物对信息处理速度下降的贡献。第三，我们按照整体 WMH 的严重程度将人群分均为 4 个亚组，评估区域 WMH 体积、区域弥散指标和信息处理速度在不同疾病阶段中的变化。

结果：我们的结果表明，SWM 和 DWM 区域的弥散指标与整体 WMH 体积密切相关，表现为随着 WMH 体积的增加，出现 FW 和 MD 的升高和 FA 的降低。在多变量回归分析中，SWM 区域的 WMH 体积和弥散指标与信息处理速度密切相关，且超过了 DWM 影像标记物对信息处理速度的影响。在所有影像标记物中，SWM 的 FW 与信息处理速度的相关性最强。我们还发现，在 WMH 体积最低的亚组中，SWM 已经出现 FW 的显著增加。

结论：SWM 区域的异常对信息处理速度的影响超过了 DWM。FW 的增加可能是 SWM 白质微结构异常的早期标志。这项研究扩展了目前对 CSVD 中功能障碍的理解，并强调了 SWM 区域对 CSVD 研究的重要性。

OR-42

# 机器学习分割肾脏实性小肿瘤的初步应用

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**目的：**构建基于 MRI 图像的肾脏实性小肿瘤的机器学习自动分割模型。
**材料与方法：**本研究回顾性连续入组经病理证实的≥4cm 的肾透明细胞癌患者 201 例。所有患者均在术前于 3.0T 机器上行完整的肾脏 MR 检查。由放射科医生采用 ITK-SNAP 软件（V3.8）在 $T_2$WI 图像上对病灶进行人工分割。我们将数据集分为训练集（153 例）和测试集（48 例），并使用 3D U-Net 卷积神经网络模型（网络架构示意图见附件图 1）在训练集上进行五折交叉验证，在测试集上对模型性能用 Dice 系数及平均表面距离（Average Surface Distance，ASD）进行评估。Dice 系数表征两个分割图之间重合的程度，dice 系数越高精度越高（具体公式见附件公式 1）。ASD 表征的是由两个分割图渲染得到的三维表面之间的距离，ASD 越低精度越高（具体公式见附件公式 2）。
**结果：**本研究共纳入 201 例病人，其中男性 151 例（75%），女性 50 例（25%），平均年龄 53±11 岁，肿瘤平均直径 2.9±0.8cm，MRI 检查时间与手术时间的平均间隔为 10 天。本模型在测试集上 Dice 系数为 0.848±0.094，平均表面距离为 1.115±1.337 mm（分割示意图见附件图 2）。
**结论：**基于深度学习的全自动分割模型可有效地在 $T_2$WI 序列上对病灶进行全自动分割，该技术有望减少研究者的工作负担，同时为后续的特征提取及进一步研究提供较为稳定准确的数据。

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# 基于磁共振特征跟踪技术的高时间分辨率心肌应力成像临床研究

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目的：心血管磁共振特征跟踪(cardiac magnetic resonance-feature tracking，CMR-FT)技术在心脏各房室心肌应变测量中广泛应用，并对心血管疾病的诊断与预后评估有一定的临床指导作用。本文通过心脏磁共振高时间分辨率成像对左室进行应变分析，与常规时间分辨率成像进行比较，并分别以左室射血分数和心率进行亚组分析，探究在不同心脏功能状态下，高时间分辨率成像对应变测量的影响。
材料与方法：我们从 2020 年 5 月 1 日至 2020 年 9 月 1 日连续招募了 153 名患有各种心脏病和健康的受试者，分别进行了高时间分辨率（10ms）和常规(40ms)的心脏磁共振电影成像。利用特征追踪技术对不同时间分辨率获得的图像进行应变分析，并对整体纵向应变（global longitudinal strain, GLS),整体周向应变( global circumferential strain, GCS)和整体径向应变(global radial strain, GRS)以及相关的收缩期和舒张期峰值应率进行比较，采用线性回归和 Bland–Altman 作相关性和一致性分析。此外，我们根据心率和左室射血分数进行亚组分析，在不同心脏功能状态下探究高时间分辨率的影响。
结果：通过 CMR-FT 测得，GCS 和 GRS 在高时间分辨率成像中显著升高 (GCS: -13.00±6.58% vs. -12.51±5.76%，p=0.001; GRS: 21.97±14.54% vs. 20.62±12.52%，p=0.001),并且 GLS 也具有升高的趋势 (p=0.731)。此外，通过线性回归和 Bland–Altman 分析，发现 GLS、GCS 和 GRS 在不同时间分辨率成像之间具有良好的相关性和一致性。亚组分析显示 LVEF≥50%和 HR<70bpm 时，应变测量值在高时间分辨率成像中显著升高，提示在不同心功能状态下，高时间分辨率成像对应变测量的影响是有差异的。其次，包括亚组分析在内，所有收缩期和舒张期峰值应率在高时间分辨率成像中显著升高。
结论：高时间分辨率成像中 CMR-FT 应变测量值显著升高，可能为心肌应变分析提供更加准确的结果，尤其是心功能状态较好的患者可获得很大收益。其次应率依赖于足够的时间分辨率，在高时间分辨率中可作为评估心肌形变的重要参数，为高时间分辨率成像的临床应用提供更多见解。

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# 基于定量磁化率图进行威尔逊病人灰质核团纹理分析的研究

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目的
已有研究表明威尔逊病人（Wilson’s disease, WD）的大脑灰质核团磁化率显著高于健康对照组，磁共振图像的纹理分析提供了另外一种定量描述组织特性的方法。因此，本研究对采用定量磁化率成像（Quantitative susceptibility mapping，QSM）技术对 WD 患者灰质核团进行二阶纹理特征分析，探究金属沉积在灰质核团中的空间分布特性。

材料和方法

招募 14 名 WD 患者（平均年龄 28.07 ± 9.6 岁）和 14 名年龄匹配的健康对照（平均年龄 28.21 ± 9.2 岁）。所有被试均在西门子 3T 磁共振设备上采用 12 通道头线圈进行扫描。磁化率图由 3D 多回波 GRE 序列获取，具体参数如下：重复时间= 60ms，第一回波时间= 6.8ms，回波间隔= 6.8ms，回波数目为 8，翻转角= 15˚，视野= 240*180mm2，分辨率为 0.625*0.625mm2，层厚为 2mm，层数为 96。

磁化率图采用偶极场反演算法进行重建得到。手动分割获取感兴趣区域，包括：双侧尾状核、苍白球、壳核、黑质、红核和齿状核。3D 二阶纹理参数采用 MaZda 软件进行计算分析，包括角二阶矩、对比度、相关性、方差、反向不同矩、熵、熵和、熵差、平均和、方差和以及平方和共 11 个特征。

结果

经过多重比较校正后， 磁化率图中尾状核的对比度（$p < 0.001$）、反向不同矩（$p < 0.001$）、平均和（$p = 0.002$）、相关性（$p = 0.002$）、熵差（$p = 0.002$）、平方和（$p = 0.005$）及方差（$p = 0.009$）在区分 WD 和健康对照组中均表现出显著性差异。壳核的对比度（$p < 0.001$）、熵差（$p < 0.001$）、方差（$p = 0.001$）、相关性（$p = 0.001$）、熵和（$p = 0.012$）及熵（$p = 0.036$）在区分 WD 和健康对照组中均表现出显著性差异。苍白球的对比度（$p = 0.003$）、相关性（$p = 0.004$）、方差（$p = 0.004$）及平均和（$p = 0.041$）在区分 WD 和健康对照组中均表现出显著性差异。黑质的角二阶矩（$p < 0.001$）、相关性（$p = 0.001$）、对比度（$p = 0.001$）、反向不同矩（$p = 0.006$）、熵（$p < 0.001$）、熵和（$p < 0.001$）、方差和（$p = 0.002$）及熵和（$p = 0.001$）在区分 WD 和健康对照组中均表现出显著性差异。红核的对比度（$p = 0.009$）、相关性（$p = 0.012$）、平方和（$p = 0.046$）、平均和（$p = 0.041$）、熵和（$p < 0.023$）、熵（$p = 0.013$）和方差（$p = 0.016$）在区分 WD 和健康对照组中均表现出显著性差异。对于齿状核，所有二阶纹理特征在 WD 和健康对照组间均无显著性差异。

两组磁化率图像二阶纹理特征的 ROC 曲线分析结果显示，在黑质区域，熵和表现出最高的曲线下面积（AUC）为 0.949。

结论

本研究首次成功地使用高阶纹理特征评估 WD 患者灰质核团铁沉积空间分布的相关特性，基于磁化率图进行二阶纹理分析可以成功的区分 WD 病人和健康对照组，为 WD 的诊断提供了新的定量生物学指标。

# OR-45

# 基于多模态磁共振影像探索孤独症谱系障碍患者脑发育状态影像学生物标记物的研究

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目的：通过对孤独症谱系障碍（ASD）患者进行高分辨定量磁敏感成像（QSM）、静息态功能磁共振成像（rs-fMRI）、扩散张量成像（DTI）和动脉自旋标记（ASL），比较脑铁含量、脑功能、白质纤维结构和脑血流量在 ASD 患者与健康儿童之间的差异，同时探索 ASD 患者各异常影像学参数值是否与脑发育状态之间具有相关性。

方法：本研究为单中心病例对照研究，共招募了 3-8 岁 ASD 患者 20 例和健康对照者 15 例，签署知情同意并获得相关临床信息和量表信息，同时收集了 ASD 患者的 QSM、rs-fMRI、DTI 和 ASL 的磁共振图像。我们收集 QSM 各感兴趣区的磁化率值，rs-fMRI 中各脑区的局部一致性（ReHo）

值和低频振幅（ALFF）值；DTI 中各白质纤维的分数各向异性（FA）值和平均扩散率（MD）值；ASL 的绝对脑血流量（CBF）。ASD 患者的临床症状采用孤独症行为量表（ABC）进行评定，大脑的发育状态采用 Gesell 发育量表进行评定。采用双样本 t 检验检测 ASD 患者与健康对照者之间的各影像学参数值的差异；采用偏相关分析评估 ASD 患者各影像学参数值与 Gesell 发育量表分值是否存在相关性。
结果：与健康对照者相比，ASD 患者的双侧红核、双侧额叶白质、左侧颞叶白质的磁化率值显著降低（均 P<0.05），ASD 患者左侧尾状核和左侧丘脑磁化率值明显低于右侧（均 P<0.05）；ASD 患者额上回、额中回、内侧额回、额下回和眶部额下回的 ALFF 值低于健康对照者，内侧额回、中央前回、左中央旁小叶、右侧补充运动区的 ReHo 值高于健康对照者；ASD 患者双侧丘脑后辐射、额枕下束、下纵束的 FA 值小于健康对照者（P=0.049）；ASD 患者的右侧顶叶、颞叶和枕叶 CBF 值高于左侧（P<0.05）。此外，研究发现 ASD 患者右侧苍白球的磁化率值与 Gesell-精细运动的量表分值成显著正相关（r=0.560, P=0.024）。
结论：ASD 患者多个核团出现了铁含量的异常降低，多个脑区出现异常激活、额叶白质微结构存在异常，但脑血流量未出现明显异常，此外，ASD 患者右侧苍白球铁含量与脑发育障碍严重程度具有相关性。右侧苍白球铁含量有望成为评价 ASD 患者神经发育障碍严重程度的影像学标记物，这些发现有助于将来探索 ASD 潜在的复杂病理生理学机制，并为客观量化评估 ASD 患者神经发育障碍严重程度提供神经影像学依据。

## OR-46
# 基于卷积神经网络的 DCE-MRI 乳腺癌肿瘤区域自动检测与分割

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摘要 目的：本项目拟采用深度学习卷积神经网络，对动态对比增强核磁共振图像（DCE-MRI）中乳腺癌肿瘤区域进行自动检测与分割。材料与方法：本项目收集来了来自三个中心共 457 例乳腺癌患者 DCE-MRI 影像数据，其中广东省人民医院 247 例为训练集、58 例为独立验证集；河南省肿瘤医院 115 例和云南省肿瘤医院 37 例分别作为独立测试集。拟采用三维残差卷积（3D-ResUnet）构建肿瘤自动检测与分割系统。相对于原始图像尺寸，肿瘤区域较小，属于大视野小目标问题，因此拟采用两步法进行系统构建。首先，将原始图像下采样到 128*128*128 的三维图像，并对肿瘤区域进行粗分割，已实现肿瘤区域的检测。再次，将检测的区域进一步下采样到 64*64*64 的大小，并构建精细分割模型。这样的设计很大程度减少了由于计算机显存不足而对模型训练造成的影响。模型在训练集、验证集、测试集上性能的评价标准为 Dice Similarity Coefficient (DSC).结果：本项目构建的乳腺癌肿瘤区域自动检测与分割模型的 DSC 指标如下：训练集（0.85）、验证集（0.82）、测试集（河南省肿瘤医院 0.72、与云南省肿瘤医院 0.80）。结论：本项目提出基于两步法卷积神经网络对乳腺癌 DCE-MRI 肿瘤区域实现自动检测与精细分割，可为乳腺癌临床诊疗提供可靠的辅助工具。

## OR-47
# 多模态 MRI 提示结核性脑膜炎的严重程度及预后：一项回顾性队列研究

曹鑫、张军、耿道颖

**目的**

磁共振成像技术（MRI）已经广泛应用于结核性脑膜炎（TBM）及其并发症的诊断，包括渗出、结核瘤、脑梗死、脑脓肿和脑积水等。本研究旨在分析导致 TBM 患者神经功能缺损和不良预后的多模态 MRI 危险因素，并通过八年随访探究患者 MRI 特征动态变化与预后之间的关系。

**方法**

对确诊为 TBM 的患者在入院时给予神经系统评估，并根据医学研究理事会（MRC）量表分成Ⅰ、Ⅱ、Ⅲ三个组。对患者进行数年随访，根据改良 Rankin 评分（MRS）分级（0-6 级），同时分为四组（0、Ⅰ、Ⅱ、Ⅲ）。随访期间患者每 3-6 个月进行一次 MRI 复查，记录并对比患者入院初诊及复查时的多模态 MRI 信号特征，如脑膜强化、结核瘤、脑梗死、脑积水和脑脓肿，包括病灶位置及大小。用 ITK-SNAP 软件测量病灶体积，用 Evan's 指数表示脑积水程度。分别计算 MRC Ⅰ组和 MRC Ⅲ组、MRS 0 组和 MRS Ⅱ组的 MRI 特征的比值比（OR），用 Spearman 相关性分析获得 MRI 特征动态变化与 MRS 分级之间的关系。

**结果**

共 110 例 TBM 患者入组。有 109 例患者接受 MRC 量表评估，分别有 31 例、59 例和 19 例分到 MRC Ⅰ、Ⅱ和Ⅲ 组。其中 71 例有不同范围的脑膜强化，47 例至少有 1 个结核瘤，23 例有急性脑梗死（ACI），18 例有陈旧性脑梗死（OCI），7 例至少有 1 个脓肿，38 例有脑积水。组间鞍上池脑膜强化和胼胝体结核瘤存在组间差异（P<0.05）。MRC 组之间的急性脑梗死（ACI）和陈旧性脑梗死（OCI）有显著性差异（P<0.01），包括额叶 ACI (P=0.01)、颞叶 ACI (P<0.01)、额叶 OCI (P<0.01)、顶叶 OCI (P<0.01)和颞叶 OCI (P<0.01)； ACI 和 OCI 的 OR 分别为 21.818（95％CI：2.440-195.075）和 6.788（95％CI：1.516- 30.392）。有 108 例患者经随访获得 MRS 分级，分别有 59 例、32 例、10 例和 7 例分为 Rankin 0、Ⅰ、Ⅱ和Ⅲ组。 其中 70 例有不同程度的脑膜增强，46 例至少有 1 个结核瘤，22 例有 ACI，18 例有 OCI，7 例至少有 1 个脓肿，36 例有脑积水。MRS 组之间的 ACI、OCI、脑积水和 Evan's 指数存在显著性差异（P<0.05）；ACI、OCI 和脑积水的 OR 分别为 6.375（95％CI：1.501-27.080）、5.556（95％CI：1.332-23.177）和 9.139（95％CI：2.052-40.700）。 Evan's 指数的变化与 MRS 分级有关（r = 0.335，P = 0.040）。

**结论**

对于 TBM 患者，脑梗死与神经功能缺损有关，脑梗死和脑积水可被视为不良预后的危险因素。多模态颅脑 MRI 可作为评估 TBM 病情严重程度、预测患者预后和功能恢复情况的有效影像学手段。定期复查 MRI，特别是关注 Evan's 指数的动态变化，有利于及时调整治疗方案，改善患者预后，降低死亡率。

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# 结合大脑深部核团及小脑的血流灌注与灰质体积用于鉴别帕金森变异型多系统萎缩（MSA-P)和帕金森病（PD）及进行性核上性麻痹（PSP）

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题目：结合大脑深部核团及小脑的血流灌注与灰质体积用于鉴别帕金森变异型多系统萎缩（MSA-P)和帕金森病（PD）及进行性核上性麻痹（PSP）

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目的：探讨 PD、PSP 和 MSA-P 患者大脑深部核团及小脑的灰质（GM）萎缩和脑血流量（CBF）特征模式。探究 CBF 结合 GM 体积是否可以用来鉴别以上疾病。
方法：对 231 名受试者 [81 名 PD 患者、39 名 PSP 患者、21 名 MSA-P 患者和 90 名健康对照 (HC)]进行 3D-T1WI 和动脉自旋标记 (ASL) MRI 扫描。通过 GE AW 4.5 工作站 的 3D ASL Functool 套件软件生成 CBF 图（CBF 是根据国际医学磁共振学会 (ISMRM) 的建议计算得出的）。采用 PD25 模板分割深部核团为 16 个 ROI，采用 SUIT 模板分割小脑为 34 个脑区 ROI。测量各组深部核团及小脑 ROI 的 CBF 和 GM 体积。采用方差分析及 Bonferroni 事后校正，分析组间差异。采用逻辑回归分析并筛选 CBF 和 GM 预测因子，建立模型预测 PD、PSP 和 MSA-P。采用 ROC 分析模型预测诊断能力。
结果：与正常对照组相比，PD、PSP 和 MSA-P 患者的以下脑区的灌注均减低（双侧尾状核、壳核、苍白球外侧部、小脑右侧 V、双侧 VI、蚓 VI、蚓 VIIb、蚓 VIIIa 和右侧间位核）（p <0.05）。PSP 患者双侧尾状核 CBF 显着低于其他组（p<0.05）。PSP 患者左侧尾状核和双侧丘脑的萎缩程度显著高于 HC（p <0.001）。MSA-P 患者的左侧尾状核、双侧壳核和多个小脑区域的萎缩程度高于 HC。MSA-P 患者双侧壳核和右侧 V 的 GM 体积显著小于其他组（均 p <0.05）。结合 CBF 与 GM 区分 MSA-P 与 HC、PD 和 PSP 的模型中，ROC 曲线下面积 (AUC) 值分别为 0.996、0.992 和 0.928。
结论：双侧尾状核灌注显著减低是 PSP 的一个特征，而双侧壳核和右侧 V 显著萎缩是 MSA-P 的一个特征，核团灌注减低而体积不变是 PD 的一个特征。结合深部核团及及小脑的灌注和灰质体积可将 MSA-P 从 PD 和 PSP 中很好的鉴别出来。

# OR-49

# 扩张的血管周围间隙与小胶质细胞相关炎症及阿尔茨海默病纵向病理改变有关

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目的：
类淋巴系统是处理脑内代谢废物的重要途径之一，类淋巴循环障碍常导致异常蛋白的沉积（如淀粉样蛋白 β、tau 蛋白等）。血管周围间隙（PVS）是类淋巴系统的重要组成部分，当其扩张时可在磁共振图像上观察到。过去研究表明扩张的血管周围间隙（EPVS）常提示脑内类淋巴清除机制紊乱，且与阿尔茨海默病（AD）相关，然而目前 EPVS 与 AD 相关病理物质纵向变化的关系尚不清楚。

此外，神经炎症参与 PVS 扩张的过程，包括炎性细胞堆积、血脑屏障破坏等等。而小胶质细胞作为脑内主要炎症反应性细胞，参与各种神经炎症的过程，目前鲜有研究关注小胶质细胞与 PVS 扩张的关系。
本研究旨在探究 EPVS 与小胶质细胞激活、AD 病理物质纵向改变之间的关系。

材料与方法：
本研究纳入 144 名认知功能正常的老年人，每名受试者进行磁共振扫描、脑脊液及血液标志物检查，主要包括基线脑脊液 Aβ、p-tau、t-tau 和基线及至少 1 次随访的血清 p-tau。其中，123 名受试者进行基线及至少一次随访的淀粉样蛋白 PET 检查，117 名受试者进行脑脊液小胶质细胞炎性标志物（sTREM2）检测。根据 PVS 视觉评分标准进行半卵圆中心及基底节 PVS 严重程度评分，分为 1 级（无/轻度）、2 级（中度）、3 级（重度/极重度）。首先采用线性回归分析（步进法），将 AD 病理纵向年变化率作为因变量，将年龄、性别、APOE 基因型、脑白质高信号体积、颅脑总体积、AD 脑脊液标志物、半卵圆中心及基底节 EPVS 分级、血管风险因素（糖尿病、高血压、高脂血症）作为自变量，探究影响纵向变化率的因素。其次，将半卵圆中心及基底节 EPVS 分级作为因变量，纳入上述其余变量作为自变量，探究影响 EPVS 分级的因素。认为当模型和变量的统计量均小于 0.05 时有统计学意义。

结果：
研究表明半卵圆中心的 EPVS 与小胶质细胞炎症（β=0.210，p=0.014）、纵向 p-tau 年变化率（β=0.147，p=0.032）以及脑白质高信号体积（β=0.290，p=0.001）相关，而基底节 EPVS 仅与年龄（β=0.185，p=0.038）、颅脑总体积（β=0.264，p=0.012）有关。

结论：
小胶质细胞相关炎性反应是 PVS 扩张的可能机制之一，且 PVS 扩张反映类淋巴循环障碍，加快病理物质沉积。

## OR-50
# 利用静动态盆底 MRI 及 DTI 技术评估女性压力性尿失禁患者尿道的应用研究

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[摘要] 目的：探讨 3.0T 静动态盆底 MRI 及 DTI 技术评估压力性尿失禁（SUI）患者尿道形态及功能的价值，为探讨疾病的发病机制提供影像学依据。方法：前瞻性收集我院经临床诊断为 SUI 患者 28 例作为 SUI 组，同期选取年龄与之相匹配的健康志愿者 45 例作为对照组，所有健康志愿者均经过国际尿失禁咨询委员会尿失禁问卷（ICI-Q-LF）调查证实无 SUI 症状。收集两组绝经情况、产次、体重指数( BMI)等参数指标，并比较两组间差异是否有统计学意义。所有患者及健康志愿者在静息态及应力状态下（行 Valsalva 动作）进行盆腔 MRI 平扫和采用横断面单次激发自旋梯度回波(SE-GRE)脉冲序列行 DTI 扫描。在静息态下测量尿道中段内括约肌及外括约肌厚度；在静息和 Valsalva 状态下测量功能尿道长度，并观察膀胱颈漏斗的有无及尿道是否开放，比较两组间尿道中段内外括约肌厚度、功能尿道长度及静息-应力状态下的功能尿道长度差值、膀胱颈漏斗阳性率、尿道开放阳性率差异是否有统计学意义。对 DTI 原始图像进行后处理获得尿道括约肌复合体肌纤维束图像，观察图像并测量尿道中段环形括约肌、中央纵行肌肌纤维的各向异性分数（FA）、表观扩散系数（ADC）值及三个特征值（λ1，λ2，λ3），比较两组间尿道中段环形括约肌、中央纵行肌 DTI 各参数差异是否有统计学意义。结果：SUI 组产次及 BMI 明显大于对照组(P＜0.05）。SUI

组静息态时的尿道中段外括约肌厚度、静息与应力状态下功能尿道长度明显减小(P＜0.05）；静息-应力状态下的功能尿道长度差值明显增大(P＜0.05）；膀胱颈漏斗阳性率及尿道开放阳性率明显增大（P＜0.05）。所有受检者均获得满意的三维尿道括约肌复合体肌纤维束图像；SUI 组尿道中段环形括约肌 FA 值明显减小(P＜0.05）；ADC 值、λ2 值、λ3 值明显增大(P＜0.05）；两组间尿道中段中央纵行肌 DTI 各参数差异无统计学意义（P＞0.05）。结论：静动态 MRI 及 DTI 技术能够客观地评估 SUI 患者尿道形态和功能的变化，为进一步探讨 SUI 发病机制及临床完善治疗方案提供重要依据。

## OR-51

# 在不使用钆对比剂的情况下，通过负荷/静息 T1 mapping 区分缺血心肌、梗死心肌、冬眠心肌和正常心肌

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目的：在慢性冠状动脉疾病中，准确检测缺血心肌和冬眠心肌非常重要，因为有针对性的血运重建可以提高临床疗效。本研究的目的是以猪为实验对象，以病理为金标准，评估静息状态和三磷酸腺苷作用下的 T1 mapping 在鉴别缺血心肌、冬眠心肌和梗死心肌中的潜力。
方法：本研究选取 13 只成年雄性中国小型猪，通过在前降支近端放置 Ameroid 环缩环来制作慢性冠状动脉狭窄模型。在四个时间点进行 CMR 成像:基线、术后 1 周、2 周和 4 周。在所有成像时间点，分别在静息和三磷酸腺苷负荷的情况下进行静息和负荷首过灌注检查，注射造影剂前后的 T1 mapping 检查及延迟强化检查。计算心肌灌注的半定量及定量参数包括心肌灌注储备指数(MPRI)，最大信号强度（maxSI），最大上升斜率（max upslope），心肌血流量（MBF）等。另外计算 native T1 值、细胞外体积(ECV)以及他们的变化率，最后测量延迟强化的程度。
结果：梗死心肌、冬眠心肌、缺血心肌和正常心肌的静息 native T1 值分别为 1586.4±159.0ms、1099.5±80.9 ms, 1066.1±96 ms, 979.2±24.8 ms。梗死心肌、冬眠心肌、缺血心肌和正常心肌的静息 ECV 值分别为 64.66±14.84, 25.71±3.86, 22.68±3.3, 23.24±4.38。MPRI 与△nativeT1(负荷 native T1 减去静息 native T1 (R=-0.45, p=0.005)和△native T1% (△native T1/静息 native T1) (R=-0.50, p=0.034)相关。另外 MPRI 与△ECV (R=-0.41, p<0.001)、△ECV% (R=-0.41, p=0.005)也有相关性。
结论：本研究检测了慢性缺血性心肌病中缺血心肌、冬眠心肌和梗死心肌这三种类型心肌的静息和负荷 native T1 和 ECV 值。静息/负荷 T1 mapping 有潜力在不需要钆对比剂的情况下无创地检测缺血心肌和冬眠心肌

## OR-52

# 分段读出平面回波弥散加权成像的影像组学模型在预测肝细胞癌增殖状态的临床应用价值

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**目的：**探讨分段读出平面回波弥散加权成像（rs-EPI DWI）的影像组学模型在预测肝细胞癌增殖状态中的应用价值，为临床预后评估提供无创性的影像学手段。

**材料与方法：**连续性纳入我院 2017 年 3 月至 2021 年 3 月经组织病理确诊的肝细胞癌患者 110 例。根据肝细胞癌术后免疫组织病理 Ki67 标记指数结果分为高 Ki67 表达组（Ki67>10%）和低 Ki67 表达组（Ki67≤10%）。收集样本临床实验室检验数据，评估肝细胞癌形态学表现包括动脉期强化程度、肿块形态是否规则和动脉期瘤周强化等；基于 rs-EPI DWI 图像在病灶最大层面通过手动勾画感兴趣区获得肿瘤组织、正常肝实质及背景噪声的信号强度，提取影像组学特征，通过 Lasso 算法进行特征筛选，采用 logistic 回归进一步构建临床-影像组学模型，评估联合模型的预测效能。

**结果：**110 例肝细胞癌患者中低 Ki67 表达组 38 例，高 Ki67 表达组 72 例。研究结果显示 AFP 表达水平、形态是否规则、病灶信号值（b=800）及对比噪声比（b=800）等在两组间具有显著性差异（*P*<0.05），其临床预测模型在训练集及验证集中的曲线下面积（AUC）分别为 0.857（95%CI：0.768-0.945）、0.776（95%CI：0.597-0.956）；基于影像组学模型在训练集及验证集中的 AUC 分别为 0.833（95%CI：0.741-0.920）、0.773（95%CI：0.588-0.943）。通过 logistic 回归构建临床-影像组学模型在训练集及验证集中的 AUC 为 0.951（95%CI：0.905-0.996）、0.814（95%CI：0.640-0.987）。

**结论：**基于 rs-EPI DWI 图像构建临床-影像组学预测模型能够在术前预测肝细胞癌的增殖状态，为临床评估肝细胞癌的侵袭性提供无创性的影像生物标志物。

## OR-53

# 基于定量磁敏感成像探索阿尔茨海默病患者一年内脑铁含量纵向变化的研究

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目的：采用定量磁敏感成像（Quantitative susceptibility mapping, QSM）技术探索老年阿尔茨海默病（Alzheimer's disease, AD）患者一年内脑铁含量和脑血流量的纵向变化。

材料和方法：研究初步纳入了 55 例 AD 患者，在入组时和一年后分别获取他们的临床信息、量表信息和 QSM 和 3D-T1 图像信息，最终共 15 例完成了回访。AD 患者的认知功能使用简易精神状态量表（Mini-mental state examination, MMSE）和蒙特利尔认知量表（Montreal cognitive assessment, MoCA）进行评估。尾状核、壳核、苍白球、红核、黑质、齿状核、海马这 7 个核团被选为感兴趣区（Regions of interest, ROI），并测量其磁化率值。采用配对 t 检验比较 AD 患者基线状态和回访时磁化率值是否存在统计学差异；采用偏相关分析评估磁化率值与认知功能评分之间以及磁化率值变化值与认知功能评分变化值之间是否存在相关性。

结果：与基线水平相比，左侧壳核、左侧齿状核和右侧海马铁含量在一年内增加。基线水平左侧红核、右侧黑质的磁化率值与 MMSE 量表呈负相关（P=0.022, P=0.048），右侧海马的磁化率值与 MMSE 量表成正相关（P=0.047）。

结论：AD 患者左侧壳核、左侧齿状核、右侧海马铁含量在一年内增加，左侧红核、右侧黑质和右侧海马的磁化率值与认知功能评分相关，这些研究结果为进一步研究 AD 患者的病理生理机制提供了新的见解。

## OR-54

# 糖尿病性黄斑水肿抗 VEGF 治疗疗效的 T2 Mapping 功能磁共振定量评估

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**目的** 探讨功能磁共振 T2 mapping 评估糖尿病黄斑水肿抗 VEGF 治疗疗效的价值；
**方法** 前瞻性入组 2020 年 11 月至 2021 年 5 月在云南大学附属医院（云南省眼科医院）就诊的糖尿病黄斑水肿（diabetic macular edema，DME）患者 16 人（20 只眼），均排除其他眼底疾病，搜集临床资料（包括眼底照相、OCT 检查、视力、眼压、血压、血糖、糖尿病病程、DME 病程、是否激光治疗等资料）。所有患眼玻璃体内注射康柏西普，均为每月注射 3 次，连续注射 3 次，随访 3 个月。在首次抗 VEGF 治疗前、治疗后 1 月、2 月、3 月行功能磁共振检查，磁共振检查包括眼眶轴位、冠状位及矢状位 T2WI、眼球 T2 mapping 扫描。取 ROI 为 0.5mm$^2$ 分别测量视网膜上 6 个区域（黄斑区、视盘区、内直肌眼环附着点交角（鼻侧）、外直肌眼环附着点交角（颞侧）、以及视盘区与鼻侧中点（鼻中）、视盘区与颞侧的中点（颞中））以及该 6 个区域对应视网膜前方 6 个区域的 T2 值；由两位头颈影像诊断经验超过 5 年的医生进行测量，重复测量 3 次，取平均值。采用统计学配对 t 检验分析比较患者每月注射康柏西普前后的 T2 值的差异，并将 T2 mapping 结果与 OCT 结果进行对比，Bland–Altman 分析评价诊断试验一致性，组内相关系数(ICC)来评估观察者的一致性。
**结果** 视盘区、黄斑区、鼻侧、鼻中、视盘区前方、黄斑区前方、颞侧前方治疗后的 T2 值低于治疗前（*P* 均<0.05），差异有统计学意义；颞侧、颞中、鼻侧前方、鼻中前方、颞中前方的 T2 值无统计学意义（*P*>0.05）；Bland–Altman 图显示 T2 mapping 与 OCT 对 DME 患者抗 VEGF 治疗疗效的评估一致性良好。两个观察者间具有良好的 ICC 系数（ICC＝0.86）。
**结论** 功能磁共振 T2 mapping 技术可以敏感并且定量反映 DME 患者抗 VEGF 治疗疗效；对于 DME 患者抗 VEGF 治疗疗效判断，功能磁共振 T2 mapping 检查与 OCT 检测具有良好的一致性。

# OR-55
# 线性钆对比剂在 2 型糖尿病大鼠脑内沉积诱导 NLRP3 炎症小体活化的机制

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目的：多次注射线性钆对比剂后脑内出现明显钆沉积，目前对于这一现象的临床生物学意义仍然未知，其未来可能对人体造成何等危害我们目前无法预估。2 型糖尿病作为一种常见的基础疾病，常伴发肿瘤、慢性肝脏疾病和血管性疾病等，患者往往需要接受多次增强 MRI 检查。糖尿病能够破坏血脑屏障的完整性，与脑内类淋巴系统的破坏也有密切关联。同时，糖尿病肾病是肾功能损害的重要原因之一。研究 2 型糖尿病状态下脑部钆沉积和清除情况对于糖尿病患者安全应用钆对比剂（GBCA）具有重要指导意义，对钆脑沉积的临床生物学意义研究也依然是非常迫切并且有意义的。
材料与方法：以 2 型糖尿病大鼠模型为基础建立钆脑沉积的动物模型，进行 MRI 扫描及病理染色、电镜、WB、流式细胞技术等检测。通过 ICP-MS 及液相色谱法定量研究钆在 2 型糖尿病大鼠颅内的沉积形式、相关影响因素及清除情况。体内尾静脉注射钆双胺及体外处理高糖刺激的小胶质和神经元细胞，检测 NLRP3 炎症小体激活、IL-1β、ASC 和 Caspase-1 的表达情况。
结果：2 型糖尿病大鼠多次注射线性 GBCA 钆双胺后会引起钆在脑内明显的沉积，9.4T MRI 平扫 T1WI 上，小脑深部核团和苍白球部位的信号强度明显升高，电镜可以观察到钆元素沉积，并且通过电感耦合等离子体质谱仪在脑组织中仍然能够检测到钆沉积；同时发现脑内 NLRP3、Caspase-1、IL-1β 蛋白表达水平升高，小胶质细胞活化增加。
结论：2 型糖尿病大鼠多次注射线性 GBCA 钆双胺后会引起钆在脑内明显的沉积，同时加重沉积部位炎症反应。

# 壁报交流

PO-001

# A prospective controlled study of distension protocols in bladder mpMRI

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OBJECTIVE: to compare the imaging quality of bladder mpMRI with different bladder distension protocols and explore the optimal patient preparation protocol for VI-RADS application.
METHODS: Patients who applied for pelvic mpMRI examination in our hospital from July 2020 to April 2021 were prospectively included with the approval of the hospital ethics committee, and were randomly divided into three groups after signing informed consent: Group 1 (urine holding alone: urine abstinence after urination 1～2 hours before scan), Group 2 (water drinking alone: drinking 500-1000 ml of water within 0.5～1 hour before scan), Group 3 (urine holding and water drinking: urination 1～2 hours before the examination + drinking 500～1000ml water before the scan). The pelvic mpMRI was performed on a 3.0T MR scanner, and the sequences included high-resolution T2WI (axial/coronal/sagittal), DWI/ADC (b-value=0/1000/1400 s/mm2), and DCE. A reviewer who was unaware of the preparation protocol performed separate quality scores for T2WI, DWI/ADC, and DCE(arterial phase) of bladder wall; motion artifacts affecting the bladder wall were evaluated; initial and final sequence bladder volumes (Vpre, Vpost) were measured using 3D Slicer, and volume changes(Vpost-pre) were calculated. Patients filled out the scale to collect height, weight, urination time, and water drink time, etc. Vpre, Vpost, and Vpost-pre in each group, the image quality and motion artifacts of each sequence in each group were compared by SPSS 21.0 software. Differences were considered statistically significant at $P < 0.05$. RESULTS: The differences of Vpre, Vpost, and Vpost-pre were statistically significant(P=0.001, 0.000, 0.000) in group 1 (31 cases, 55.9±14.4 years), group 2 (31 cases, 56.2±12.9 years) and group 3 (30 cases,60.0±13.6 years). T2WI, DWI/ADC, DCE quality scores showed: Group 3 ＞ Group 2 ＞ Group 1, and the differences were statistically significant (F=9.989,9.844,13.068; P=0.000,0.000,0.000), while the differences in motion artifact scores between groups were not statistically significant (F=1.861; P=0.161). CONCLUSION: The combination of the urine holding and water drinking protocol, which is recommended as the optimal bladder distension protocol for VI-RADS scoring, has advantages over urine holding or water drinking alone protocol in bladder distension and image quality.

PO-002

# Analysis of factors affecting the quality of bladder mpMRI

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OBJECTIVE: To explore the factors affecting the quality of bladder mpMRI imaging by comparing the quality of pelvic mpMRI bladder wall imaging, patients' general condition, urinary tract condition, and tolerance.
METHODS: Patients who applied for pelvic mpMRI examination in our hospital from July 2020 to April 2021 were prospectively enrolled after signing informed consent with the approval of the hospital ethics committee. And patients were abstained from urination 1～2 hours before the examination and drank 500～1000 ml of water half an hour～one hour before the examination,

and the time of urination and drinking was recorded. All pelvic mpMRI examinations were done on 3.0T MR scanners, and sequences included high-resolution T2WI (axial/coronal/sagittal), DWI/ADC (b-value = 0/1000/1400 s/mm2) and DCE. A reader who was unaware of the patients' information gave separate quality scores for T2WI, DWI/ADC, and DCE(arterial phase) of bladder wall. The bladder volume of initial sequence, final sequence (Vpre, Vpost) were measured by 3D Slicer, and volume changes(Vpost-pre) were calculated. All patients were asked to fill out the scale to collect personal general conditions, urinary conditions, and tolerance. Statistical analysis was performed using SPSS 21.0 software to compare information related to patients in different quality score groups in each series with ANOVA chi-square test and correlation analysis. Differences were considered statistically significant at $P < 0.05$.
RESULTS: Among the different quality score groups of T2WI, the differences of the duration of urine holding, Vpre and Vpost were statistically significant (F=4.261, 4.898, 8.808; P=0.012, 0.006, 0.000), and their correlation coefficients were -0.348, 0.687, 0.776, respectively; among the different quality score groups of DWI/ADC, the differences of Vpre and Vpost were statistically significant(F=5.790, 13.357; P=0.003, 0.000), with correlation coefficients were.697 and 0.801, respectively; among the different quality score groups of DCE, the differences of Vpre and Vpost were statistically significant (F=4.707, 8.582; P=0.008, 0.000), with correlation coefficients were 0.653 and 0.750, respectively.
CONCLUSION: Bladder volume is an independent influencing factor of bladder mpMRI imaging quality, suggesting that good bladder distension is crucial for bladder mpMRI.
*Clinical Relevance/Application:
Although factors related to bladder mpMRI is more complicated than CTU, proper bladder distension is still the most important quality control factor, and is the key to the success of bladder mpMRI for VI-RADS scoring.

PO-003

# The Application of Compressed Sensing on Liver Diffusion Weighted Imaging

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Purpose
Exploring CS in improving HR-DWI for liver applications.
Materials and methods
15 healthy volunteers (5 males, 51.9±9.6 years) were recruited and underwent the HR-DWI scan of liver with default SENSE 2 and CS factors of 2 on a 3.0 T MR scanner (Ingenia CX, Philips Healthcare, Best, the Netherlands). The scan parameters are shown in table 1. Two radiologists using a five-point visual scoring system for overall image quality (1: very poor, image not usable for interpretation; 2: poor, relevant limitations for image interpretation; 3: adequate, moderate limitations for image interpretation; 4: good, minimal limitations for image interpretation; 5: excellent, no limitations for image interpretation), and the score more than 3 was considered in line with clinical requirements. The Kappa test was used to evaluate the consistency of the scores between the two radiologists. If the consistency was good, the scores would be used for subsequent analysis. The Mann-Whitney U test was used to assess the difference of score.
Results
The scores by the two observers were in good agreement (p=0.613). In Table 2, it was shown that there were statistically significant differences in the score of the two sequences. When CS=2, the subjective score was higher than the conventional sequence.
Discussion and Conclusions
CS can be used to reduce noise artifacts for liver HR-DWI significantly.

PO-004

# 磁共振弥散成像中 T2 穿透效应的影响及解决方法研究

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目的：探讨磁共振弥散成像中的 T2 穿透效应，及从根本上消除该效应的方法。
方法：应用 1.5T 超导 MR 系 统及自旋平面回波成像序列，对 30 名志愿者采集含脑干部位的头部弥散成像数据；除通常采集的 b≠0 及对应 TE 的 b=0 的数据外，额外采集一组更短 TE 的 b=0 数据，从两组不同 TE 的 b=0 数据，计算像素组织的 T2 值，并用它除 去 b≠0 图像数据中的 T2 衰减，得到无 T2 穿透效应的弥散加权图像数据。
结果：脑干小脑上脚交叉结构较之周边 组织有较长的 T2 值。在消除了 T2 穿透效应后，正常脑干区小脑上脚交叉部分和脑干区皮质脊髓束部分在弥散加 权图像上的信号差异消失。
结论：通过采集两组不同 TE 的 b=0 数据，计算得到每个像素组织的 T2 值；应用得到 的 T2 值从 b≠0 的弥散加权图像中去除 T2 衰减，可以完全去除弥散成像中的 T2 穿透效应。

PO-005

# 感兴趣区勾画方法对直肠癌 APTw 值及观察者间变异的影响

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目的
探讨不同感兴趣区勾画法对直肠癌肿瘤 APTw 测量及观察者间变异的影响。
材料与方法
收集术后病理证实为直肠癌患者 11 例(年龄 70.82±9.28)岁，均未行新辅助治疗。所有患者术前行 3.0T MR (Ingenia CX, Philips) APT 及常规平扫检查。两名观察者(分别有 2 年、5 年的诊断经验)分别用三种兴趣区勾画方法（全肿瘤、单一层面、实性部分抽样勾画）测量肿瘤 APTw 值，所有测量均在飞利浦工作站(Intellispace Portal, Philips Healthcare)进行后处理，测量在 APT 与 T2WI 融合图像上完成。全肿瘤勾画法是沿着肿瘤边界勾画，将包含肿瘤所有层面勾画出来并取其平均值，单一层面勾画法是在肿瘤最大层面沿肿瘤边界勾画病灶，实性部分抽样勾画法是在肿瘤最大层面实性部分分别勾画出 3 个圆形感兴趣区（每个兴趣区面积约 10mm2 ），最后取其平均值，需要避免坏死、囊变和大血管区(图 1)。采用组内相关系数(ICC)和 Bland-Altman 对三种测量方法中两名观察者的一致性进行分析，采用 Friedman M 检验比较三种测量方法得到的 APTw 值。
结果
使用全肿瘤勾画法，两位观察者间的 ICC 为 0.989，观察者间差值均数为 0.03%，95%的一致性界限为(-0.20,0.26)%，单一层面勾画法分别为 0.986、-0.00%、(-0.26、0.25%)%，实性部分抽样勾画法分别为 0.949、-0.01%、(-0.37、0.34)%(表 1，图 2)。三种方法所测得的 APTw 值差异有统计学意义(P=0.014, F=4.902)。实性部分抽样勾画法的 APTw 值(2.68±0.40)显著高于全肿瘤勾画法(2.03±0.56)和单一层面勾画法(2.18±0.55)(P= 0.005、0.03)，但全肿瘤勾画法与单一层面勾画法所测得的肿瘤 APTw 值无统计学差异(P=0.479)。
结论

感兴趣区勾画方法对肿瘤的 APTw 值以及观察者间的变异性有相当大的影响。全肿瘤勾画法测量的 APTw 值可以反映直肠癌的整体情况，同时，观察者间的变异性最小，可重复性最好。

## PO-006

# 磁靶向诊疗一体化纳米探针通过 PA/MR 双模态成像指导磁热联合化疗

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**目的：**诊疗一体化纳米平台在影像引导的肿瘤联合治疗中具有广阔的应用前景。在这项工作中，本研究拟构建一个由方形形态的超顺磁性氧化铁（superparamagnetic iron oxide，SPIO）、$MnO_2$ 和盐酸阿霉素（doxorubicin，DOX）组成的混合纳米探针。该探针利用肿瘤微环境实现特异性磁共振 T2-T1 成像、“开-关”式光声成像以及肿瘤微环境的药物可控释放反应，从而更好地指导磁热治疗联合化疗抑制乳腺癌。**材料与方法：**利用热分解法和溶剂交换法两步程序制备具有磁热特性的方形 SPIO；利用温和的超声方法在 SPIO 周围生长 $MnO_2$ 纳米片；采用静电吸附法将 DOX 吸附在 SPIO@$MnO_2$ 上，完成 SPIO@$MnO_2$@DOX（简称 IMD）纳米探针的组装。纳米探针经过透射电镜、马尔文粒度仪、紫外可见吸收光谱、荧光光谱、磁共振成像以及光声成像进行基本表征以及验证药物释放、荧光恢复、成像等特性。体外细胞实验验证 IMD 纳米探针的毒性、靶向入胞情况以及磁热联合化疗治疗效果。小鼠体内实验验证 IMD 纳米探针的特异性成像诊断能力以及治疗效果。**结果：**透射电镜、紫外可见吸收光谱结果表明了 IMD 纳米探针的成功制备。马尔文粒度仪测定 IMD 纳米探针水动力平均直径为 221.93±19.356 nm，表面带负电荷。磁致加热装置加热 IMD 后，IMD 具有良好的升温性能。且经肿瘤微环境破坏后，投射电镜下观察到二氧化锰纳米片结构消失，DOX 荧光得到恢复，DOX 的释放进一步增强。磁共振表征结果显示经过肿瘤微环境响应后纳米探针由 T2 对比效应转为 T1 对比效应。光声成像显示 IMD 经肿瘤微环境作用后光声信号消失。体外细胞实验结果表明，磁靶向作用更能好地帮助纳米探针进一步聚集；MTT 实验证实了单纯 SPIO@$MnO_2$ 的毒性作用小；联合治疗评估中，磁热联合化疗对肿瘤细胞的生长有更好的抑制作用。体内实验结果表明，该智能纳米平台具有磁靶向性 MRI T2-T1 和光声的高效成像能力，表明 IMD 是一种很有前途的成像造影剂。此外，磁热与化疗的协同作用显著抑制小鼠肿瘤生长，而副作用可忽略不计。**结论：**IO@$MnO_2$@DOX 复合纳米探针作为一种集成的诊疗一体化纳米探针在特异性肿瘤成像诊断和肿瘤生长抑制方面具有应用潜力。

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## PO-007

# 注射式预刺激对提升磁共振肝脏动态增强成功率及图像质量的价值研究

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目的：研究注射式预刺激对提升肝脏动态增强成功率及图像质量的价值及意义。

方法：收集 2021 年 1 月-2021 年 5 月，到我院就医行上腹部磁共振增强检查患者共 85 例，其中常规钆剂增强检查患者 53 例，普美显增强检查 32 例。常规钆剂增强注射方式采用 Ulrih 高压注射器注射，在注射钆剂前，先行上腹部预扫描的同时采用高压注射器以 4ml/s 的速度注射生理盐水，扫描完毕后观察预扫描图像质量，根据图像质量用语音跟患者进行沟通，让患者在接下来注射钆剂增强时，能有一个预刺激式心理准备，从而提升动态增强的成功率。普美显增强，我科是采用手推的方式进行注射，在注射普美显增强前，行上腹部预扫描同时采用手推的方式快速注射 15ml 生理盐水，扫描完毕后观察预扫描图像质量，同样根据图像质量与患者进行沟通，从而提高接下来普美显动态增强的成功率。
结果：常规钆剂上腹部动态增强共 53 例，其中首次成功 49 例，优质图像 46 例，首次成功率 92.3％，优质率 86.8％。对比我科近 40 天上腹部钆剂动态增强共 153 例，其中首次成功 125 例，优质图像 115 例，首次成功率 81.7％，优质率 75.2％，首次成功率和图像优质率都有明显提高。普美显上腹部动态增强共 32 例，其中首次成功 28 例，优质图像 25 例，首次成功率 87.5％，优质率 78.1％。对比我科近一个月上腹部普美显动态增强共 82 例，其中首次成功 64 例，优质图像 58 例，首次成功率 78％，优质率 71％，首次成功率和图像优质率都有明显提高。
结论：注射式预刺激对提升肝脏磁共振动态增强成功率及图像质量优质率有着比较显著的作用。在行钆剂或者普美显动态增强前，先给患者行预扫描同时注射生理盐水，让患者预先感受这个注射刺激，预扫描结束后，根据图像质量与患者进行沟通，让患者有一个心理准备，从而提高患者在接下来行钆剂或者普美显动态增强时的闭气质量，从而提高动态增强的成功率以及图像质量。

PO-008

# DWI 联合传统 MRI 和传统 MRI 技术在鉴别低风险胸腺瘤，高风险胸腺瘤和胸腺囊肿的应用研究

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目的 探讨优化扫描参数后的胸部磁共振扩散成像检查的 ADCb=0-900mm2/s 和 ADCb=150-900mm2/s 值在区分低风险胸腺瘤，高风险胸腺瘤和胸腺囊肿三者的能力，并比较磁共振扩散成像联合传统磁共振技术与单纯传统磁共振技术两者诊断能力的差异，为临床诊断提供帮助。材料和方法 采用 3.0T（TRIO；Siemens）磁共振扫描机对 42 例有术后病理结果的胸腺占位患者进行传统磁共振和扩散成像技术检查。测量所有病灶在 ADCb=0-900mm2/s 和 ADC b=150-900mm2/s 图像上 ADC 值，计算 ADC 减低率。对 ADCb=0-900mm2/s、ADC b=150-900mm2/s 和 ADC 减低率采用 ANOVA 检验，两两比较采用 Bonferroni，以上均为 P＜0.05 有统计学差异。并分别对 ADCb=0-900mm2/s，ADC b=150-900mm2/s 在低风险胸腺瘤和高风险胸腺瘤，低风险胸腺瘤和胸腺囊肿之间做 ROC 分析，诊断医师对所有病灶的位置，边缘和坏死特征做出主观评价，并采用测量所有病灶直径采用 Kruskal-Wallis 检验，并做两两比较，以上均为 P＜0.05 有统计学差异。诊断医师采用盲法对 42 例患者的传统核磁图像和 DWI 图像做出胸腺囊肿，低风险胸腺瘤和高风险胸腺瘤诊断，以病理结果作为金标准，采用卡方检验判断图像诊断的准确率，诊断差异评价采用 McNemar 检验。
结果 42 例胸腺肿物在胸腺囊肿，低风险和高风险胸腺瘤三组 ADCb=0-900mm2/的平均值和标准差分别为 3.52±0.54、2.04±0.50 和 1.21±0.50，三者之间有统计学意义（P＜0.000），ADC b=150-900mm2/s 的平均值和标准差分别为 2.73±0.24、1.59±0.49 和 0.82±0.15，三者之间有统计学意义（P＜0.000）。ADC 减低率平均值和标准差分别为 14.05±4.97、15.17±2.97 和 8.78±3.10（P=0.492）。低风险和高风险胸腺瘤的 ADC b=0-900mm2/s 和 ADCb=150-900mm2/s 的 ROC 曲线下面积和 Cutoff 值及其敏感度，特异度和准确度分别为 0.885、1.345、96.2%、75%、71.2% 和 0.964、1.06、84.6%、100%、84.6%；低风险胸腺瘤和胸腺囊肿的 ADCb=0-900mm2/s 和

ADCb=150-900mm2/s 的 ROC 曲线下面积和 Cutoff 值及其敏感度，特异度和准确度分别为 0.976、2.9、100%、96.2%、96.2%和 0.976、2.345、100%、96.2%、96.2%。磁共振扩散成像联合传统磁共振技术相比单纯传统磁共振技术有更高的准确率（95.24 vs.76.19），更高的 Kappa 值（0.913 vs. 0.578），两者诊断方法之间有明显区别，P=0.008。
结论 ADCb=0-900mm2/s 和 ADCb=150-900mm2/s 都能在胸腺囊肿，低风险胸腺瘤和高风险胸腺瘤之间进行鉴别诊断，ADCb=150-900mm2/s 相比 ADCb=0-900mm2/s 在区分低风险胸腺瘤和高风险胸腺瘤上有更好的表现；磁共振扩散成像技术联合传统成像磁共振技术的诊断能力明显高于传统磁共振成像技术。

PO-009

# 磁共振 T1WI 在 Legg-Calvé-Perthes 病中的诊断价值：其他常规扫描序列是否可以省略？

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目的：Legg-Calvé-Perthes 病（LCPD）是由髋关节供血不足引起的，进而可发展为股骨头坏死、畸形。在疾病的早期，MR 可以检测出股骨头坏死的程度和范围。本文比较研究 T1WI 与其他常规扫描序列在 LCPD 病中的诊断价值。
材料与方法：对 2019 年 1 月至 2021 年 1 月共 24 例髋关节 MRI 病例进行研究。X 线片为标准盆腔平片，采用 3.0T 磁共振对临床诊断为 LCPD 的患者进行检查。MRI 图像分为横向和冠状位，扫描方案为 TSE-T1WI、TSE-T2WI、TIRM 序列。常规获得以下序列：冠状位 TSE T1WI（FOV：320×430mm；TR/TE：881/20；矩阵：512×512；层厚：3.0mm；层间距：4.65mm），横轴位 TSE-T2WI（FOV：320×430mm；TR/TE：3500/107；矩阵：512×512；层厚：3.0mm；层间距：4.20mm），横轴位 TSE T1WI（FOV：320×430mm；TR/TE：440/13；矩阵：512×512；层厚：3.0mm；层间距：4.20mm），冠状位 TIRM-T2WI（FOV：320×430mm；TR/TE：4200/56；矩阵：512×512；层厚：3.0mm；层间距：4.5mm）。根据坏死股骨头的形态可分为三组：A 组，球形股骨头；B 组，椭圆形股骨头；C 组，扁平股骨头头。根据髋关节轮廓可分为四级：4 分，轮廓完全清晰；3 分，轮廓清晰（＞50%）；2 分，轮廓清晰（＜50%）；1 分，轮廓不清楚。三位放射科医生回顾性分析 24 例临床诊断为 LCPD 的患儿。

结果：
T1WI、T2WI 和 TIRM 三种扫描诊断的敏感性、特异性分别为： 97.9%和 93.7%、78.9%和 86.7%、88.9%和 90.7%。三种方法诊断 LCPD 具有较高的一致性，kappa 值为 0.70–0.81。T1WI、T2WI 和 TIRM 三组评分分别为 3.52±0.30、2.98±0.34 和 3.20±0.56。T1WI vs.T2WI，T2WI vs. TIRM 和 T1WI vs. TIRM 的 q 值分别为 8.12（P<0.05）、2.08（P>0.05）和 6.34（P<0.05）。
结论：T1WI 序列对 LCPD 有较高的诊断价值。与 T2WI 和 TIRM 序列相比，T1WI 能更好地显示病灶边界，描述股骨头形态，精确计算坏死面积。TSE-T1WI 可以满足临床诊断，而且节省了扫描时间 70%，有利于麻醉患儿顺利完成检查。

PO-010

# 单层面感兴趣区 ADC 与全容积 ADC 直方图分析在预测肌层浸润性膀胱癌新辅助化疗疗效中的价值

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目的：探讨单层面感兴趣 ADC（2D-ADC）及全容积 ADC 直方图分析在治疗前预测肌层浸润性膀胱癌(muscle-invasive bladder cancer, MIBC)新辅助化疗(neoadjuvant chemotherapy, NAC)疗效中的价值。
材料与方法:回顾性分析了临床分期在 T2N0M0-T4a 之间的 MIBC 患者 58 例，所有患者均经病理证实为尿路上皮癌并且分别在 NAC 治疗前和 NAC 治疗后术前进行两次膀胱 MRI 检查。采用单层面感兴趣区方法测得肿瘤 NAC 治疗前后的 2D-ADC 值并计算其变化率（Δ2D-ADC%），同时采用全容积直方图分析方法获得治疗前 ADC 直方图参数（ADCmean、ADCmax、ADCmin、熵值、峰度、均匀度、偏度、及百分位数）。基于 NAC 治疗前后肿瘤最大直径的变化将患者分为有反应组及无反应组，采用 Mann-Whitney-U 检验、独立样本 t 检验分析两组之间各参数差异，并绘制 ROC 曲线来评估 2D-ADC 和 ADC 直方图参数在预测 NAC 反应疗效中的价值。
结果：在 NAC 治疗后，33 例(57%)患者为有反应者，25 例(43%)患者为无反应者。有反应组治疗前 2D-ADC 为$(1.30\pm0.17)\times10^{-3}mm^2/s$，无反应组$(1.09\pm0.14)\times10^{-3}mm^2/s$，两组之间有显著差异($p < .001$)。有反应组的 Δ2D-ADC%高于无反应组(29.3%±27.0 vs 16.2%±30.5,p=.051)。大部分 ADC 直方图参数(ADCmean、ADCmax、熵值、峰度、均匀度、偏度、第 50、75 和 90 百分位数)在两组之间存在显著差异($P < 0.05$)。治疗前 2D-ADC 的 AUC 最高(0.842)。
结论:与 ADC 直方图参数相比，治疗前 2D-ADC 值预测 MIBC 患者 NAC 疗效的准确性更高。

PO-011

# 动脉自旋标记（ASL）指标与动态磁敏感增强灌注成像（DSC-PWI）参数在缺血性脑卒中诊断及预测患者预后的对比研究

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目的 比较动脉自旋标记（ASL）指标（PLD=1.5S、2.5S）与动态磁敏感对比增强灌注成像（DSC-PWI）参数在缺血性脑卒中患者血流动力学改变的相关性。并探讨 ASL 中动脉穿行伪影（ATA）对脑卒中患者预后的预测价值。方法 研究对象选择 2019 年 5 月-2020 年 5 月期间中国科学技术大学附属第一医院神经内科门诊及住院治疗的动脉狭窄/闭塞患者 80 例。所有患者均接受 CTA 或 MRA 确诊，并完成 ASL 及 DSC-PWI 扫描。通过一年期随访，依据随访结果，将患者分为再发缺血性卒中组和未再发缺血性卒中组，比较两组患者的影像学指标（ASL-CBF、PWI-CBF、PWI-CBV、PWI-MTT、PWI-TTP）在评估脑血流动力学方面参数的相关性。另外，同时比较两组患者影像学指标、临床指标，判断这些指标与患者预后是否相关。结果 1.ASL-CBF（PLD=1.5S）与 PWI-CBF、PWI-CBV 具有统计学差异（P＜0.05），ASL-CBF（PLD=1.5S）与 PWI-MTT、PWI-TTP 无明显统计学差异（P＞0.05）;经 Kappa 分析，ASL-CBF（PLD=1.5S）与 DSC-PWI 参数中 PWI-CBF、PWI-CBV、PWI-MTT、PWI-TTP 的 Kappa 值分别为 0.412、0.387、0.548、

0.652，ASL-CBF（PLD=1.5S）与 PWI-TTP 具有较好的一致性。2. ASL-CBF（PLD=2.5S）与 PWI-MTT、PWI-TTP 具有统计学差异（P＜0.05），ASL-CBF（PLD=2.5S）与 PWI-CBF、PWI-CBV 无明显统计学差异（P＞0.05）;经 Kappa 分析，ASL-CBF（PLD=2.5S）与 DSC-PWI 参数中 PWI-CBF、PWI-CBV、PWI-MTT、PWI-TTP 的 Kappa 值分别为 0.764、0.682、0.428、0.336，ASL-CBF（PLD=2.5S）与 PWI-CBF 具有较好的一致性。 3.80 例患者中，共 46 例患者的 ASL 图中出现动脉穿行伪影。随访结果，再发缺血性卒中组 24 例，其中 8 例患者 ASL 图中出现动脉穿行伪影，未再发组 56 例，其中 38 例患者 ASL 图中出现动脉穿行伪影，两组比较有统计学差异（P＜0.05）。由此可见 ASL 图中出现动脉穿行伪影，在预后好的患者中更多见，这有助于预测患者的预后情况。
结论 1.缺血性脑卒中患者 ASL-CBF（PLD=1.5S）与 DSC-PWI 技术中 PWI-TTP 参数结果有较好的一致性，ASL-CBF（PLD=2.5S）与 DSC-PWI 技术中 PWI-CBF 参数结果有较好的一致性，ASL 检查具有无创性、可重复性、安全性等特点。2.ASL 灌注图中动脉穿行伪影（ATA）可作为缺血性脑卒中患者预后的预测指标。

PO-012

# Subclinical systolic dysfunction in type 2 diabetes mellitus patients with preserved ejection fraction related to myocardial extracellular interstitial expansion: a cardiac MR T1 mapping and tissue-tracking study

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Objective: To assess the left ventricular myocardial T1 value, extracellular volume fraction (ECV) and strain in type 2 diabetes mellitus (T2DM) patients with preserved ejection fraction, and the underlying relationships between them.
Materials and methods: 46 patients were enrolled in this study, including 13 T2DM only patient (G1), 13 diabetic patients with Hypertension (G2), 20 with hypertension (G3), and 32 sex-, age- and BMI-matched healthy controls (HCs). All subjects undergo CMR examinations (1.5T, MAGNETOM Amira, Siemens, Best, Netherlands). The values of native T1, post-contrast T1 and ECV were measured from the basal, mid and apical part of the left ventricular myocardial according to AHA 17-segmentation via the modified Look-Locker inversion recovery technique. The left ventricular global longitudinal strain (GLS) was evaluated using routine cine images and tissue-tracking analysis software (CVI42, Circle Cardiovascular imaging, Calgary, AB, Canada). The baseline clinical and biochemical indices were collected before the CMR examination.
Results: The myocardial native T1 values, ECV, mass and mass index were significantly higher in all diabetic patients than in the healthy controls (native T1: 1078.73±13.28 ms vs. 1034.35±12.34 ms; ECV: 29.4 ± 3.8% vs. 25.5 ± 2.3%; Myo-Mass: 64.24 ± 4.62g vs. 52.41 ± 4.54g; Myo-Mass index: 53.43 ± 1.82g/m2 vs. 40.56 ± 2.33 g/m2; $p < 0.05$ for all). G2 had increased ECV (31.7 ± 2.3% vs. 27.6 ± 2.5%, [G1] $p < 0.05$; 31.7 ± 2.3% vs. 27.5 ± 2.4%, [G3] $p < 0.05$). Myocardial mass and Myocardial mass index were significantly higher in G2 patients (Myo-Mass: 69.52±5.29g vs. 54.64±4.47g; Myo-Mass index: 54.03±4.92g/m2 vs. 42.26±2.37g/m2; [G1] $p < 0.05$ for all). G1 had reduced LV longitudinal strain (GLS) compared with HCs (-18.6 ± 3.2% vs -20.7 ± 2.4%, $p < 0.05$). G2 had greater GLS than G1 (-20.6 ± 3.8% vs -18.6 ± 3.2%, $p < 0.05$). However, the left ventricular volume, ejection fraction, GRS and GCS were similar between the diabetic patients and the healthy controls. And myocardial systolic strain was no significant difference between G2 and G3 patients. In the T2DM only patients, The ECVs were independently associated with the GLS (standardized $\beta = 0.389$, $p < 0.05$).

Conclusions: Type 2 diabetes mellitus patients with preserved ejection fraction exhibit increased ECV and depressed GLS. The amelioration of LV strain might be associated with myocardial extracellular interstitial expansion.

PO-013

## The potential value of intravoxel incoherent motion diffusion weighted imaging in predicting pancreatic neuroendocrine neoplasms grading

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**Objective:** This study aimed to explore the parameters of intravoxel incoherent motion (IVIM)-diffusion weighted imaging (DWI) in predicting pancreatic neuroendocrine neoplasms (pNENs) grading.
**Methods:** Subjects comprised 41 histologically proven pNENs. All patients underwent pancreas multi-b values DWI. Standard apparent diffusion coefficient ($ADC_{standard}$), slow ADC ($D_{slow}$), fast ADC ($D_{fast}$) and perfusion fraction ($f$) were calculated. Long diameters (LD) and IVIM-DWI parameters of G1 and G2-3 pNENs were compared using Independent Sample t-test. Receiver operating curve (ROC) analysis and Spearman-correlation test were performed to evaluate the performance of imaging parameters in pNENs grading and the relationship with histology-derived parameters.
**Results:** The LD of G1 pNENs were significantly smaller than those of G2-3 tumors (1.663 vs. 3.475 cm, P<0.001). Mean $f$ values of G1 pNENs were significantly higher than those of G2-3 tumors (63.80 vs. 51.35 %, P<0.001). When LD was ≤1.71cm or $f$ value was >45.8%, the sensitivity and specificity for diagnosing G1 pNENs were all 100%. There were good negative correlation between $f$ value and Ki-67 Index (r =-0.539，P<0.001) and inferior positive correlation between LD and Ki-67 Index (r =0.469，P=0.002) in pNENs.
**Conclusions:** IVIM-DWI derived perfusion parameter $f$ and LD may be useful for distinguishing G1 pNENs from G2-3 pNENs. LD combined with $f$ can predict G1 pNENs with the highest sensitivity and specificity. IVIM-DWI may serve as a promising noninvasive biomarker to evaluate the tumor proliferation of pNENs.

PO-014

## Multiparameter Model Based on Carotid Plaque Composition and Burden for Prediction the Synchronized Ipsilateral Acute Cerebral Infarction severity

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Purpose: To investigate high resolution MRI findings of carotid plaque composition and burden in relation to severity of synchronic ipsilateral acute cerebral infarction (ACI) risk by DWI-ASPECTS score.

Methods: Between January 2020 and April 2021, 35 patients with carotid plaques performed one-stop high-resolution MRI in our institution were retrospectively evaluated. All patients were

performed synchronic MRI-DWI sequence examination. And the DWI-ASPECTS score was evaluated by one radiologist with 30 years of experience in cerebral ischemic. Then, the patients were divided into low DWI-ASPECTS group with scoring 0-5 point and high DWI-ASPECTS group with scoring 6-10 point. The clinical risk factor, laboratory examination results and the presence and or absence of specific plaque components (calcification, fibrous cap [FC], lipid-rich necrotic core [LRNC], intraplaque hemorrhage [IPH]), and the quantitative vascular parameters (total vessel area, lumen area, wall thickness, wall area, and wall standardized index) were also evaluated and measured by the other radiologist. SPSS 23.0 software was used for statistical analysis. The t-test and c test was used to compare the differences between two groups. Logistic regression analysis was used to screening the predictor for DWI-ASPECTS score and generated a combined model. ROC analysis was used to evaluate the efficacy of the model. $P < 0.05$ was considered statistically significant.

Results: Of the 35 patients, 25 had DWI-ASPECTS score (6-10) and 10 had DWI-ASPECTS score (0-5). Compared to low DWI-ASPECTS score group, more male patients were discovered in high DWI-ASPECTS score group (P=0.049). There was no significant difference in other baseline clinical, laboratory results and plaque components between the two groups (P>0.05). Compared to high DWI-ASPECTS score (6-10) group, smaller mean lumen area (7.27±8.22, 21.29±16.21; p=0.002), smaller minimum lumen area (4.11±7.78, 15.79±15.42; p=0.006), larger mean normalized wall index (0.89±0.16, 0.74±0.19; p=0.035) were detected in patients with low DWI-ASPECTS score (0-5). Logistic regression analysis showed that the mean lumen area was an mild adverse predictor for DWI-ASPECTS score (OR=1.10; 95%CI, 0.84-0.99; P=0.030). The combined variable model had the optimal predictive performance for low DWI-ASPECTS score. The sensitivity, specificity and AUC were 100.00%, 60.00% and 0.808, respectively.

Conclusion：The mean lumen area was a mild adverse predictor for the severe the ACI. And, the multiparameter model based on carotid plaque composition and burden showed a high performance for ACI severity stratification.

## PO-015

# 乳腺癌化疗相关主观认知抱怨患者内在自发脑振荡活动与其执行功能相关

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目的：乳腺癌是我国女性最好发的恶性肿瘤性疾病，本研究目的在于探究不同频段下乳腺癌患者化疗后出现主观认知抱怨时（SCC 组）的自发脑振荡活动。
材料与方法：纳入 SCC 组（N=32）、乳腺癌术后化疗前患者（BC 组，N=43）及健康对照组（HC 组，N=24）进行静息态功能 MRI 扫描，使用主观（癌症治疗功能评估-认知功能）及客观认知测验（①蒙特利尔认知评估-北京版 ②连线测验 ③Stroop 色词测验 ④Rey 听觉语言学习测验）评估其认知功能。计算三组在典型频段（0.01~0.08 Hz）与特定频段（slow-5 频段：0.01~0.027 Hz；slow-4 频段：0.027~0.073 Hz）的全脑低频振幅（ALFF）值。使用方差分析计算三组具有显著差异的脑区，随后进行事后比较分析两组之间（SCC vs. BC，SCC vs. HC）具有显著差异脑区。基于事后分析结果提取差异脑区平均 ALFF 值并与认知得分作相关分析，并构建支持向量机模型对 SCC 组患者进行判别分析。
结果：SCC 组患者主观认知表现显著低于 BC 组，而客观认知仅 Rey 听觉语言学习测验-再认部分得分显著减低。在典型频段，SCC 组与 BC 组之间 ALFF 值比较无显著差异脑区；与 HC 组相比，SCC 组在右侧小脑后叶 ALFF 值显著升高，在左侧小脑后叶、左侧额内侧回及右侧额中回 ALFF 值

显著减低。在 slow-5 频段，结果与典型频段相似。在 slow-4 频段，与 BC 组相比，SCC 组在右侧后扣带回 ALFF 值显著减低；与 HC 组相比，SCC 组在双侧小脑后叶 ALFF 值显著升高，在右侧小脑前叶、左侧额内侧回及右侧额中回 ALFF 值显著减低。相关分析显示这些脑区 ALFF 值主要与患者执行功能显著相关。此外，支持向量机模型也能够有效区分 SCC 组患者。
结论：本研究表明乳腺癌患者在化疗后出现主观认知抱怨时小脑内在自发活动代偿性增加及默认网络区域自发活动减少，并且与患者执行功能相关；且这些脑区活动的改变主要由 slow-4 频段贡献。其次，基于自发脑振荡活动改变所构建的支持向量机模型显示出较好的潜力能够将 SCC 组患者从 BC 及 HC 组中区分。

PO-016

## Classification of Parkinson's disease using a region-of-interest- and resting-state functional magnetic resonance imaging-based radiomics approach

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Objective:
To investigate the value of combining amplitude of low-frequency fluctuations (ALFF)-based radiomics and the support vector machine (SVM) classifier method in distinguishing Parkinson's disease (PD) patients from healthy controls (HCs).
Methods:
A total of 123 PDs and 90 HCs from three centers with functional and structural MRI images were included in this study. We extracted radiomics features using the Brainnetome 246 atlas from the mean ALFF maps. A two-sample t-test and recursive feature elimination combined with SVM method were applied for feature selection and dimensionality reduction. We used SVM classifier to construct model and identify the discriminative features. The automated anatomical labeling (AAL) 90 atlas and 5-fold cross-validation were used to evaluate the robustness and generalization of the classifier.
Results:
We found our model obtained a high classification performance with an accuracy of 78.07%, and AUC, sensitivity, and specificity of 0.8597, 78.80%, and 76.08%, respectively. We detected 7 discriminative brain subregions, which included the right inferior frontal gyrus, parahippocampal gyrus, superior temporal gyrus, left postcentral gyrus, precentral gyrus, middle frontal gyrus, and the superior frontal gyrus. The 5-fold cross validation and AAL 90 atlas also got high classification accuracy, and we found Brainnetome 246 atlas achieved higher classification performances than the AAL 90 atlas both with 10-fold and 5-fold cross-validation.
Conclusions:
Our method could effectively identify quantitative ALFF biomarkers to discriminate PDs from HCs and may be helpful for the early diagnosis of PD and could provide support for research on PD mechanisms and clinical evaluation.

PO-017

## Cortical Sulcus Depth Alterations in Patients with Tinnitus Before and After Sound Therapy: A Surface-Based Morphometry Study

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Purpose: As one of the quantitative measures of the cerebral cortex, sulcal depth has been widely used in brain morphology research, and sulcal deepening with age and disease. Our study aimed to explore alterations in brain surface-based morphometry sulcal depth in patients with idiopathic tinnitus before and after 24 weeks of sound therapy.
Methods and Materials: Thirty-three tinnitus patients underwent magnetic resonance imaging scans at baseline and after 24 weeks of sound therapy. Twenty-six age- and sex-matched healthy control (HC) individuals also underwent two scans over a 24-week interval. For all participants, 3.0T magnetic resonance imaging (MRI) and high-resolution 3D structural images were acquired with a 3D-BRAVO pulse sequence. Structural image data preprocessing was performed using the DPABISurf toolbox. Tinnitus Handicap Inventory (THI) scores were used to assess the severity of tinnitus before and after treatment. Two-way mixed model analysis of variance (ANOVA) and Pearson's correlation analysis were used in the statistical analysis. Student-Newman-Keuls (SNK) tests were used in the post hoc analysis.
Results: Compared to HCs, those in the tinnitus group at baseline had significantly lower sulcal depth in the left medial temporal cortex (MTC) and right somatosensory and motor cortex (SMC). After 24 weeks of sound therapy, the tinnitus patients demonstrated significantly increased sulcal depth in the left MTC and right SMC. There were no significant differences in sulcal depth between the tinnitus patients after treatment and HCs.(Fig1-Fig.3)
Conclusions: The remodeling of sulcal depth after sound therapy is an indicator for effective sound therapy. These brain regions may serve as potential neuroimaging biomarkers for the evaluation of tinnitus treatment effects.

PO-018

# 4D flow 联合 CMR 组织特征追踪成像对射血分数保留的肥厚性心肌病患者左心室舒张功能的评价

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目的：采用舒张期应变率、舒张早期及晚期血流平均速度参数，以健康对照组为参照标准，探讨 4D flow 及 CMR 组织特征追踪成像评价射血分数保留的肥厚性心肌病（HCMpEF）患者心脏舒张功能的价值。材料和方法：本研究回顾性收集 70 例 HCMpEF 患者（平均年龄±标准差，45 岁±13；44 名男性），42 例健康人（作为对照组，36 岁±15；25 名男性），均进行了 3.0T 磁共振常规序列扫描。并且有 23 例肥厚性心肌病患者及 22 例健康人群增加扫描了左心室流入流出道 4D flow 序列。采用 CVI42 后处理软件测量肥厚性心肌病患者和对照组的径向、周向、纵向舒张期应变率、舒张早期（左心室抽吸）及晚期（左心房主动收缩）的二尖瓣下平均血流速度。两组数据分别采用 Mann-Whitney 检验进行舒张期应变率的比较，T 检验进行舒张早、晚期平均速度的比较；两组数据分别使用 Pearson 相关性分析进行舒张期应变率与舒张早期平均速度的相关性分析。结果：70 例 HCMpEF 患者径向、周向、纵向舒张期峰值应变率均显著小于对照组（径向：-1.37(-0.86)vs-2.17(1.35),周向：0.87(2.44)vs1.16(0.53),纵向：0.46(0.24)vs0.68(0.33),HCMpEF 组 vs 对照组，单位：1/s，P＜0.001）；其中，23 例肥厚性心肌病患者舒张早期平均血流速度小于对照组(35.14±11.22vs.46.01±11.04，HCMpEF 组 vs 对照组，单位：cm/s，P＜0.01)，而舒张晚期平均血流速度肥厚性心肌病患者与对照组无统计学差异。舒张期应变率与舒张早期平均血流速度相关性如下：径向：r=-0.44，p=0.002；周向：r=0.42，p=0.004；纵向：r=-0.03，p=0.824。结论：HCMpEF 患者尽管射血分数保留，但是左心室舒张功能已经受损，4D flow 及 CMR-FT 定量分析技术可以为评价心脏舒张功能提供新的依据。

PO-019

# MRI 衍生的整体舒张早期纵向应率与射血分数保留心力衰竭患者预后的关系

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目的：应变成像可以定量评估射血分数(heart failure with preserved ejection fraction，HFpEF)保留的心力衰竭(HF)患者左心室射血分数(LVEF)受损前的亚临床心肌变形。然而，研究心肌应变在 HFpEF 的预后价值的数据有限。本研究旨在评价左室舒张早期纵向应变率(global early diastolic lobgitudinal strain rate, eGLSR)与 HFpEF 患者预后(全因死亡或心衰再住院)之间的关系。
方法：在这项回顾性研究中，连续入选 2010 年 1 月至 2013 年 3 月接受了心血管磁共振(CMR)成像检查的 HFpEF 患者。用线性回归分析左室舒张早期纵向应变率（eGLSR）与变量的相关性。采用 Cox 比例回归分析 eGLSR 与预后的关系。
结果：本研究共纳入 186 例 HFpEF 患者(平均年龄 59 岁，女性占 41.4%)。eGLSR 与左室舒张末期容积指数(LVEDVI)(r=-0.39，P<0.001)、心率(r=0.35，P<0.001)、LVEF(r=0.30，P<0.001)呈现弱相关性，与左室收缩末期容积指数(LVESVi)中度相关(r=-0.44，P<0.001)。在调整了多个临床和实验室检查变量后，eGLSR 受损(<中位数，0.57/s)与心衰再住院或全因死亡的风险增加相关(调整后的风险比，HR=2.01，95%可信区间，1.10-3.66；P=0.02)。
结论：我们发现左室舒张早期纵向应变率，是一个量化评估心脏舒张功能的 CMR 指标，与射血分数保留的心力衰竭患者的不良结局独立相关。仍需要进一步的多中心、大样本的前瞻性研究来验证心肌应变在这些患者中的临床价值。

PO-020

# 特发性全面性癫痫儿童神经血管耦合改变的 MR 研究

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目的：基于功能连接强度（FCS）和脑血流量（CBF），探讨特发性全面性癫痫（IGE）患儿神经血管耦合改变及其与认知功能表现的相关性。
材料和方法：纳入 IGE 患儿 25 例及年龄、性别、受教育程度相匹配的健康儿童 26 例（表 1），收集 2 组的人口统计学数据及临床资料,并行静息态功能磁共振成像（rs-fMRI）及静息态动脉自旋标记（ASL）脑灌注成像检查，得到每位被试者全脑功能连接强度（FCS）和脑血流量（CBF），计算每位受试者每个体素的 FCS、CBF 及 CBF/FCS 比值（每单位连接强度的血流供应量），使用独立样本 T 检验比较两组受试者 CBF/FCS 比值、CBF 和 FCS 组间差异。提取出有显著组间差异脑区的 CBF/FCS 比值、CBF、FCS，与 IGE 患儿认知功能评分及发病年龄进行偏相关分析（年龄、性别和教育作为协变量），采用 Bonferroni 方法进行多重比较校正（P<0.05/4=0.0125）。
结果：与对照组相比，IGE 患儿组左侧中扣带回 CBF/FCS 比值增加（表 2，图 1A），左侧壳核的 FCS 降低（表 3，图 1B），IGE 患儿组右侧顶上小叶、枕中回 CBF 增加，左侧中央后回 CBF 降低（表 4，图 1C）。IGE 患儿左侧中扣带回 CBF/FCS 比值与韦氏智力量表的总智商（FIQ）和言语智商（VIQ）呈负相关（r=-5.39，P=0.010；r =-5.55，P=0.007；Bonferroni 校正）（图 2）。IGE 患儿 FIQ 与左侧中央后回 CBF 呈负相关（r=-0.424，P=0.049，未校正），与 IGE 患儿左侧壳核 FCS 呈正相关（r=0.424，P=0.049，未校正）（表 5）。

结论：IGE 患儿存在神经血管耦合的改变，并且这种改变与 IGE 患儿的认知功能表现有关，这可能有助于我们从神经血管耦合的角度来理解 IGE 的神经病理机制。

PO-021

# Effects of iron accumulation in the substantia nigra on brain functional networks in Parkinson's disease: a multimodality magnetic resonance study.

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Objective: In Parkinson’s disease (PD), iron accumulation in the substantia nigra (SN) exacerbates oxidative stress and a-synuclein aggregation, leading to neuronal death. In this study, we investigated the effects of iron accumulation in the SN on the brain functional network in Parkinson's disease by multimodality magnetic resonance imaging.
Materials and Methods: 85 PD patients and 140 normal controls (NC) underwent resting-state fMRI and susceptibility weighted imaging scans, as well as motor and non-motor symptoms assessments. According to the median iron content in the substantia nigra of NC, PD and NC were divided into high iron group and normal iron group, respectively. The effects of iron accumlation in the SN on the brain functional networks in Parkinson's disease were investigated by voxel-based interaction analysis.
Results: Based on voxel-based interaction analysis, we found that there was an interaction between iron and PD disease status in the left insular lobe and left rolandic operculum in the basal ganglia network (peak MNI coordinate: X=-33.5, Y=3.5, Z=13.5; F=16.49) (Fig.1a), as well as right middle occipital gyrus, right superior temporal gyrus and both sides of cuneus in the visual network (peak MNI coordinate: X=42.5/66.5/4.5, Y=-86.5/-38.5/-82.5, Z=11.5/13.5/33.5; F=18.56/21.95/14.36, respectively) (Fig.1b). Through further analysis, we found that the functional connectivity of the basal ganglia network interaction brain region in the PD high iron group was lower than that in the PD normal iron group ($P < 0.001$), while the functional connectivity of this brain region was not significantly different between the NC high iron group and the NC normal iron group ($P=0.227$) (Fig.2a). In the whole PD group, the functional connectivity of this brain region was negatively correlated with UPDRS Ⅱ ($r=-0.223$; $P = 0.044$) (Fig.3a). In addition, the functional connectivity of the visual network interaction brain region was increased in the PD high iron group compared with the PD normal iron group ($P=0.001$), while the functional connectivity of this brain region was decreased in the NC high iron group compared with the NC normal iron group ($P < 0.001$) (Fig.2b). In the whole PD group, the functional connectivity of this brain region was significantly positively correlated with UPDRS Ⅱ ($r=0.236$; $P = 0.032$) (Fig.3b). Furthermore, there was a significant negative correlation between the functional connectivity of basal ganglia and visual network interaction brain region in the whole PD group ($r=-0.31$; $P = 0.005$) (Fig.4).
Conclusion: Iron accumlation in the substantia nigra can specifically affect the basal ganglia and visual network in Parkinson’s disease, and is closely related to the severity of disease. Our study provides imaging basis for understanding the mechanism of the occurrence and development of PD related to iron accumlation in the substantia nigra.
Key words: Parkinson's disease; functional magnetic resonance imaging; susceptibility weighted imaging; substantia nigra; brain iron; brain network

PO-022

# 基于纤维束追踪的空间统计分析(TBSS)探讨多发性硬化和视神经脊髓炎谱系疾病脑白质微结构损伤的横向与纵向变化差异

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目的：本研究基于一项 DTI 技术-纤维束追踪的空间统计分析(TBSS)探讨 1)视神经脊髓炎谱系疾病（Neuromyelitis Optical Spectrum Disorder，NMOSD） 和多发性硬化（Multiple sclerosis, MS） 患者在基线期白质微结构损伤的差异； 2) 在平均 18 个月的随访间隔后，NMOSD 和 MS 间白质微结构损伤的模式差异。
方法：本研究共招募了 42 名 NMOSD 患者、51 名 MS 患者和 56 名健康对照 (HC)，并且在平均间隔约 18 个月后对 其中 14 名 NMOSD 患者和 13 名 MS 患者进行了随访研究，收集临床残疾量表评分并采集 3D-T1, DTI 和 flair 序列。分别使用 ITKsnap 及 LST 软件对 T1 病灶、T2 病灶体积进行计算。并基于 TBSS 技术计算 NMOSD 和 MS 患者在基线和随访时的各向异性分数 (FA)、平均扩散 (MD)、轴向扩散率 (AD) 和径向扩散率 (RD) 差异。同时运用 FSL 软件包提供的 JHU 白质图谱将脑白质分割为 20 个脑区，并计算 TBSS 统计的组间差异体素占白质骨架内总体素的百分比来评估脑白质完整性损伤的程度。
结果：在基线期，与 HC 相比，NMOSD 患者在 17 个脑区显示出 FA 减低（差异体素占比 26%），而 AD，MD 和 RD 无显著差异。在 MS 患者在 20 个脑区显示出广泛的 FA 减低（82%）和 MD（92%），AD（68%）和 RD（94%）升高。 与 NMOSD 相比，MS 同样也在 20 个脑区显示出 广泛的 FA 减低 (87%) 和 MD(72%) 、 RD (82%)升高，以及 16 个脑区的 AD 升高(68%)。在纵向随访中，MS 组（1.72±1.07 年）和 NMOSD 组（1.42±0.60 年）患者的随访时间间隔无显著差异。与基线期组相比，随访组 NMOSD 和 MS 的 EDSS 评分升高。同时，NMOSD 组的 T1 病灶体积、T2 病灶体积和灰、白质体积组间比较无显著差异，而 MS 组的 T2 病灶体积在随访组中增高、灰质体积减少，T1 病灶体积和白质体积无显著差异。在 DTI 纵向结果显示 MS 组在 17 个脑区的 FA 值降低（23%），6 个脑区的 MD 升高（1%），15 个脑区的 RD 升高（15%）。然而，在 NMOSD 组中未观察到基线和随访之间的显著变化。
结论：在 NMOSD 和 MS 中的白质的微观结构特性均发生了显着变化，但在 NMOSD 患者中的白质微结构损伤程度远小于 MS。此外，在平均为期 18 个月的随访间隔内，NMOSD 和 MS 患者的残疾程度加重。与此同时，MS 患者的白质微结构损伤呈进行性加重，但 NMOSD 患者却未表现出白质微结构进行性损伤的表现。

PO-023

# Functional stability predicts depressive and cognitive improvement in major depressive disorder: a longitudinal functional MRI study

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Functional stability is a newly developed dynamic functional connectivity approach. The objective of this study was to adopt functional stability to investigate diagnosis-associated abnormalities (patients vs. controls) and status-related changes (acute vs. remitted status) in brain function in major depressive disorder (MDD). 132 MDD patients and 102 healthy controls underwent resting-

state functional MRI as well as clinical and cognitive assessment at baseline, with 48 patients completing follow-up examinations at an average of 7 months. Results showed no group differences in baseline functional stability and no longitudinal functional stability changes from acute to remitted status in patients. However, we found that baseline functional stability in the dorsal and ventral anterior cingulate cortex, calcarine sulcus, and middle occipital gyrus could predict improvement in depressive symptoms from acute to remitted status in MDD patients, with longitudinal functional stability changes in these regions related to the degree of symptom improvement. In addition, lower baseline functional stability in the inferior temporal gyrus could predict a greater improvement in sustained attention, which was associated with a greater functional stability increase in this region. Our findings highlight functional stability as a potential prognostic biomarker to predict and track disease progression or stratify MDD patients for optimizing disease management and treatment strategies.

PO-024

## Iron Quantitative Analysis in an Integral View of Motor Cortex for Diagnosis and Evaluation in Amyotrophic Lateral Sclerosis

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Purpose To explore whether susceptibility weighted imaging (SWI) can be a valid biomarker for amyotrophic lateral sclerosis (ALS) through a quantitative method with an integral view of the primary motor cortex (M1).
Methods Thirty-two non-demented ALS patients and thirty-five age- and gender-matched healthy controls (HC) were retrospectively recruited. SWI and 3D-T1-MPRAGE were obtained using a 3.0T MRI scanner. The bilateral posterior band of M1, including motor and bulbar area, were manually delineated on phase images by two neuroradiologists. The mean phase value of M1 and its subregions were compared between two groups, and the correlation with clinical status were performed including stratification analysis. Receiver operating characteristic (ROC) curves were calculated toexamine the diagnostic power of phase values for ALS.
Results Significantly increased phase values were found in the entire, motor and bulbar region of M1 in ALS compared with HC, including the whole ($p<0.001$, $p<0.001$ and $p=0.001$, respectively) and elder level (all $p<0.001$). Phase values of M1 and two subregions were negatively correlated with the clinical score in the whole group ($p=0.0086$, 0.0197 and 0.0329, respectively). Phase values of M1 and motor part were positively correlated with progression rate in the whole ($p=0.0004$ and 0.0008) and elder group ($p=0.0182$ and 0.0174). In stratification analysis, phase value was higher in the fast progression rate than the slow group. ROC curves showed the value of the entire M1 had the best diagnostic performance (AUC=0.8759), especially in the elder group (AUC=0.9357).
Conclusion SWI can quantitatively detect iron deposition of M1 and subregions in ALS and reflect clinical status, which may be a valuable biomarker for clinical practice.

PO-025

## Common and distinct functional stability abnormalities across three major psychiatric disorders

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Delineating the neuropathological characteristics across psychiatric disorders is critical for understanding their pathophysiology. The purpose of this study was to investigate common and distinct brain functional abnormalities across psychiatric disorders by using functional stability, a recently developed dynamic functional connectivity approach. Resting-state functional magnetic resonance imaging data were collected from a transdisease sample of healthy controls (n = 115) and individuals with schizophrenia (SZ) (n = 47), bipolar disorder (BD) (n = 44), and attention deficit/hyperactivity disorder (ADHD) (n = 40). Functional stability of each voxel was calculated by measuring the concordance of dynamic functional connectivity over time. Differences in functional stability among the four groups were assessed voxel-wisely. Compared to healthy controls, individuals with SZ demonstrated a distributed pattern of higher functional stability in the bilateral inferior temporal gyrus yet lower stability in the bilateral calcarine sulcus and left insula; individuals with BD only manifested local higher stability in the left inferior temporal gyrus; no differences were found between ADHD and healthy individuals. Notably, individuals with SZ and BD had common higher functional stability in the left inferior temporal gyrus, whereas higher functional stability in the right inferior temporal gyrus and lower stability in the bilateral calcarine sulcus and left insula were unique abnormalities in individuals with SZ. Additionally, direct comparisons between disorders revealed that individuals with SZ showed lower functional stability in the right calcarine sulcus compared to those with BD and higher stability in the left inferior temporal gyrus compared to those with ADHD. However, no significant associations between functional stability and clinical symptoms were observed. Our findings suggest that the functional stability approach has the potential to be extended to the domain of psychiatry and encourage further investigations of shared and unique neuropathology of psychiatric disorders.

PO-026

# Neural correlates of the association between depression and high density lipoprotein cholesterol change

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Background: There is evidence that major depressive disorder (MDD) is related to serum lipid level alterations. However, the neural correlates underlying this association remain poorly understood.
Methods: Forty-nine patients with MDD and fifty healthy controls underwent structural, resting-state functional and diffusion magnetic resonance imaging scans. Voxel-based morphometry, functional connectivity (FC) and tract-based spatial statistics analyses were performed to assess gray matter structure, function and white matter integrity, respectively. Peripheral venous blood samples were collected to measure serum levels of lipid variables including total cholesterol, triglyceride and high density lipoprotein cholesterol (HDL-C). Correlation and mediation analyses were conducted to investigate the associations of serum lipid levels with brain imaging measures in MDD patients and healthy controls, respectively.
Results: Serum HDL-C level in patients with MDD was lower than that in healthy controls. The lower serum HDL-C level was associated with lower gray matter volume (GMV) in the ventromedial prefrontal cortex, higher within-network FC of the default mode network, and lower micro-structural integrity in multiple white matter regions in MDD patients. Moreover, the within-default mode network FC mediated the relationship between GMV in the ventromedial prefrontal cortex and serum HDL-C level; white matter integrity in the genu of corpus callosum was a mediator of the association between serum HDL-C level and depressive symptom severity. However, we did not observe any correlations between serum lipids and brain imaging parameters in healthy controls.

Conclusion: These findings help to identify neural correlates underlying the association between depression and serum HDL-C change, which may provide new insight into intervention, treatment and prevention of depression from the perspective of regulating serum lipids.

PO-027

# 全身 MRI 定量参数预测新诊断多发性骨髓瘤早期治疗反应的价值

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目的：
本研究旨在探讨基线肿瘤负荷分数（tumor burden score,TBS）及表观扩散系数（Apparent Diffusion Coefficient,ADC）和脂肪分数（signal Fat Fraction,sFF）是否可用于预测新诊断多发性骨髓瘤（newly diagnosed multiple myeloma,NDMM）患者的早期治疗反应。
材料与方法:
回顾性分析了于天津市第一中心医院行 WB-MRI 检查的 56 例 NDMM 患者全部图像。所有患者来自中国医学科学院血液病医院，均经骨髓穿刺病理证实（平均年龄 57.39±9.64 岁，范围 36-75 岁，其中男性 40 例，女性 16 例）。根据 2019 年全身 MRI 骨髓瘤反应评估和诊断系统评估每位患者的 TBS。测定了 173 个弥漫型病变部位和 158 个局灶型病变的 ADC 值，脂肪信号强度（signal of fat only image, SIFO）和水信号强度（signal of water only image, SIWO）。通过公式 sFF= SIFO /（SIWO+ SIFO）计算 sFF。计算每位患者的平均 ADC 及 sFF 值。并收集了基线临床数据，包括骨髓浆细胞比例、β2-微球蛋白、白蛋白、血红蛋白、肌酐、国际分期、四个周期化疗治疗方案及治疗后反应等。完全缓解、非常好的部分缓解定义为深度反应组；部分缓解、最小缓解、疾病稳定以及疾病进展定义为非深度反应组。根据外周血 Hb 是否低于 100g / L 进行亚组分析。比较两组间临床数据和影像学参数差异。使用 Student’s t 检验或 Mann-Whitney U 检验，卡方检验或 Fisher’s 精确检验比较组间差异。使用 Spearman 相关分析分别评估各参数与不同治疗反应之间的相关性。对全部及非贫血亚组患者绘制受试者工作曲线，根据最大 Youden 指数确定最佳截断值。
结果：
深度反应组（共 24 例，其中男性 15 例，女性 9 例，平均年龄 54.63±10.12 岁）与非深度反应组（共 32 例，其中男性 25 例，女性 7 例，平均年龄 59.47±8.87 岁）基线临床数据、骨髓浆细胞浸润部位及模式差异无统计学意义。TBS（p=0.015），ADC（p=0.009）及 sFF（p=0.005）存在统计学差异。TBS （r=-0.328, p=0.013） 和 ADC 值（r=-0.354, p=0.007）均与反应深度呈负相关。sFF 值（r=0.375, p=0.004）与反应深度呈正相关。ROC 曲线下面积分别为 TBS=0.690, ADC=0.706, sFF=0.71。相应截断值 TBS=14.5, ADC=0.844×$10^{-3}$$mm^2$/s, sFF=0.148。
在亚组分析中，非贫血患者的 TBS（p=0.027），ADC（p<0.001）及 sFF（p<0.001）存在统计学差异。TBS 与反应深度呈中等负相关（r=-0.405），ADC 值与反应深度呈高度负相关（r=-0.707），sFF 与反应深度呈高度正相关（r=0.635）。预测治疗反应曲线下面积分别为 TBS=0.773、ADC=0.908 和 sFF=0.867。相应截断值为 TBS=16.0，ADC=0.844×10-3$mm^2$/s，sFF=0.148。联合三个参数预测效能最佳（AUC=0.938,p<0.0001）。对于贫血患者，所有结果均为阴性。
结论：
TBS 作为新的生物标志物，可预测新诊断 MM 患者早期治疗反应，联合 TBS、ADC 及 sFF 三个参数具有最佳预测效能。WB-MRI 定量参数可更好的预测非贫血患者的早期治疗反应。

PO-028

# Sex-dependent gut microbiota-brain-cognition associations: a multimodal MRI study

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Background: There is bidirectional communication between the gut microbiota and the brain. Empirical evidence has demonstrated sex differences in both the gut microbiome and the brain. However, the effects of sex on the gut microbiota-brain associations have yet to be determined. We aim to elucidate the sex-specific effects of gut microbiota on brain and cognition.
Methods: 157 healthy young adults underwent brain structural, perfusion, functional and diffusion MRIs to measure gray matter volume (GMV), cerebral blood flow (CBF), functional connectivity strength (FCS) and white matter integrity, respectively. Fecal samples were collected and 16S amplicon sequencing was utilized to assess gut microbial diversity. Correlation analyses were conducted to test for sex-dependent associations between microbial diversity and brain imaging parameters, and mediation analysis was performed to further characterize the gut microbiota-brain-cognition relationship.
Results: We found that higher gut microbial diversity was associated with higher GMV in the right cerebellum Ⅵ, higher CBF in the bilateral calcarine sulcus yet lower CBF in the left superior frontal gyrus, higher FCS in the bilateral paracentral lobule, and lower diffusivity in widespread white matter regions in males. However, these associations were absent in females. Of more importance, these neuroimaging biomarkers significantly mediated the association between gut microbial diversity and behavioral inhibition in males.
Conclusions: These findings highlight sex as a potential influential factor underlying the gut microbiota-brain-cognition relationship, and expose the gut microbiota as a biomarker-driven and sex-sensitive intervention target for mental disorders with abnormal behavioral inhibition.

PO-029

# IDEAL-IQ 及 T2*mapping 序列在乙肝所致肝纤维化中的诊断价值

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目的 乙肝导致肝纤维化的分级依赖于肝活检病理学检查，影像学检查技术，包括超声、磁共振弹性成像和影像组学等，在诊断纤维化方面取得了很好的效果。乙肝肝纤维化过程中，炎性反应刺激导致间质纤维结缔组织增生，并可能伴随铁沉积。本研究目的是探讨肝实质的 T2 值、百分比变异系数（标准差/T2 均数×100%）和 R2*值（反应铁沉积情况）对慢性乙型病毒性肝炎患者肝纤维化程度定量评估和分期的价值。
方法 回顾性分析 2019 年 7 月-2021 年 3 月在中国科学技术大学附属第一医院安徽省立医院南区的慢性乙型病毒性肝炎患者，根据中华医学会肝病学会推荐意见，以实验室检查指标 S 指数、FIB-4 和 APRI 为诊断标准分组，将入选的 67 名慢乙肝肝纤维化患者分为轻度肝纤维化 33 人和明显肝纤维化组 34 人；另外收集正常人 31 名作为对照组。所有受试者都接受 3.0TMRI 检查，扫描包括

IDEAL-IQ 和 T2*mapping 等序列。扫描得到的数据传输到 ADW4.7 后处理工作站，自动生成 R2*图和 T2* mapping 彩图，选取相同位置感兴趣区域(ROI)，并测量计算 R2*值及 T2 值、百分比变异系数，最后得到的值为所有 ROI 的平均值。采用统计学分析正常对照组和肝纤维化组之间、肝纤维化分组之间肝脏 R2*值及 T2 值、百分比变异系数的差异，并评估三组参数和肝纤维化分组之间的相关程度。
结果 对照组与轻度肝硬化组、明显肝纤维化组 T2 值分别为(17.15±3.71)ms、(18.88±4.86)ms、(18.26±3.12)ms，各组之间差异无统计学意义（P=0.217）；百分比变异系数分别为(8.19±2.47)%、(9.19±3.19)%、(12.51±4.33)%，明显肝纤维化组与两组之间差异均具有统计学意义（P<0.05），对照组与轻度肝纤维化组之间差异无统计学意义（P=0.238）。对照组、轻度肝纤维化组、明显肝纤维化组的 R2*值分别是（39.89±4.26）Hz、（45.21±11.93）Hz 和（55.09±9.59）Hz，三组之间差异均具有统计学意义（P<0.05）；随着肝纤维化程度的进展，肝脏 R2*值逐渐增大。Spearman 相关性分析显示百分比变异系数、R2*值与肝脏纤维化程度分别呈中等、明显正相关（r=0.472、r=0.618）。百分比变异系数、R2*值诊断轻度与明显肝纤维化 ROC 曲线下面积分别为 0.733、0.756，两者联合曲线下面积为 0.815。
结论 正常人、轻度及明显肝纤维化组肝脏 T2 值无明显差异。明显纤维化组肝脏的百分比变异系数、R2*值高于轻度肝纤维化及正常肝脏，且均呈正相关；百分比变异系数、R2*值对于轻度与明显肝纤维化具有很好的诊断效能，两者联合可以进一步提高诊断效能。

PO-030

# 体素内不相干运动扩散加权成像在新冠肺炎 治愈患者肾功能损伤监测中的应用价值

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**目的** 新型冠状病毒肺炎部分患者表现出肝肾功能损伤等肺外症状。亦有患者在治愈后出现慢性肾功能损伤。对新冠肺炎治愈患者肾功能损伤进行早期监测对于早期干预改善患者预后具有一定的意义。体素内不相干运动扩散加权成像（IVIM-DWI）已越来越多地应用于肾脏疾病的诊断和肾功能损伤的监测。目前关于 COVID-19 康复出院患者是否存在潜在的肾脏损伤影像学表现鲜见报道。本文主要探讨 IVIM-DWI 在新冠肺炎治愈患者肾功能损伤监测中的应用价值。**方法** 前瞻性分析阜阳市第二人民医院 2020 年 5 月至 6 月康复出院 3 个月、门诊随访符合下述纳入和排除标准且接受 IVIM-DWI 检查的 34 例 COVID‑19 患者的临床及影像资料，其中普通型 22 例，男 12 例，女 10 例，40~70（50±10）岁；重型 12 例，男 7 例，女 5 例，35~65（55±12）岁。34 例患者自康复出院至接受 IVIM-DWI 检查的时间为 90~110（100±7）d。3 例有高血压病史。分析 34 例阜阳市第二人民医院收治的确诊新型冠状病毒肺炎治愈患者与 23 例健康对照磁共振体素内不相干运动扩散加权成像参数、肾损伤实验室指标的差异。**结果** 新冠患者组与健康对照组临床特征均符合入组要求。入组研究对象均成功采集到 IVIM - DWI 图像，肾脏皮髓质结构显示较好，部分皮、髓质分界稍模糊，但能够满足参数采集要求。34 例 COVID-19 康复患者组与健康对照组间肾髓质 D 测量值差异存在统计学意义。新冠患者重型与普通型亚组间肾髓质 D 测量值的差异无统计学意义（表 1、2）。34 例 COVID-19 康复患者 MRI 平扫：T1WI 皮髓质分界清晰，T2WI 未见明显肾脏周围积液。**结论**本研究中采用了 12 个 b 值，其中 9 个≤200 s /mm2 低 b 值，并主要分布在 100 s /mm2 以下，能够很好抑制大血管在成像区域的影响，体现微循环灌注信息。本研究以肾脏皮质、髓质用于肾脏功能评估，避开皮质边缘伪影，便于测量统计。medul - D 参数可作为监测新冠肺炎治愈患者肾功能损伤的一个参考指标。

PO-031

# Quantitative evaluation of posterior visual pathway abnormalities base on deterministic fiber tracing in patients with pituitary adenoma: a diffusion tensor imaging study

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**Objective** To investigate the value of deterministic fiber tracing and diffusion tensor imaging in quantitative assessment of posterior visual pathway abnormalities in patients with pituitary adenoma.
**Methods** The imaging and clinical data of 17 patients with large pituitary adenoma diagnosed in the Affiliated Hospital of Yunnan University from October 2020 to May 2021 were prospectively collected. The best corrected visual acuity (BCVA) score of the patients was recorded. Seventeen age- and sex-matched healthy controls were enrolled at the same time. All subjects underwent MRI scanning, including routine T1WI, T2WI, FLAIR and diffusion tensor imaging (DTI) sequences using a Philips 3.0T MR scanner. MRI data pre-processing was carried out by FSL, diffusion tensor imaging reconstruction and fiber tracking using Diffusion Toolkit and tractography analysis by TrackVis to measure the fractional anisotropy (FA), mean diffusivity (MD), radial diffusivity (RD), axial diffusivity (AD) and apparent diffusion coefficient (ADC) of the optic radiations.Two independent sample *t* test was used to identify these parameters with statistically significant differences between these two groups of subjects. Spearman correlation analysis was used to calculate the correlation between DTI parameters and clinical data in patients with large pituitary adenoma.
**Results** Diffusion tensor imaging analysis of the optic radiations showed:①In the healthy control group, the FA of the right side optic radiation was higher than the left side ($P< 0.05$); and there were no significant differences in MD, AD, RD and ADC between the two sides of optic radiations ($P > 0.05$). In the pituitary adenoma group, there were no significant differences in FA, MD, AD, RD and ADC between the two sides of optic radiations ($P > 0.05$). ② Compared with the control group, there were significant FA decreases and RD increases in two sides of optic radiations for the pituitary adenoma group ($P < 0.05$); the MD and ADC of the right side optic radiation of the patient group were higher than those of the control group ($P< 0.05$). There were no significant differences in bilateral AD, left side MD and ADC between the two groups ($P > 0.05$).③ There was no significant correlation between BCVA score and the mean of FA, RD, MD and ADC ($P > 0.05$).
**Conclusion** The deterministic fiber tracing and DTI may noninvasively provide quantitative information to detect optic radiation abnormalities and provide a new perspective for further exploring the damage degree and prognosis of the visual pathway injury in patients with large pituitary adenoma.

PO-032

# 探索脑小血管病患者深部核团脑铁沉积和白质损伤之间的关系：一项基于 CADASIL 患者的初步研究

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广泛弥漫的脑白质损伤是脑小血管病患者的典型表现。既往大量研究发现白质微观结构的损伤可以很好地监测患者疾病的病程，并且与脑小血管病患者认知损伤、情绪情感及步态障碍均密切相关。脑小血管病患者的白质损伤被认为与皮层下的缺血灶密切相关，比如说白质高信号、腔隙灶等。然而大量的研究发现这类患者的白质损伤不仅局限于皮层下白质所在的区域，其正常白质区域也会存在损伤，主要表现为微观结构中 FA 数值的下降及 MD 数值的上升。这种病理性改变除了可能是肉眼可见缺血灶的早期病变外，还可能是继发性的一种改变。大量研究发现在阿尔茨海默病及帕金森氏病等老年退行性疾病中，皮层及皮层下核团的退行性变会导致白质脱髓鞘或者轴突破坏，进而导致白质损伤。

在脑小血管病患者中，除了供应白质区域的脑膜穿支动脉受损以外，其供应基底节区域的小动脉也会损伤。既往研究发现脑小血管病患者无论是在白质区域还是基底节区域均存在广泛的血脑屏障的破坏。因此除了皮层下可见的缺血灶外，其基底节区域也会发生损伤，而这一损伤可以通过核团脑铁沉积进行量化。

因此在本次研究中一方面，我们旨在利用 quantitative susceptibility mapping（QSM）量化脑铁技术检测脑小血管病患者深部核团的损伤情况。另一方面，我们将探索脑铁沉积是否会造成白质纤维束的损伤。

方法：

纳入遗传性脑小血管病 CADASIL 患者 36 人，社区招募正常志愿者 48 人。利用 QSM 技术量化深部核团（壳核、苍白球、尾状核、黑质、红核）铁含量。量化 CADASIL 患者脑内白质高信号的体积，并评估脑内腔隙灶、微出血的情况。利用 FSL 提取患者 FA、MD、AD、RD 结构图，并且基于白质骨架，提取每一位 CADASIL 患者全脑白质微结构的 FA、MD、AD、RD 数值。

结果：

CADASIL 患者较正常患者尾状核（P=0.002）、壳核（P<0.001）区域脑铁沉积显著增加。白质平均骨架 FA 值与尾状核（r=-0.416，P = 0.022）及壳核（r=-0.404，P = 0.027）均成显著负相关，白质平均骨架 RD 值与尾状核铁沉积（r = 0.386，P = 0.035）呈显著正相关，并与壳核铁沉积（r=0.346，P = 0.061）呈接近显著且这种关系是独立于其他脑小血管病征象存在的。

结论：

脑小血管病患者存在深部核团的损伤，主要表现为尾状核及壳核的铁沉积增加。此外深部核团的铁沉积增加可能是导致脑小血管病患者白质损伤的另一个原因，主要是表现为白质髓鞘的损伤。

PO-033

# Evaluation of Amide Proton Transfer-weighted Imaging and 18F-FDG PET for Histological Subtype and Ki-67 index of Lung Cancer

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**Purpose** To investigate the potential of amide proton transfer-weighted imaging (APTWI) and 2-[18F]-fluoro-2-deoxy-D-glucose positron emission tomography ($^{18}$F-FDG PET) imaging in evaluating lung cancer histological subtype and Ki-67 index.

**Methods** A total of 78 patients with lung cancer, 13 small cell carcinomas (SCLC) and 65 non-SCLCs (25 squamous cell carcinomas and 40 adenocarcinomas), underwent hybrid $^{18}$F-FDG PET/MRI. The apparent diffusion coefficient (ADC), magnetization transfer ratio asymmetry (MTRasym (3.5 ppm)), maximum standardized uptake value ($SUV_{max}$), metabolic tumor volume (MTV), and total lesion glycolysis (TLG) were calculated. The Shapiro-Wilk test was applied to evaluate whether the data of each group followed a normal distribution. The comparison of each parameter between different groups was analyzed with the independent sample t-test or Mann-Whitney U test. Receiver operating characteristic (ROC) curves were generated to describe diagnostic efficacy, and the Delong test was applied to identify differences in the area under the ROC curve (AUC) of different parameters. Logistic regression analyses were used to identify independent factors and combination diagnosis. The Pearson correlations were employed to describe the correlation of each parameter with the Ki-67 index ($r \geq 0.75$, good; $0.50 \leq r < 0.75$, moderate; $0.25 \leq r < 0.50$, mild; and $r < 0.25$, little or none). A $P < 0.05$ was considered statistically significant.
**Results** The SCLC group had higher MTRasym(3.5 ppm) [(5.01 ± 2.05) vs (2.29 ± 4.23) % ], MTV [(67.92 ± 64.79) vs (13.79 ± 18.27) ml], and TLG [(360.21 ± 343.87) vs (85.14 ± 134.09) g ] values and lower ADC [(1.17 ± 0.13) vs (1.36 ± 0.27) $\times 10^{-3} mm^2/s$] values than the non-SCLC group (all $P < 0.05$). The difference in $SUV_{max}$ value between the two groups was not significant ($P > 0.05$). MTRasym(3.5 ppm), ADC, and MTV were independent predictors of of differentiation between SCLC and non-SCLC. For the diagnosis of SCLC and non-SCLC. groups, the AUC values were ranked as follows: AUC (MTRasym(3.5 ppm) + ADC + MTV) > AUC (MTV) > AUC (TLG) > AUC (MTRasym (3.5 ppm)) > AUC (ADC), and the differences between AUC (MTRasym(3.5 ppm) + ADC + MTV) and AUC (TLG), AUC (MTRasym (3.5 ppm)), and AUC (ADC) were significant ($Z = 2.336$, 3.085, and 3.114, $P = 0.018$, 0.002, and 0.002, respectively). MTV and TLG both showed moderate positive correlations with the Ki-67 index, respectively ($r = 0.518$, 0.561, $P < 0.05$). $SUV_{max}$ was mildly and positively with the Ki-67 index ($r = 0.494$, $P < 0.05$). ADC showed a mild negative correlation with the Ki-67 index ($r = - 0.308$, $P < 0.05$). There was no significant correlation between MTRasym(3.5 ppm) and the Ki-67 index ($r = 0.117$, $P = 0.248$).
**Conclusion** The APTWI and $^{18}$F-FDG PET parameters were able to distinguish between SCLC and non-SCLC and evaluate the expression of Ki-67.

PO-034

# 基于 IDEAL-IQ 技术定量评估中老年人大腿肌肉脂肪含量与肌力的相关性

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目的 探讨中老年人大腿肌肉肌间脂肪分数（FF）、肌内 FF、骨骼肌指数（SMI）与肌力的相关性。
材料与方法 前瞻性招募 30 名中老年志愿者（男性 14 名，女性 16 名），年龄（53.67±6.13）岁，BMI（25.03±4.42）kg/m2。所有受试者均接受 3.0T MR 扫描，包括大腿中部 T1WI、IDEAL-IQ 序列，由两名高年资医师分别独立勾画左侧大腿中部股四头肌及腘绳肌感兴趣区，获得肌间 FF、肌内 FF 及肌肉横截面积（CSA），将 CSA 标准化获得 SMI[=肌肉 CSA/身高 2（cm2/m2）]。此外，选取 60(°)/s、180(°)/s 的角速度对所有受试者膝关节进行等速肌力测试，获得膝关节屈伸肌群（即腘绳肌及股四头肌）的峰力矩（PT）及总功（TW）。采用独立样本 t 检验或非参数检验（Mann-Whitney U 检验）比较不同肌群、性别肌间 FF、肌内 FF、PT、TW、SMI

的差异。采用 Pearson 或 Spearman 相关分析及多元线性回归法检测大腿肌肉肌间 FF、肌内 FF、SMI 与 PT、TW 的相关性。
结果 两名医师测量受试者的大腿肌肉肌间 FF、肌内 FF、肌肉 CSA 一致性好，ICC 值分别为 0.866、0.901、0.859。中老年人大腿屈、伸肌群肌内 FF 与 PT 呈中度负相关（r=-0.635、-0.546，P 均<0.001），与 TW 呈高、中度负相关（r=-0.718、-0.616，P 均<0.001）；屈、伸肌群肌间 FF 与 PT 呈中度负相关（r=-0.519，P=0.003；r=-0.443，P=0.014），与 TW 呈低、中度负相关（r=-0.363，P=0.049；r=-0.552，P=0.002）；屈、伸肌群 SMI 与 PT、TW 均无明显相关性。多元线性回归分析显示，只有肌内 FF 与屈、伸肌群的 PT、TW 显著相关（屈肌群：R2=0.469， P=0.004；R2=0.470， P＜0.001；伸肌群：R2=0.339， P=0.023；R2=0.504，P=0.003）。
结论 中老年人大腿屈伸肌群肌间 FF、肌内 FF 与 PT、TW 均呈负相关关系，且肌内 FF 是屈伸肌群 PT、TW 的独立预测因素，可为中老年人大腿肌力的变化情况提供重要参考。

# PO-035
# 扩散峰度成像在脑胶质瘤 TERT 分子分型的预测价值

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目的：
探讨扩散峰度成像（diffusion kurtosis imaging，DKI）在 WHO II 级和 III 级异柠檬酸脱氢酶（isocitrate dehydrogenase，IDH）野生型脑胶质瘤端粒酶反转录酶（telomerase reverse transcriptase，TERT）分子分型的预测价值。
材料与方法：
回顾性收集经神经外科手术且病理证实 WHO II 级和 III 级脑胶质瘤患者 27 例，所有患者均有完整的常规影像、DKI 影像资料和基因检测结果，依据基因检测结果将 IDH 野生型患者分为 TERT 突变组（8 例）和 TERT 野生组（19 例）。分析两组脑胶质瘤患者的临床资料，同时由 2 名高年资影像科医师评估患者的常规结构影像学特征。后处理 DKI 图像，分别在肿瘤实质区、瘤周水肿区及对侧正常脑白质区勾画感兴趣区（region of interest，ROI），测得各区域 DKI 参数值即平均峰度（mean kurtosis，MK)、轴向峰度(axial kurtosis，Ka)、径向峰度（radial kurtosis，Kr)、各向异性分数（fractional anisotropy，FA）、平均扩散系数（mean diffusivity，MD），将其校正后得到相对 MK（relative rMK)、相对 Ka (relative rKa)、相对 Kr（relative rKr)、相对 FA（relative rFA）、相对 MD（relative rMD）。应用卡方检验比较 TERT 突变组和野生组患者的常规影像特征，用 Wilcoxon 秩和检验分析两组患者 DKI 各参数差异，对有统计学意义的参数绘制受试者工作特征(receiver operating characteristic，ROC)曲线，得到曲线下面积（area under the curve，AUC），计算阈值、敏感性及特异性，从而确定最佳预测指标。
结果：
1. TERT 突变组和野生组患者的临床资料（性别、年龄、病理组织学级别）在两组之间差异无统计学意义（P>0.05）。
2. TERT 突变组与野生组患者的常规影像特征在两组之间的差异均无统计学意义（P>0.05）。
3. 在肿瘤实质区，TERT 突变组患者 rMK、rKr 明显高于野生组，且差异具有统计学意义（P<0.05），rMK、rKr 曲线下面积分别为 0.803、0.770，rMK 诊断敏感性和特异性分别为 87.5%、70%；rKr 诊断敏感性为 71.4%，特异性为 80%，rMK 值敏感性较高，rKr 值特异性较高；其余参数差异无统计学意义（P>0.05）。
4. 在瘤周水肿区，TERT 突变组与野生组患者 DKI 各参数在两组之间差异无统计学意义（P>0.05）。
结论：

DKI 技术作为一种无创检查手段，其 rMK、rKr 参数值有助于对脑胶质瘤 TERT 分子分型的预测，且均具有较高的敏感性和特异性。因此，DKI 通过早期反映肿瘤组织微观结构的改变能够无创评估脑胶质瘤分子分型，为患者治疗方案的选择和预后评估提供了新方法。

## PO-036

# 酰胺质子转移成像和扩散峰度成像评估 早期子宫内膜癌的风险分层

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**目的：**探讨磁共振酰胺质子转移成像(APTWI)和扩散峰度成像(DKI)在早期子宫内膜癌(endometrial carcinoma, EC)风险分层评估中的价值。
**资料与方法：**对 60 例早期 EC 患者(FIGO < II 期)的 DWI、APTWI 和 DKI 图像进行分析，分别测量高、中、低风险组的表观扩散系数(ADC)，非对称磁化转移率(MTRasym(3.5ppm))，平均扩散系数(MD)和平均扩散峰度 (MK)。单因素方差分析被用于对比高、中、低分险组间各参数的差异，独立样本 *t* 检验和 *U* 检验被用于两两对比；受试者工作特征曲线 (receiver operating characteristic curve, ROC)被用于评估诊断效能，*Delong* 检验被用于对比诊断效能的差异；*Logistic* 回归分析被用于独立预测因子的评估。*Spearman* 等级相关被用于评价各参数与分险分层的相关性(*r ≥ 0.75*, 高度;*0.50 ≤ r < 0.75*, 中度; *0.25 ≤ r < 0.50*, 低度; *r < 0.25*, 轻度)。*P<0.05* 为差异有统计学意义。
**结果：**参数对比方面：低风险组的 ADC 和 MD 值均显著高于中风险组[(0.92 ± 0.10) vs (0.84 ± 0.06)×$10^{-3}$$mm^2$/s, (0.99 ± 0.12) vs (0.89 ± 0.07)×$10^{-3}$$mm^2$/s]; MTRasym(3.5ppm)和 MK 值显著低于中风险组[(3.14 ± 0.31) vs (3.56 ± 0.36) %, (0.82 ± 0.03) vs (0.87 ± 0.03)]。低风险组的 ADC 和 MD 均显著高于高风险组[(0.92 ± 0.10) vs (0.82 ± 0.07)×$10^{-3}$$mm^2$/s, (0.99 ± 0.12) vs (0.84 ± 0.05)×$10^{-3}$$mm^2$/s]，MTRasym(3.5ppm)和 MK 值均显著低于高风险组[(3.14 ± 0.31) vs (3.65 ± 0.33) %, (0.82 ± 0.03) vs (0.91 ± 0.06)]。中，高风险组间 ADC 和 MD 值的差异无统计学意义。诊断效能方面：低风险 vs 中风险，MK、MTRasym(3.5 ppm)、MD 和 ADC 值的 AUC 分别为 0.866、0.812、0.798 和 0.776，且 MK 和 ADC 之间 AUC 的差异有统计学意义(*Z = 2.566, P < 0.05*)；低风险 vs 高风险，MK、MTRasym(3.5 ppm)、MD 和 ADC 值的 AUC 分别为 0.936、0.852、0.828 和 0.809，且 MK 和 MD 及 ADC 之间 AUC 的差异均有统计学意义(*Z = 2.766*、*2.899, P < 0.05*); 中风险 vs 高风险，MK 和 MTRasym(3.5 ppm)的 AUC 分别为 0.846、0.762，且二者之间的差异有统计学意义(*Z = 3.166, P < 0.05*)。MK 和 MTRasym(3.5 ppm)值均与风险分层呈中度正相关(*r = 0.715，0.662*)，MD 和 ADC 值分别与风险分层呈中、低度负相关(*r = - 0.635，-0.452*)。MK 和 MTRasym(3.5 ppm)值是早期 EC 风险分层的独立预测因子($OR_{psd}$= 3.635，2.452， P < 0.05)。
**结论：**APTWI 和 DKI 均可用于在早期 EC 的风险分层的评估，MK 和 MTRasym(3.5 ppm)是其独立预测因子。

## PO-037

# 酰胺质子转移成像和 18F-FDG PET 评估非小细胞肺癌分期及分级

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**目的：**探讨磁共振酰胺质子转移成像(amide proton transfer- weighted imaging, APTWI)和 $^{18}$F-FDG 正电子发射计算机断层显像(positron emission tomography, PET)鉴别早（≤ IIIA）、晚期（≥ IIIB）非小细胞肺癌价值，并分析各参数与组织学分级的相关性。
**资料与方法：**共 87 例非小细胞肺癌(34 例早期、52 例晚期)患者进行了 $^{18}$F-FDG PET/MRI 检查。分别测量表观扩散系数(apparent diffusion coefficient, ADC)，非对称磁化转移率(magnetization transfer ratio asymmetry, MTRasym(3.5ppm))，最大标准化摄取值(maximum standardized uptake value, $SUV_{max}$)、肿瘤代谢体积(metabolic tumor volume, MTV)和病变总糖酵解(total lesion glycolysis, TLG)。采用 *Shapiro-Wilk* 检验评估各组数据是否服从正态分布，独立样本 *t* 检验和 *U* 检验被用于两两对比，受试者工作特征曲线 (*receiver operating characteristic curve, ROC*)被用于评估诊断效能，*Delong* 检验被用于对比诊断效能的差异，*Logistic* 回归分析被用于独立预测因子的评估，*Spearman* 等级相关被用于评价各参数与分险分层的相关性(*r ≥ 0.75,* 高度; *0.50 ≤ r < 0.75*, 中度; *0.25 ≤ r < 0.50,* 低度; *r < 0.25,* 轻度)。*P<0.05* 为差异有统计学意义。
**结果：**1、早期组的 MTRasym(3.5ppm)、$SUV_{max}$、MTV 和 TLG 值均显著小于晚期组 [*(1.25 ± 4.35) vs (3.16 ± 4.06)%, (7.06 ± 5.26) vs (11.25 ± 7.36), (7.78 ± 15.35) vs (17.72 ± 19.08), (43.25 ± 87.84) vs (112.53 ± 151.79), P* 均*<0.05*]; 早、晚期组间 ADC 值的差异无统计学意义[*(1.35 ± 0.25) vs (1.36 ± 0.28)×10*$^{-3}$$mm^2/s$, P = 0.863]。2、MTRasym(3.5ppm)、$SUV_{max}$ 和 MTV 是早、晚期非小细胞肺癌的独立预测因子(*OR = 1.175*、*1.125* 和 *1.055*，*P* 均*<0.05*)。3、独立预测因子(MTRasym(3.5ppm) + $SUV_{max}$ + MTV)、MTRasym(3.5ppm)、$SUV_{max}$、MTV 和 TLG 的 AUC 分别为 *0.779*、*0.636*、*0.676*、*0.780* 和 *0.754*，其中独立预测因子与 MTRasym(3.5ppm)和 $SUV_{max}$ 之间 AUC 的差异有统计学意义(*Z = 2.026*、*2.285, P* 均*<0.05*)。4、$SUV_{max}$ 和 TLG 均与组织学分级呈中度正相关(*r = 0.514*、*0.526*，*P* 均*<0.05*)，MTV 和 MTRasym(3.5 ppm)分别与组织学分级呈低、轻度正相关(*r = 0.455*、*0.203*，*P* 均*< 0.05*)，ADC 与组织学分级呈低度负相关(*r = - 0.382*，*P < 0.05*)。
**结论：**APTWI 和 $^{18}$F-FDG PET 参数能够区分早、晚期非小细胞肺癌，并评价其组织学分级。

PO-038

# In-vivo Visualization of Iron and Neuromelanin Simultaneously Using MTC-STAGE imaging: Combining Neuromelanin and Iron as Complementary Imaging Biomarkers in Differentiating Parkinson's Disease and Parkinsonian Multiple System Atrophy

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Synopsis:
MSA with a parkinsonian variant (MSA-P) and PD share many common clinical presentations, such as parkinsonism and autonomic failure to mention just a few. The early differential diagnosis of these two disorders has been established more or less empirically despite a lack of a subjective, satisfactory biomarker. Neuroimaging has revolutionized in-vivo visualization of neuromelanin and iron in the substantial nigra (SN), which has been considered as the primary and predominant pathophysiological change in PD patients. We found significant neuromelanin changes in the SN in patients with MSA-P compared with PD and HC.

Introduction: Parkinson's disease (PD) and multiple system atrophy (MSA) are devastating and deteriorating neurodegenerative diseases characterized by certain similar neuropathological impairments. They are both characterized by abnormal α-synuclein aggregation and propagation in the nigro-striatal pathway1. The clinical presentation of MSA is highly variable, so neurologists designate patients as having MSA-P if parkinsonian features predominate or MSA-C if cerebellar features predominate2. Many overlapping clinical manifestations between PD and MSA-P impose substantial challenges on clinicians to differentiate the two disorders especially in the early stage. Neuroimaging biomarkers of varying magnetic resonance imaging (MRI) modalities, such as T1 weighted (T1W)3, T2*W4 and diffusion5 weighted imaging have provided valuable information to assist clinical diagnosis. The pathological hallmark of PD is neuromelanin depigmentation followed by elevated iron deposition in the substantia nigra (SN)6. With the advent of quantitative MRI techniques, we can trace the disease-specified trait of the nigral iron deposition that contributes to the pathogenesis of α-synuclein-related movement disorders such as PD and MSA7,8. The aim of this study was to use a single 3D magnetization transfer contrast (MTC) sequence to simultaneously assess three metrics as complementary imaging biomarkers to distinguish PD and MSA-P patients: the NM volume (as measured on MTC), SN volume and susceptibility value (as measured with quantitative susceptibility mapping (QSM)).
Methods: Three age- and gender-matched groups: 10 MSA-P patients, 10 PD patients and 10 healthy controls (HCs) were scanned on a 3T Philips MRI system with a 15-channel coil using a 3D multi-echo gradient recalled echo susceptibility weighted imaging (SWI) sequence with an MTC pulse. The imaging parameters were as follows: an in-plane resolution = 0.67 mm × 1.34 mm, seven echoes with TE1 = 7.5ms, ΔTE = 7.5ms, TR = 62ms, pixel bandwidth = 174Hz/pixel, matrix size = 384 × 384 and slice thickness = 2mm.The regions of interest (ROIs) for the NM and SN were automatically segmented on MTC magnitude and QSM maps, respectively, using SPIN software (SpinTech, Inc., Bingham Farms, MI, USA). Then we simultaneously measured NM volume on the MTC magnitude image (TE1= 7.5ms), SN volume and iron deposition on the QSM data extracted from the second echo (TE2= 15ms). Intergroup difference analysis was performed using GraphPad Prism Version 8.0. Furthermore, in order to assess the sensitivity and specificity of the proposed models to diagnose MSA-P and PD patients, a receiver operating curve (ROC) and area under the curve (AUC) analysis were performed using GraphPad Prism Version 8.0.
Results: Table 1 shows the demographic characteristics of patients with MSA-P and age-, gender-matched PD and HC. There were no significant between-group differences in age, gender or disease duration. Figure 1 shows MTC magnitude images for patients with MSA-P, PD and HC. Judging from the MTC images, smaller NM volume compared with HC indicates NM depigmentation in MSA-P and PD patients, with MSA-P patients showing the worst NM degeneration. Overall NM volume, SN volume and QSM susceptibility (median ± interquartile range) of each VOI as well as comparisons among the different groups are listed in TABLE 2. The MSA-P patients had significantly smaller NM volume compared with the PD patients ($p=0.0017$) and HCs ($p=0.0013$). No significant differences were observed among the groups regarding the overall SN volume and susceptibility value.
Discussion and conclusion:
In this work, we have developed a new approach to visualize iron deposition and NM degeneration in-vivo using one single multi-echo SWI MTC sequence with the goal of searching for a comprehensive and robust set of imaging biomarkers for differential diagnosis between

MSA-P and PD. To our knowledge, this is the first report of the utility of quantitative NM measurements (NM volume) to differentiate MSA-P and PD. We have demonstrated that this diagnostic biomarker can be obtained using a single rapid sequence in roughly 7 min in a standard clinical imaging with clinically useful diagnostic accuracy (with an AUC as high as 92%). However, no inter-group difference of iron-related was found among three groups. Therefore, a larger sample of MSA-P, PD patients and HCs are required to assess the NM and iron changes to confirm these findings prior to clinical application.

Acknowledgements
No acknowledgement found

## PO-039

# 基于平扫多平面的 MR 成像对局部进展期食管-胃连接部腺癌侵犯胃裸区的预测价值

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**目的：**探讨平扫多平面 MR 成像对食管-胃连接部（EGJ）腺癌侵犯胃裸区（GBA）的预测价值。
**方法：**回顾性收集 2015 年 1 月至 2020 年 12 月在中国医学科学院肿瘤医院经手术病理证实的 EGJ 腺癌患者的临床及 MRI 资料，在根治性胃切除术前 2 周行平扫多平面 MRI 检查，检查序列包括 T1WI、T2WI 及 DWI，共纳入 79 例患者。根据术后病理结果是否侵犯胃裸区（GBA）分为 GBA 侵犯组和 GBA 无侵犯组。在横轴位、冠状位及矢状位 T2WI 图像上进行影像学定性指标观察，包括肿瘤是否侵犯胃壁全层（透壁性侵犯）、是否侵犯膈肌或胃膈韧带、GBA 周围脂肪浸润情况（光整、模糊或消失）以及是否有 GBA 区淋巴结肿大；观察的定量指标有肿瘤最大径。GBA 侵犯组和 GBA 无侵犯组的临床病理及影像学的定性参数比较采用 $\chi^2$ 检验或 Fisher 确切概率法，定量参数比较采用 *t* 检验。将上述分析中有统计学意义的参数作为自变量，GBA 是否侵犯为因变量，进行多因素 Logistic 回归建立预测模型，得出的预测概率（pre）作为自变量，以病理学 GBA 侵犯为金标准，采用 ROC 分析预测模型对 EGJ 腺癌侵犯 GBA 的诊断效能。
**结果：**79 例患者中，男性 67 例，女性 12 例；中位年龄 59 岁；根据术后病理分组，GBA 侵犯组 42 例，GBA 无侵犯组 37 例。临床病理因素中，肿瘤最大径、pT 分期和 pN 分期在两组中有显著差异（均 $P<0.05$）。MRI 影像征象中，膈肌或胃膈韧带侵犯、GBA 周围脂肪浸润及 GBA 区淋巴结肿大在两组中有显著差异（均 $P<0.05$）。膈肌或胃膈韧带侵犯预测 GBA 侵犯的敏感度、特异度和准确度分别为 61.9%、78.4%和 69.6%，GBA 周围脂肪浸润预测 GBA 侵犯的敏感度、特异度和准确度分别为 95.2%、35.1%和 67.1%，GBA 区淋巴结肿大预测 GBA 侵犯的敏感度、特异度和准确度分别为 81.0%、45.9%和 64.6%。将肿瘤最大径、膈肌或胃膈韧带侵犯、GBA 周围脂肪浸润及 GBA 区淋巴结肿大纳入多因素 Logistic 回归模型，联合多个参数预测 GBA 侵犯的 ROC 分析显示，其曲线下面积（AUC）、敏感度和特异度分别为 0.825、66.7%和 83.8%。
**结论：**多平面 MRI 征象可术前预测 EGJ 腺癌的 GBA 侵犯，且多参数联合模型可以提高预测效能，有助于临床医生对 EGJ 腺癌患者制定个体化治疗方案。

## PO-040

# Multi-region Radiomic Analysis Based on Multi-sequence MRI to Preoperatively Predict Microvascular Invasion in Hepatocellular Carcinoma

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**Objective:** Microvascular invasion (MVI) affects postoperative prognosis in hepatocellular carcinoma (HCC) patients, but there is a lack of reliable and effective tools for preoperative prediction. Radiomics has shown great potential in providing valuable information for tumor pathophysiology. Thus, we aimed to construct and validate prediction models including radiomic models, clinico-radiological model and fusion models to predict MVI.
**Materials and Methods:** One hundred and fifteen patients with pathologically confirmed HCC (training set: *n* = 80; validation set: *n* = 35) who underwent preoperative magnetic resonance imaging (MRI) within one month were retrospectively recruited. Recursive feature elimination (RFE) was used as the radiomic feature selection method. Radiomics models based on multi-sequence MRI and various regions (including intratumoral and/or peritumoral areas) were built using four classification algorithms. Clinico-radiological model was constructed individually or combined with radiomics model to generate fusion model, by multivariable logistic regression. The predictive efficacy of different models was assessed by the area under the receiver operating characteristic curve (AUC), accuracy, sensitivity and specificity. And integrated discrimination improvement (IDI) was calculated to compare the discriminative value of the fusion model with that of other models. Besides, the calibration efficacy and clinical utility of the fusion model were evaluated by calibration plots as well as decision curve analysis, respectively.
**Results:** The clinico-radiological model had good efficacy with the AUC (95% CI), accuracy, sensitivity and specificity of 0.819 (0.732-0.905), 0.763, 0.886 and 0.611 in the training dataset with the cut-off of 0.552, and 0.717 (0.551-0.883), 0.714, 0.789, 0.625 in the validation dataset, which involved non-smooth margin (adjusted OR = 10.689) and peritumoral hypointensity on HBP (adjusted OR = 6.007). Among single-sequence radiomics models, T2WI, AP and HBP models exhibited satisfying power for MVI prediction with AUCs above 0.75. And among all radiomics models, the model based on T2WI and arterial phase (T2WI-AP model) in the volume of the liver-HCC interface ($VOI_{interface}$) showed the best predictive power (AUC (95% CI): 0.866 (0.783-0.947) in the training group and 0.855 (0.731-0.963) in the validation group). The fusion model that incorporated T2WI-AP radiomics model in $VOI_{interface}$ and non-smooth tumor margin showed an excellent prediction efficacy (AUC (95% CI) = 0.915 (0.853-0.976) and 0.868 (0.749-0.988), respectively) and was well fitted in calibration curves ($p > 0.05$), outperforming clinico-radiological model and T2WI-AP radiomics model in the training and validation set (IDIs > 0, $p < 0.05$). The accuracy, sensitivity and specificity in the training and validation cohorts were respectively 0.850, 0.841, 0.861 and 0.771, 0.684, 0.875 with the threshold of 0.576.
**Conclusions:** Radiomics models are effective and non-invasive tools to preoperatively identify MVI status. The fusion model achieves desirable prediction of the individualized risk estimation of MVI in HCC patients, and may be beneficial to make precise decisions for personalized medicine.

# PO-041
# 尼古丁依赖者半球水平动态功能连接改变的磁共振评价

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目的 长期吸烟与大脑多个区域之间的静态功能连接异常有关。采用具有时变分析功能的动态功能连接密度 dynamic functional connectivity density（dFCD）分析尼古丁依赖者全脑和半球水平脑功能网络的动态性改变。
材料与方法 通过网络平台招募 37 名尼古丁依赖者和 47 名年龄和教育程度相匹配的不吸烟志愿者并采集静息状态功能性磁共振成像数据。将全脑功能连接分解为半球间和半球内功能连接，采用滑

动窗口分析捕获半球内和半球间 dFCD。利用半球内和半球间的标准差 Standard Deviation (SD)，进一步量化功能连接动态的时间变异性。
结果 与健康对照组相比，尼古丁依赖者在左侧岛叶、左侧壳核的全脑 dFCD 值升高。在半球间水平比较中，尼古丁依赖者在左侧岛叶、左侧壳核的时间变异性升高。在半球内水平，左侧岛叶、左侧壳核变异性增加显示出与全脑和半球间 dFCD 值增加相似的模式。（GRF 校正，P<0.005，团块水平 P<0.05）。
结论 与健康对照者相比，尼古丁依赖者左侧岛叶和左侧壳核的功能连接模式的时变性反映了它们与大脑其他区域的异常通信，从神经活动角度解释了尼古丁依赖者情绪波动和强迫吸烟的行为异常，并暗示了半球水平功能连接异常在尼古丁成瘾机制中的潜在作用。此外，尼古丁依赖者的大脑存在左侧偏侧化。

## PO-042
# 心脏磁共振组织追踪分析肺高压患者左右心室应力研究

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研究目的：利用心脏磁共振组织追踪技术，回顾性分析肺高压患者的左右心室应力参数，讨论患者左右心室应力的相关性，以及心功能保留时肺高压患者心室应力的变化。
研究方法： 收集 65 例肺高压组患者与 32 例对照组的常规心脏扫描电影序列，使用 CVI 42 软件后处理得到左右心室的心功能参数及应力参数，分别对全部肺高压组的左右心室应力参数及心室功能保留的肺高压组患者心室应力进行分析，应用组间均值比较、斯皮尔曼相关系数分析及组内相关系数(ICC)分析。
结果：组织追踪分析肺高压组左右心室的整体径向应力、周向应力、纵向应力可重复性较好（ICC≥0.75）。肺高压组与对照组相比左右心室的整体径向应力、周向应力、纵向应力均存在显著差异。肺高压组的左右心室整体径向应力呈中等程度相关（r=0.487,p<0.01），左右心室的周向应力呈中等程度相关（r=0.437,p<0.01）,而左右心室的纵向应力在统计学上不存在相关性（r=0.035，p=0.780）。对于右心室功能保留的肺高压组 14 例患者，右心室整体径向、周向、纵向应力与对照组均存在明显差异[(16.79±5.31)%和(23.33±7.98)%、(-13.36±4.23)%和(-20.08±6.41)%、(-10.28±3.00)和(-13.30±4.23)%，P 值均＜0.01]，而右室基底部的周向应力不存在显著差异[(-6.70±6.08)%和(-7.45±8.52)%，Z=-1.110，p=0.27]。对于左心室功能保留的肺高压组 39 例患者，只有左心室的纵向应力与对照组间存在明显差异[(-14.16±3.04)%和(-16.79±2.86)%，Z=-3.444，p<0.01] ，左心室整体和部分的径向、周向应力不存在显著差异。
结论：心脏磁共振组织追踪技术能够定量评价肺高压患者的左右心室应力参数，且具有较好的可行性及可重复性；左右心室的整体径向应力、周向应力中等程度相关，左右心室的纵向应力没有显著相关；右心功能保留的肺高压组患者与对照组比较，三个方向的整体应力存在显著差异，部分径向及周向应力中，基底部的周向应力不存在显著差异；左心室功能保留的肺高压患者与对照组比较，整体的纵向应力存在显著差异。

## PO-043
# Morphology and T2* value changes in knee joint cartilage subregions before and after running a marathon

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Objective: We aimed to assess the changes in articular cartilage volumes, thicknesses, and T2* values in amateur athletes before and after running a marathon.
Methods: Twenty-six amateur athletes were assessed pre- and post-marathon running. A three-dimensional double-echo steady-state (3D-DESS) sequence and T2* mapping sequence were used to acquire morphology and biochemical information of the knee cartilage. All volunteers underwent magnetic resonance (MR) scanning including 3D-DESS and T2* mapping sequences one week pre-marathon and within twelve hours post-marathon. Among them, fourteen volunteers underwent the third MR examination seven days post-marathon, while the other twelve volunteers underwent the third MR examination two months post- marathon. The data were imported into prototypic semi-automatic cartilage segmentation software, and knee cartilage was segmented into twenty-one subregions. Cartilage volume, thickness, and T2* value sub-regions were calculated.
Results: The thickness of the femoral lateral central cartilage was significantly increased within twelve hours post-marathon, and the thickness of the tibial medial anterior (TMA) was significantly reduced two months post-marathon. There was no significant difference in the volume of any of the cartilage subregions before and within twelve hours post-marathon. However, within twelve hours post-marathon, the T2* values of the femoral trochlea medial (FTM), femoral trochlea central (FTC), femoral lateral posterior (FLP), patella lateral inferior cartilages were significantly higher, and tibial medial central cartilage were significantly lower compared with pre-marathon values. During the seven-day follow-up, the volume of the patella medial central (PMC) and patella medial superior cartilage was significantly reduced, while FTM and FTC values were still significantly higher. Two months post-marathon, femoral lateral anterior and TMA volumes decreased significantly, T2* values of the femoral medial central (FMC), FTM, and FLP were significantly higher, and the T2* value of the TMA was significantly lower compared with pre-marathon values.
Conclusions: MR biochemical imaging can be used to assess the internal structure and morphologic changes of knee cartilage. The anterior part of the medial tibial plateau might be a high-risk area for cartilage degeneration during long-distance running.

## PO-044

# 心脏磁共振组织追踪技术在鉴别急性与慢性心肌梗死中的应用价值

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目的：探讨心脏磁共振组织追踪技术（CMR-TT）在定量评估左室心肌梗死后急慢性期左、右心室应变参数中的应用价值。
方法：本研究共纳入 104 名受试者，根据左心室是否存在心肌梗死分为健康对照组（64 例）和左心室心肌梗死组（40 例），40 例心肌梗死患者均有梗死后 7 天（急性期）和梗死后 6 个月（慢性期）随访的 CMR 研究、SSPF 电影序列以及对比延迟增强扫描。利用磁共振组织追踪技术对梗死心肌及其相应远端节段的应变参数以及右室整体应变进行分析，获得径向、周向、纵向的 CMR-TT 三维应变参数，对心肌梗死急慢性期左右心肌应变参数进行配对 t 检验，对健康对照组与心肌梗死患者急慢性期左右心室应变参数分别进行独立样本 t 检验，并建立 ROC 曲线以评价诊断效能。
结果：1.急性期心肌梗死区与其相对应的远端正常心肌径向应力（RS）、纵向应力（LS）和周向应力（CS）差异具有统计学意义（P＜0.05）。且以周向应力 ROC 曲线下面积最大，为 0.895，当以 CS＜-14.47 作为诊断急性心肌梗死时，其诊断灵敏度及特异度分别为 95%和 75%；2.心肌梗死患者慢性期，梗死心肌的径向应变从急性期的 12.99±7.28 增加到 18.57±6.66（P <0.001），而 CS 从急性期的-8.82±4.71 增加到-12.78±3.55（P <0.001）。以周向应变 ROC 曲线下面积最大，

为 0.751，并以 CS< -14.57 作为诊断急慢性心肌梗死得界值时，诊断急性心肌梗死的灵敏度和特异度分别为 55%和 95%；3.健康对照组左室整体心肌应变参数与急慢性心肌梗死患者左室心肌整体应变差异均有统计学意义；4.健康对照组右心室心肌应变整体径向应变、整体周向应变和整体纵向应变分别为 25.75±6.28，-15.54±2.52 和 -26.74±5.56，和急性心肌梗死患者差异有统计学意义；5.健康对照组右心室整体周向应变和整体纵向应变与慢性心肌梗死患者差异有统计学意义，而整体径向应变差异无统计学意义。
结论：心脏磁共振组织追踪技术获得的径向应变和周向应变在急、慢性心肌梗死的鉴别诊断中具有较高的敏感性和特异性，与正常人相比，急慢性心肌梗死患者左右心肌应变参数均发生较明显的改变。

## PO-045
## 增强 MRI 定量测量判断乳腺癌新辅助治疗后可疑残余癌

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目的 探讨乳腺癌新辅助治疗后动态增强 MRI 的信号增强幅度定量测量对判断可疑残余强化的价值。
材料和方法 回顾性分析我院 2015 年接受新辅助治疗并完成手术治疗的乳腺癌连续性病例。所有病例均行基线和术前 MRI 评价，由 2 位医师主观判读筛选出治疗后 MRI 上难以确定是否癌残余的病变，并测量信号增强幅度比值（SER）。根据手术病理结果分为有、无残余癌 2 组，比较临床病理因素和图像特征。利用 ROC 曲线分析并获得 SER 诊断残余癌的 AUC 及最佳截断值，计算诊断敏感度、特异度、阳性预测值（PPV）、阴性预测值（NPV）和准确度，并与主观诊断结果比较。
结果 共纳入 184 例病例，包括无残余癌 67 例和残余癌 117 例。两组病例的激素受体（HR）状态、基线 MRI 病灶强化形态、晚期时相 SER 存在统计学差异（p<0.05）。无残余癌组的晚期时相 SER 值低于残余癌组（分别为 83.83%和 102.8%）。根据不同 HR 状态与基线强化形态进行亚组分析，HR（-）病变亚组，无残余癌组的早晚期时相 SER 值(分别为 58.00%和 73.17%)均低于残余癌组（分别为 95.32%和 122.05%）（p＜0.05），单中心肿块型病变亚组无残余癌组早晚期时相 SER 值（分别为 63.36%和 79.94%）均低于残余癌组（分别为 83.18%和 104.98%）（p＜0.05）。SER 诊断残余癌的 AUC 值在 HR(-)的单中心肿块型病变亚组中最高，早晚期时相 SER 诊断残余癌的 AUC 值分别为 0.867 和 0.875，早晚期时相 SER 的最佳截断值分别为 53%和 76%，由二者计算诊断残余癌的准确度均为 82.61%，高于医师主观诊断残余癌的准确度（52.17%）。
结论 对乳腺癌新辅助治疗后 MRI 上难以主观判断残余的可疑强化灶，简单的信号增强幅度定量 SER 可以作为辅助的定量判断方法，尤其对于 HR（-）单中心肿块型病变的可疑残余强化，SER 的定量判断可能更有价值。

## PO-046
## 产后抑郁症脑白质微结构改变的神经影像学研究

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目的：
产后抑郁症（Post-partum depression, PPD）是育龄期妇女最常见的精神障碍，不仅影响产妇，也会对新生儿及婴幼儿产生不利影响。本研究对产妇产后的精神状态进行评估，并通过弥散张量成

像(Diffusion Tensor Imaging, DTI)探寻 PPD 患者的脑白质微结构完整性的改变，同时测量性激素水平以了解母亲产后的激素水平变化与产后抑郁的发病、临床症状及脑白质微结构变化的关系。

材料与方法:
对 687 名于华西第二医院就诊的产妇进行筛查，纳入 51 名既往无抑郁病史的 PPD 患者和 49 名年龄、产后天数等匹配的健康产后女性。使用西门子 3.0T 磁共振扫描仪采集两组的 DTI 数据，用纤维束自动定量分析软件(Automating Fiber-Track Quantification, AFQ)进行数据处理，提取脑内主要的神经纤维束，并对纤维束各个节点的弥散参数进行测量，包括：分数各向异性(Fractional anisotropy, FA)、平均扩散率(Mean diffusivity, MD)、径向扩散率(Radial diffusivity, RD)和轴向扩散率(Axial diffusivity, AD)，并探讨这些弥散指标与患者临床焦虑、抑郁症状评分及性激素水平的关系。
结果:
使用 AFQ 提取出 18 条脑白质内主要的纤维束，发现 PPD 组与对照组相比： PPD 患者连接额叶和丘脑的白质纤维束的弥散特性发生了改变，其中，右侧丘脑前放射束的 FA 值和 AD 值显著升高，右侧扣带束的 FA 值显著升高，而 RD 值明显减低，丘脑前放射束和扣带束的异常可能会导致母亲的认知障碍、情感处理失衡、脑奖励功能扭曲及亲子关系处理受损；其次，在 PPD 患者中，右侧丘脑前放射束的 AD 值与产妇的焦虑量表评分呈负相关，右侧扣带束的 FA 值与产妇的焦虑、抑郁症状评分呈负相关，进一步说明产后抑郁患者在产后数月内白质纤维束完整性的改变与其焦虑、抑郁临床症状的发展之间存在关联；第三，两组的纤维束的完整性、EPDS 量表、BDI 量表及 BAI 量表评分与受试者性激素水平均无显著相关性， PPD 患者的脑结构和功能的变化与内分泌系统变化的需要进一步的探索；第四，大多数 PPD 组患者的 BAI 量表结果为阳性，这与产妇产后出现过度焦虑的临床症状一致，提示焦虑可能与产后抑郁生理病理有关。
结论:
PPD 患者 FA 值的变化提示其额叶-丘脑环路白质纤维束完整性遭到破坏。额叶—丘脑环路的受损可能是产后抑郁症患者情绪调节受损和母婴关系减弱的病理学基础，同时也为后续临床治疗提供了潜在靶点。

# PO-047
# 自动纤维量化技术在终末期肾病患者脑白质纤维束损伤中的应用

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**目的：**应用自动纤维量化技术 (Automated fiber quantification, AFQ) 探讨终末期肾病 (end-stage renal disease, ESRD) 患者脑白质纤维束的损伤特征及其与肾功能指标的相关性。
**材料和方法：**前瞻性收集 ESRD 患者（男：10 例；女：8 例；平均年龄：57.28 岁）及年龄、性别、体质指数 (body mass index, BMI)、教育程度与之匹配的对照组共 19 例（男：8 例，女 11 例；平均年龄：56.05 岁）进行研究。所有被试者行 3.0T MRI 头部扫描，获取高分辨率 3D-T1 及 DTI (diffusion tensor imaging) 序列。采用 AFQ 技术提取每例被试全脑 20 条主要纤维束，每条纤维束被等分为 100 个节段，定量每条及每段纤维束的 DTI 指标（FA、MD、AD 及 RD）。在 FSL (Functional MRI of the Brain Software Library) 中进行两组间体素水平的分析来比较每段纤维的 DTI 指标；两组间整条纤维的 DTI 指标差异应用双样本 t 检验进行比较；所有结果经 FDR 校正，并将有差异的指标值与肾功能指标进行偏向关及多元线性回归分析。
**结果：**整条纤维水平分析显示：与对照组相比，ESRD 患者在多条纤维上的 FA 值降低，MD、AD 及 RD 值增高，主要包括，右侧丘脑辐射(ATR)、双侧扣带回扣带部(CC)、双侧额枕下束(IFOF)、双侧下纵束 (ILF)、胼胝体小钳等（**图 1-4**）。体素水平分析显示：与对照组相比，ESRD 患者左侧

皮质脊髓束（CST）的第 25-37 段、胼胝体小钳的第 16-26 及 68-81 段、IFOF 的第 1-9、18-22、52-62 段 FA 值降低 (**图 5**，FDR 校正, P <0.05)；与对照组相比，多条纤维束的 MD 值增高，主要包括：左侧 CST 的第 12-14、19-39、67-100 段，右侧 CST 的第 12-30 与 64-100 段，胼胝体大钳的第 90-100 段，左侧 IFOF 的 1-8 段、34-69 段、88-100 段，右侧 ILF 的第 35-60、80-83 段，右侧钩状束(UF)的 10-18 段，左侧 ILF、胼胝体小钳和上纵束(SLF)的大部分 (**图 6**，FDR 校正, P <0.05)；与对照组相比，双侧 CST 的部分节段，左侧 ILF 的 64-66 段 AD 值增高 (**图 7**，FDR 校正, P <0.05)；ESRD 患者的双侧 CST（左侧 20-40 段，右侧 12-29 段），胼胝体大钳的 14-18 及 80-85 段，左侧 ILF 的 1-13、19-61 段、89-95 段，右侧 ILF 的 34-60 段、81-83 段，左侧 SLF 的 4-27 段，右侧 UF 的 94-100 段及整个胼胝体小钳，大部分的左侧 IFOF 的 RD 值均有增高 (**图 8**，FDR 校正, P <0.05)。偏向关及后续多元线性回归显示左侧 ATR 的 MD 均值及左侧 CST 的 66-100 段 AD 值与血清尿素值呈正相关；右侧 IFOF 的 MD 均值及左侧 CST 的 19-39 段 MD 值与血肌酐值呈正相关（**表 1**）。

**结论：**ESRD 患者存在广泛的脑白质纤维束改变，且多位于左半球；采用 AFQ 分析方法能够更加精细、准确地发现 ESRD 患者脑白质纤维束的受损节段；肾功能受损可能引起左侧丘脑辐射，左侧皮质脊髓束及右侧额枕下束的局部损伤。

PO-048

# Diffusion Tensor Imaging and Tractography in Deep Brain Stimulation Postoperative Participants with Parkinson's Disease

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Purpose

Nigrostriatal pathway, dentate rubro thalamic (DRTT) and hyperdirect pathway have been shown to be involved with control of motor behavior or to be responsible in the pathophysiology of tremor in PD patients. It is of great clinical and research value to evaluate the white matter tracts after DBS. Preliminary evidence supports the safety of diffusion weighted tractography in postoperative patients with DBS, but it has not been reported whether the different states of DBS (switch on or off) affect the fiber bundle reconstruction, and whether it is feasible to depict the tracks using deterministic tractography method.

METHODS

This study was approved by the local Institutional Review Board and all subjects signed a consent form. A total of 31 postoperative PD cases were collected on a 1.5 T MR scanner (Magnetom Aera; Siemens Healthcare, Erlangen, Germany) with a 16-channel head coil. At first, all the 31 patients were scanned with the DBS device on. After turning off the DBS device for about one hour, 22 of them were rescanned using the same MRI protocol. The complete sequence consisted of 64 diffusion-weighted directions with b = 1000 s/mm$^2$ and 16 interspersed scans where b = 0 s/mm$^2$. TR=6500ms, TE=126ms, matrix=110×110, voxel size=2×2×2mm$^3$, BW= 1336 Hz/pix, acquisition time=9 min and 13 s, SAR= 0.34±0.02 w/kg, lower than the recommend threshold level (0.4 w/kg). Nine patients with severe shaking symptoms after turning off the DBS device gave up the second scan. For a visually image quality assessment (QA), A trained analyst visually inspected all 80 volumes for each DTI scan. Any volume that appeared to contain artifact was recorded. The deterministic tractography method was used to reconstruct the fibers. The track count number between left and right-side fibers in both DBS ON and OFF images, and the differences between DBS ON and OFF in the same side fibers were compared using paired t-test. Findings of a p value >0.05 were considered significantly similar.

RESULTS

For both the DBS-ON and DBS-OFF DTI, nigrostriatal pathway can be reconstructed in more than two-thirds cases; hyperdirect pathway can be seen in a small number of cases (about 1/10); and DRTT cannot be reconstructed at all. The track count numbers of right nigrostriatal pathway were larger than that of the left nigrostriatal pathway, but there were no significant differences (DBS ON: p value=0.07; DBS OFF: p value=0.17). Compared the nigrostriatal pathway track count number of the DBS ON to the DBS OFF, there were no statistical differences in both side (right side: p value=0.7; left side: p value=0.15).
CONCLUSION
Both DBS ON and OFF DTI are safe and the tractography results are significantly similar. It is feasible to depict the nigrostriatal pathway using deterministic tractography method based on the postoperative DTI.

# PO-049

## 青年人躲避伤害性性格与低水平的脑功能连接存在密切关联

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目的：
不同人之间的性格往往迥异，形成了多姿多彩的人类社会。但是，目前，我们对不同类别性格背后的脑组织架构知之甚少。本研究借助静息态功能磁共振（rsfMRI）来探索不同类别性格的大尺度功能网络，旨在阐明不同类别性格背后的脑功能基础，为深化了解“人性”提供必要的客观依据。
材料与方法：
本研究通过入排标准，共纳入 97 名青年被试（女性：男性=49:48，年龄范围 18-30 岁）。每一位被试均完成了一项三维人格测试，分别包含了三种性格得分（猎奇性，躲避伤害性和奖赏依赖性）。此外，也采集了每一位被试的情绪量表、多种认知状态量表以及 rsfMRI 数据。针对 rsfMRI 数据，本研究采用 fMRIprep 进行了标准化预处理，采用 GRETNA 分别计算了每一位被试的脑网络拓扑属性，包括全脑网络属性（全局效率与局部效率）、节点属性（节点效率与节点局部效率）以及基于 NBS 的连边分析。
首先，本研究采用数据驱动聚类算法将 97 名被试分成两类，分别是躲避伤害性为主型（HA）和奖赏依赖性为主型（RD）。之后，采用独立样本 T 检验、一般线性模型、偏相关分析探讨了两种性格人群的认知心理指标以及脑网络拓扑属性的改变。年龄、性别及教育作为无关变量进行了回归。
结果：
与 RD 组相比，HA 组人群的状态焦虑、特质焦虑水平均较高（$p = 0.013$、$0.003$）。在全脑网络属性中，HA 组人群存在显著降低的全局效率（$p = 0.018$）与局部效率（$p = 0.018$），且这些属性与 HA 得分存在显著的线性负相关（$p = 0.007$, $r = -0.274$; $p = 0.009$, $r = -0.268$）。此外在节点属性上，HA 组广泛的节点属性（主要分布在颞枕区域）显著降低（$p < 0.009$，多重比较校正后），且与 HA 得分也存在显著的线性负相关。通过 NBS 分析发现 HA 较 RD 存在一个负性成分网络（$p < 0.001$），且分别与 HA 呈线性负相关（$p < 0.001$, $r = -0.450$）、与 RD 存在线性正相关（$p = 0.030$, $r = 0.224$）。
结论：
本研究借助数据驱动聚类方法和经典大尺度脑网络分析方法揭示了不同类别性格人群的脑功能基础，即低水平的脑功能连接状态可能是人群表现出躲避伤害性行为的重要脑内部机制。

# PO-050

# Feasibility of predicting pelvic lymph node metastasis based on IVIM-DWI and texture parameters of the primary lesion and lymph nodes in patients with cervical cancer

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Purpose: To investigate the feasibility and value of intravoxel incoherent motion diffusion weighted imaging (IVIM-DWI) and texture parameters of primary lesions and lymph nodes for predicting pelvic lymph node metastasis (PLNM) in patients with cervical cancer.
Methods: A total of 143 patients with cervical cancer confirmed by surgical pathology were analyzed retrospectively and 125 patients were enrolled in primary lesions study, 83 patients and 134 lymph nodes were enrolled in lymph nodes study. Patients and lymph nodes were randomly divided into training group and test group at a ratio of 2: 1. The IVIM-DWI parameters and 3D texture features of primary lesions and lymph nodes of all patients were measured. The least absolute shrinkage and selection operator algorithm, spearman's correlation analysis, independent two-sample t-test and Mann-Whitney U-test were used to select texture parameters. Multivariate Logistic regression analysis and receiver operating characteristic (ROC) curves were used to model and evaluate clinical and imaging variables.
Results: In primary lesions study, model 1 was constructed by combining f value, original_shape_Sphericity and original_firstorder_Mean of primary lesions. In lymph nodes study, model 2 was constructed by combining short diameter, circular enhancement and rough margin of lymph nodes. Model 3 was constructed by combining ADC, f value and original_glszm_Small Area Emphasis of lymph nodes. The areas under curve (AUC) of model 1, 2 and 3 in training group and test group were 0.882, 0.798, 0.907 and 0.862, 0.771, 0.937 respectively.
Conclusions: Models based on IVIM-DWI and texture parameters of primary lesions and lymph nodes both performed well in diagnosing PLNM of cervical cancer and were superior to morphological features of lymph nodes. Especially, parameters of lymph nodes showed higher diagnostic efficiency and clinical significance.

PO-051

# 心脏磁共振多模态技术评估肿瘤患者免疫治疗后心肌损伤

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目的
探讨多模态心脏磁共振成像(CMR)在评估肿瘤患者接受免疫检查点抑制剂(ICIs)治疗后我心肌损伤情况的价值。
材料与方法
前瞻性收集 2020 年 10 月至 2021 年 3 月武汉协和医院肿瘤中心准备应用免疫治疗的肿瘤患者 23 例，于免疫治疗前、第一次免疫治疗后 3 周及 2 月共三个时间点，行 1.5T 心脏磁共振(MAGNETOM Altea)扫描、心电图及实验室检查，获取基线、免疫后第一次及第二次复查结果，将 CMR 相关序列图像导入后处理软件(CVI$^{42}$)进行半自动分析，计算双心室(LV, RV)心功能(舒张末期容积/EDV、收缩末期容积/ESV、每搏输出量/SV、射血分数/EF、心输出量/CO、心脏指数/CI)、心肌应力(整体纵向/径向/周向应力：GLS/GRS/GCS)、心肌 native T1 值、心肌 T2 值及细胞外容积(ECV)值。两名放射科诊断医师对 T2 stir、早期/晚期钆增强(EGE/LGE)等定性序列图像进行判读。将基线 CMR 结果分别与免疫后第一次、第二次 CMR 复查结果进行配对 t 检验，$p<0.05$ 为差异有统计学意义。
结果

免疫后第一次 CMR 复查与第一次免疫间隔时间 29±13 天，与基线 CMR 比较发现，心功能参数 LVSV(65.3±18.2 ml vs. 60.1±17.5ml), LVEF(52.5±6.5%vs.50.1±6.4%), LVCO(5.0±1.0 L/min vs. 4.5±1.0L/min), LVCI(2.9±0.6 L/min/$m^2$ vs. 2.5±0.5 L/min/$m^2$), RVEF(44.0±8.9% vs. 40.3±7.7%)显著减低($p<0.05$)；应力参数 RVGRS(35.1±14.6% vs. 29.6±11.2%)显著减低($p<0.05$)；
免疫后第二次 CMR 复查与第一次免疫间隔时间 78±13 天，与基线 CMR 比较发现，心功能参数 LVSV(65.3±18.2 ml vs. 58.2±16.0ml), LVEF(52.5±6.5% vs. 50.6±5.7%), LVCO(5.0±1.0 L/min vs. 4.2±1.0L/min), LVCI(2.9±0.6 L/min/$m^2$ vs. 2.4±0.6 L/min/$m^2$), RVESV(52.6±16.6ml vs. 59.0±15.9ml), RVSV(41.9±16.3ml vs. 34.7±13.7ml), RVEF(44.0±8.9% vs. 36.8±9.5%), RVCO(3.2±1.1L/min vs. 2.5±1.0 L/min)；应力参数 LVGCS(-19.7±3.0% vs. 18.2±2.9%), LVGLS(-13.4±2.6% vs. -11.4±2.9%), RVGRS(35.1±14.6% vs. 28.3±11.0%)显著减低($p<0.05$)。
两次复查与基线数据比较显示，心肌 native T1 值、T2 值及 ECV 值无明显统计学差异($p>0.05$)。1 例(1/23)患者于免疫治疗后第一次复查时显示高敏肌钙蛋白升高(67.6ng/L)，且 T2 stir 序列显示左室下侧壁斑片状信号增高且 LGE 可见相应区域强化，局部测得 native T1 值（1104ms）及 T2 值（57ms）较基线 CMR 结果（native T1 值：1045ms，T2 值：48ms）稍升高。
结论
接受免疫治疗的肿瘤患者双心室心功能及整体心肌应力减低，且随着免疫治疗应用增加，心功能及应力减低更为显著，定性序列 T2 stir、LGE 及组织特征定量序列可帮助识别肿瘤患者免疫后心肌损伤的发生及演变。

# PO-052

## Whole-tumor ADC histogram analysis for differentiating endometriosis-related tumors: seromucinous borderline tumor, clear cell carcinoma and endometrioid carcinoma

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AIM: To investigate the feasibility of whole-tumor apparent diffusion coefficient (ADC) histogram analysis for differentiating endometriosis-related tumors: seromucinous borderline tumor (SMBT), clear cell carcinoma (CCC) and endometrioid carcinoma (EC).
MATERIALS AND METHODS: A total of 85 patients (22 with SMBT, 42 with CCC and 21 with EC) were retrospectively enrolled. Clinical data, solid component ADC ($ADC_{SC}$) and whole-tumor ADC histogram-derived parameters were compared among SMBT, CCC and EC. The diagnostic efficacy of these parameters was evaluated using receiver operating characteristic curve analysis.
RESULTS: Patients with SMBT were significantly younger than patients with CCC/EC. Significantly higher $ADC_{SC}$ and smaller volume were found in SMBT than CCC/ EC. ADCmean was significantly higher in CCC than EC. 10th percentile ADC was significantly lower in EC than SMBT/CCC. 50th and 90th percentile ADCs were significantly higher in CCC than SMBT/EC. For differentiating SMBT from CCC, AUCs of $ADC_{SC}$, volume, 50th and 90th percentile ADCs were 0.97, 0.86, 0.72 and 0.81, respectively. For differentiating SMBT from EC, AUCs of $ADC_{SC}$, volume and 10th percentile ADC were 0.97, 0.71 and 0.72. For differentiating CCC from EC, AUCs of ADCmean, 10th, 50th and 90th percentile ADCs were 0.79, 0.72, 0.81 and 0.85, respectively.

CONCLUSIONS: Similar with $ADC_{SC}$, whole-tumor ADC histogram analysis was valuable for differentiating endometriosis-related tumors. It was helpful for 50th, 90th percentile ADCs and volume in differentiating SMBT from CCC; for volume and 10th percentile ADC in differentiating SMBT from EC, and for ADCmean, 10th, 50th and 90th percentile ADCs in differentiating CCC from EC.

PO-053

# Differentiation of lung squamous cell carcinoma and lung adenocarcinoma by hybrid PET/MR

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Differentiation of lung squamous cell carcinoma and lung adenocarcinoma by hybrid PET/MR

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Key words: PET imaging ,APTw,IVIM,PET/MR,NSCLC

Purpose

To explore the ability of PET/MR to distinguish lung squamous cell carcinoma (SCC) and lung adenocarcinoma (AC).

Materials and Methods

A total of 65 patients with NSCLC were included in this study, including 17 patients with lung squamous cell carcinoma and 48 patients with lung adenocarcinoma. All patients underwent a combination of PET/MR examinations, including T2WI, positron emission tomography (PET) imaging, amide proton transfer weighted imaging (APTw), and incoherent intravoxel motion (IVIM). Region of interests (ROIs) were placed on the largest layer of the lesion, and measured and evaluated to obtain magnetic transfer ratio asymmetry at the 3.5 ppm mapping (MTRasym), true diffusion coefficient D, perfusion fraction f, false diffusion coefficient D*, maximum standardized uptake value (SUVmax). The independent sample t-test was used to evaluate the inter-group differences in APTw, IVIM and PET parameters. Receiver operating characteristic (ROC) curve was used to evaluate the ability of different parameters to distinguish NSCLC subtypes. DeLong test was used to analyze whether there were differences in areas under curves (AUCs) of each parameter. Pearson correlation test is used to explore the correlation between parameters, and correlation coefficient R of 0-0.5 is a poor correlation, 0.5-0.8 is a medium correlation, and R >0.8 is a high correlation.

Result

The values of SUVmax and D* (11.3±6.0, 69.2±48.4) in squamous cell carcinoma group were significantly higher than those in adenocarcinoma group (6.7±4.6, 42.7±38.2), and the values of MTRasym and D (0.8±1.0, 1.0±0.2) were significantly lower than those in adenocarcinoma group (4.1±2.6, 1.3±0.3). The diagnostic efficacy of APTw, IVIM and PET for SCC and AC, namely the area under the ROC curve (AUC), was 0.907, 0.895 and 0.623, respectively. APTw and IVIM had no significant difference in differentiating SCC and AC, but both of them were significantly higher than PET imaging. The AUC of the combined diagnosis of SCC and AC was 0.961, significantly higher than that of any of the parameters. Pearson correlation analysis shows that MTRasym and D value (r=0.313, P=0.011) have a significant weak positive correlation，SUVmax and D value (r=-0.265, P=0.033),SUVmax and f value (r=-0.25) , P=0.045) both have a significant weak negative correlation.

Conclusion
The results of this experiment show that the three imaging methods of hybrid PET/MR, PET, APT and IVIM can distinguish SCC and AC, and the distinguishing ability of APT and IVIM is significantly greater than PET imaging. PET/MR imaging is an effective way to identify SCC and AC.

PO-054

# A Nomogram of Combining IVIM-DWI Parameters and Radiomics for Preoperative Risk Evaluation of Non-enlarged Lymph Node Metastasis in Primary Lesion of Rectal Adenocarcinoma

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Abstract
Objective To evaluate the value of the nomogram model combining intravoxel incoherent motion diffusion weighted imaging (IVIM-DWI) parameters and radiomic features on magnetic resonance imaging (MRI) in predicting lymph node （LN） metastasis with a short diameter ≤9 mm of primary lesion of rectal adenocarcinoma preoperatively.
Methods Retrospective analysis was performed on 126 cases of rectal adenocarcinoma confirmed by surgical pathology. All patients received conventional pelvic MRI and IVIM-DWI scan before surgery. Based on the pathological results of LN, the patients were divided into positive LN (LN+) and negative LN (LN−) groups. ADC, D, D* and f value of primary leision of rectal adenocarcinoma were measured and calculated, three-dimensional（3D） radiomic features were measured on axial T2WI and IVIM-DWI（b=800 s/mm2）. Independent sample t test or Mann-Whitney U test and Multivariate Logistic regression are used for radiomic features selection and then developed a radiomics signature named Rad-score. A nomogram model using IVIM-DWI combined with radiomic features was developed. The diagnostic efficiency of the nomogram model was estimate by the area under the curve (AUC) of the receiver operator characteristic (ROC).
Results There were 47 cases in the LN+ group and 79 cases in the LN− group. The LN+ group had a significantly lower D* value (P<0.05), and a higher f value (P<0.05) than the LN−group, and the other parameters were not statistically significant. The AUC values of D* and f value were 0.706 (sensitivity: 72.2%, specificity: 63.8%), 0.675 (sensitivity: 57.4%, specificity: 75.9%), respectively. There were four radiomics features that were identified as independent risk factors for lymph node metastasis（LNM）by Multivariate Logistic regression. The AUC value of Rad-score to predict LNM was 0.834（sensitivity: 76.6%, specificity: 82.3%). The nomogram model incorporating D*, f with radiomics features improved the predictive performance and diagnostic accuracy(AUC=0.876, sensitivity: 80.9%, specificity: 86.1%).
Conclusion The nomogram model of D*, f value combined with radiomic features on T2WI and IVIM-DWI（b=800 s/mm2）was associated with regional LN status with a short diameter ≤9 mm in rectal adenocarcinoma, which had a high application value to help improve the prediction of nodal stage and provide support for therapeutic decision-making.

PO-055

# 左心房功能障碍早于左心房扩大及左心室纵向功能障碍：基于心脏磁共振特征追踪技术的研究

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目的：利用心脏磁共振特征追踪技术（cardiac magnetic resonance feature tracking，CMR-FT）比较左心房体积正常的肥厚型心肌病（hypertrophic cardiomyopathy，HCM）和高血压（hypertension，HTN）患者的左心房功能；探索左心房功能用于心血管疾病早期患者临床评估和预测不良事件的能力。
材料与方法：按照纳入和排除标准回顾性收入 2012 年 8 月-2016 年 3 月在我院进行 CMR 检查的左房大小正常的 60 名 HCM 患者，60 名 HTN 患者以及性别年龄相匹配的 60 名正常志愿者。采用半傅里叶单次激发技术及平衡稳态自由进动序列获得标准心脏各长轴及短轴切面及电影序列,由 2 名医师独立测量左心房和左心室功能参数,包括体积化参数、应变及应变率等。不同组间相应参数的比较采用单因素方差分析和卡方分析。主要终点事件包括全因死亡、卒中、新发或恶化再住院的心衰、阵发或频发房颤。采用单因素 Cox 回归进行生存分析，并通过受试者工作特征操作曲线（receiver operating characteristic, ROC）计算出参数的 cut-off 值从而得出相应的 Kaplan–Meier 生存分析曲线。
结果：与正常对照组相比，HTN 和 HCM 患者表现为左心房储存功能参数和导管功能参数显著减低，包括射血分数、左心房容积、应变和应率，伴不同阶段的左心房泵血功能障碍。高血压患者的左房泵血期应变显著低于 HCM 患者和正常对照，HCM 患者的左心房泵血期应变有大于正常人的趋势但无统计学差异(对照组, 24.3% ± 8.9; HTN 患者, 20.6% ± 6.1; HCM 患者, 25.5±9.7, $p<0.01$)。随访的中位事间为 6.8 年，23 例患者发生主要终点事件。左心房应变参数预测主要终点事件的发生比左心室纵向应变更敏感(左心房储存期应变: (33.9±7.5)% vs (41.2±14.3)%, p=0.02; 左心房导管期应变：(13.6±6.2)% vs (17.4±10.4)%, p=0.03; 左心房泵血期应变: (20.2±6.0)% vs (23.7±8.8)%, p=0.07; 左心室纵向应变: (-19.4±6.4) vs. (-20.0±6.8)%, p=0.70）。Cox 回归分析证明在高血压和肥厚型心肌病早期阶段，左心房储存期应变和泵血期应变与临床预后显著相关（$p<0.05$）。Kaplan–Meier 分析显示当左心房泵血期应变<22.5% （p=0.04）, 左心室最大室壁厚度≥16.1mm （p=0.01）时患者发生主要终点事件的可能性显著提高。
结论：对于左心房大小正常的 HTN 和 HCM 患者，CMR-FT 衍生的左心房应变是一项有前景并且稳健的参数用于证实左心房受损机制、量化左心房血流动力学改变以及提示左心房-心室耦联受损。其反映的左心房功能障碍可能是疾病早期临床评估和预测预后的有力指标，甚至优于左心室纵向应变。

PO-056

# 初探 APTw 联合 mDixon-Quant 序列鉴别 I 期子宫内膜癌与子宫内膜息肉的价值

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【摘要】目的 探讨酰胺质子转移加权（amide proton transfer，APTw）联合 mDixon-Quant 序列鉴别 I 期子宫内膜癌（endometrial carcinoma, EC）与子宫内膜息肉（endometrial polyp, EP）的价值。方法 回顾性分析 2019 年 5 月至 2021 年 5 月经手术病理证实的 37 例 I 期 EC 和 27 例 EP 的患者资料，所有患者术前均行 3.0T MR 检查，扫描序列包括 T1WI、T2WI、APTw 和 mDixon-Quant。由两位观察者分别测量病灶 APTw 成像的 APT 值，mDixon-Quant 成像的 R2*值及 FF

值。采用组内相关系数（Intraclass Correlation Coefficient,ICC）对两位观察者各参数测量结果的一致性进行检验；根据数据符合正态分布与否，采用独立样本 t 检验或 Mann-Whitney 秩和检验比较各参数值的差异，采用工作者受试者（receiver operating characteristic curve,ROC）曲线评估有统计学差异的参数对早期 EC 与 EP 的鉴别诊断的曲线下面积（area under curve,AUC）。采用 Logistic 回归计算 APTw 联合 mDIXON-Quant 鉴别早期 EC 与 EP 的 AUC。采用 Delong 检验比较 AUC 间的差异性。结果 两位观察者测得两组病灶各参数值的一致性良好（ICC>0.75）。早期 EC 的 APT 值（3.03±1.03）%及 R2*值（21.73±8.19）Hz 大于 EP 的 APT 值（2.02±0.53）%与 R2*值（16.72±3.82）Hz，差异均具有统计学意义。APT 值、R2*值以及二者联合鉴别早期 EC 与 EP 的 AUC、阈值、敏感度、特异度分别为：0.829、0.691、0.848；2.775%、21.783Hz；56.40%、41.00%、71.80%；100.00%、96.40%、96.40%。APT 值鉴别早期 EC 与 EP 的 AUC 与 R2*值的 AUC、APT 值的 AUC 与二者联合的 AUC 以及 R2*值与二者联合的 AUC 之间的差异的 P 值分别为 0.07、0.45、0.01。结论 APT 值、R2*值可定量鉴别早期 EC 与 EP，二者联合诊断效能得到了提升，具有一定的临床应用价值。

# PO-057

# MRI 在卵泡膜-纤维瘤与子宫浆膜下平滑肌瘤 及卵巢实性恶性肿瘤鉴别诊断中的价值

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目的
评估 MRI 对卵泡膜-纤维瘤与子宫浆膜下平滑肌瘤及卵巢实性恶性肿瘤的鉴别诊断价值。
资料和方法
回顾性分析自 2011 年 1 月至 2018 年 6 月期间,于天津医科大学总医院行术前 MRI 检查的附件区实性肿块患者 158 例，包括卵泡膜-纤维瘤 58 例，子宫浆膜下平滑肌瘤 60 例，卵巢实性恶性肿瘤 40 例。所有患者均于本院行手术切除，并有组织病理学结果。评估指标如下：年龄、临床症状、子宫内膜；肿块的位置、最大径、形状、包膜、T1WI 和 T2WI 信号特点、DWI 信号强度、囊变区特点、双侧卵巢可视性、流空血管的检测及腹水，并测量各组病灶的 ADC 值。对上述指标中的连续变量使用 t 检验或 Mann-Whitney U 检验，分类变量使用 Pearson 卡方检验或 Fisher 确切概率法进行组间差异统计。然后，将有统计学差异的变量纳入二元 Logistic 回归模型中，并利用 AUC 评估诊断效能。
结果
在卵泡膜-纤维瘤与子宫浆膜下平滑肌瘤的鉴别诊断中：(1) 单变量分析得出年龄、形状、T2WI 信号特点、囊变区特点、流空血管的检测、双侧卵巢可视性和腹水在两组病变之间的差异均有统计学意义（P<0.05）。(2) Logistic 分析得出 T2WI 上伴絮状/结节状高信号、囊变位于中心、无流空血管和双侧卵巢均不可视这 4 个特征为鉴别诊断的重要指标，尤其是 T2WI 上伴絮状/结节状高信号(OR =11.41)和无流空血管(OR =11.09)对两者的鉴别诊断具有更高的价值。当这 4 个特征联合应用时诊断灵敏性为 91.8%，特异性为 96.7%，AUC 为 0.984。
在卵泡膜-纤维瘤与卵巢实性恶性肿瘤的鉴别诊断中：(1) 单变量分析得出子宫内膜、最大径、包膜、T2WI 信号特点、囊变区特点、流空血管的检测、DWI 信号强度和 ADC 值在两组肿瘤之间均具有显著性差异（P<0.05）。(2) ROC 曲线分析得出 ADC 值鉴别两组肿瘤的最佳临界值为 1.27×10-3 mm2/ s，其相应的敏感度、特异度和 AUC 分别为 70.9%、62.7%和 0.670。当 ADC 值低于 1.27×10-3 mm2/ s 时更倾向于卵巢实性恶性肿瘤的诊断。(3) Logistic 分析得出有包膜、T2WI 上伴絮状/结节状高信号、囊变位于中心、DWI 低或等信号和 ADC 值大于 1.27×10-3 mm2/ s 这 5 个特征为鉴别诊断的重要指标，特别是 DWI 低或等信号(OR =71.53)和有包膜(OR =15.45)对两者

的鉴别诊断具有更高的价值。当这 5 个特征联合应用时诊断灵敏度和特异度均为 91.5%，AUC 为 0.967。
结论
MRI 对卵泡膜-纤维瘤与子宫浆膜下平滑肌瘤及卵巢实性恶性肿瘤的鉴别诊断具有很高的准确性。

# PO-058

# Prominence of Cerebral Veins of Neonates with Punctate White Matter Lesions in Different Degrees: a Susceptibility Weighted Imaging Study

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**Objectives**: To evaluate the cerebral veins by the quantification of normalized visible venous volumes (NVVVs) in susceptibility-weighted imaging (SWI) exams in neonates with punctate white matter lesions (PWMLs) at different degrees.
**Material and methods**: Neonates with PWML were divided into 3 grades (grades I-III). Normalized visible venous volumes (NVVVs) between neonates with punctate white matter lesions and controls were compared. Blood gas results were also analyzed.
**Results**: Fifty neonates with evidence of PWMLs and eighteen controls were enrolled in this study. Twenty-two, twenty and eight neonates with PWML were classified into grade I,II and III, respectively. NVVVs of PWMLs cases in Grade I and II were significantly higher than those in Grade III and controls. However, there was no significant difference of NVVVs between grade III and control. NVVVs and PH were positively correlated, wheras NVVVs was negative correlated with PCo2.
**Conclusion:** NVVVs in SWI exams could reflect the physiological changes in different grades of PWMLs.

# PO-059

# 基于多参数 MRI 影像组学信号预测直肠癌 Kras 基因突变的研究

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目的：探索多参数 MRI 影像组学信号模型预测直肠癌（rectal cancer， RC）KRAS 基因突变的价值。
资料与方法：回顾性分析深圳市人民医院 2019 年 4 月至 2020 年 12 月 104 例经病理证实且行术前 MRI 检查的直肠癌患者的临床病理资料和提取 RC 的多参数 MRI 影像组学特征。采用 t 检验、c2 检验或 Mann–WhitneyU 检验分析临床病理特征和影像组学特征与 KRAS 基因突变的相关性，将有统计学意义的特征纳入 LASSO 回归模型进行特征选择和建立影像组学信号。采用受试者（receiver operating characteristic，ROC）的曲线下面积（area under the curve，AUC）评价影像组学信号对 KRAS 基因突变的预测效能。
结果：临床病理资料在有无 KRAS 基因突变间差别无统计学意义。321 个影像组学特征中，单因素分析表明 16 个影像组学特征与 KRAS 基因突变有相关性。LASSO 回归筛选出 7 个影像组学特征

构建影像组学信号，在验证集和预测集中预测 KRAS 基因突变的 AUC 值分别为 0.81(0.70-0.92)和 0.77(0.63-0.91，P=0.60)。
结论：MRI 影像组学特征可以作为预测 KRAS 基因突变的生物学标记。

## PO-060

# 酰胺质子加权成像联合扩散峰度成像诊断原发性肝恶性肿瘤的价值

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目的：
本研究旨在探讨酰胺质子加权成像（Amide proton transfer-weighted，APTw）联合扩散峰度成像（Diffusion kurtosis imaging，DKI）诊断原发性肝恶性肿瘤的价值。
方法：
本研究纳入了 20 例在本院做过 3.0TMRI（(Ingenia CX, Philips Healthcare, the Netherlands）检查（包括 APT 及 DKI 序列）的肝占位患者，均是经手术病理证实或临床诊断而入组，其中肝细胞肝癌 14 例，年龄在 40~60 岁；肝内胆管细胞癌 6 例，年龄在 46~70 岁。入组患者的 APT 原始数据被传输至 ISP（Ingenia CX, Philips Healthcare, the Netherlands）工作站用于后处理，相应的 DKI 原始数据在 GE AW 4.6 工作站进行后处理并生成功能参数图，包括各向异性（FA）、平均扩散系数（MD）、径向扩散系数（Da）、垂直扩散系数（Dr）、平均扩散峰度（MK）、径向扩散峰度（Ka）、垂直扩散峰度（Kr）、峰度各向异性分数（FAk）。由一位经验丰富的放射学医师在 T2W 及 APTw 融合图像中最大病灶层（避开囊变、坏死区域）放置 3 个相同的 ROI（100 - 200 mm2），以及参照 T2W 图像，在 DKI 功能图中同病灶层面放置完全相同的 ROI，记录自动生成的值。采用 Mann-Whitney U 检验比较两组间定量参数的差异性。曲线下面积（ROC）用于评价各有差异参数鉴别肝良性实性占位的价值。采用逻辑回归评估联合参数的鉴别效能。使用 delong 检验比较各 AUC 之间的差异性。当统计值 P<0.05 时，视为有统计学差异。

结果：
肝细胞癌的 APTw、MD、Dr 值低于肝内胆管细胞癌，差异有统计学意义（P<0.05），Ka 值大于肝内胆管细胞癌，其余参数无统计学差异。ROC 曲线下面积分析显示，APTw、MD、Dr 及 Ka 值诊断原发性肝恶性肿瘤的效能分别为 0.821、0.833、0.833 及 0.857。MD、Dr、Ka 三者联合以及 APTw、MD、Dr、Ka 四者联合的 AUC 值分别 0.893、0.952，各 AUC 之间并无统计学差异。

## PO-061

# 扩散加权磁共振成像（DWI）比 RECIST 更能预测靶向治疗后结直肠癌肝转移（CRLM）患者的生存

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目的：比较扩散加权成像（DWI）与 RECIST 标准对结直肠癌肝转移（CRLM）在不同新辅助化疗方案（化疗联合靶向治疗 vs 单纯化疗）的疗效预测价值。

方法：纳入 2013 年 1 月至 2018 年 11 月在本院确诊结直肠癌肝转移并接受新辅助化疗、随后接受肝部分切除手术的患者，根据其新辅助治疗方案分为两组：靶向治疗组（BEV 组：化疗方案含有贝伐珠单抗）和单纯化疗组（non-BEV 组，化疗方案不含有贝伐珠单抗）。选择未经化疗时基线最大的转移灶为靶病灶，在 GE 工作站上沿病灶外缘（治疗前、后）勾勒出整个病灶，计算出靶病灶治疗前、后的表观扩散系数（ADCmean）值；同时，在靶病灶最大层面的病灶边缘、病灶中心分别勾勒 ROI，计算周边（ADCperi）和中心（ADCcentral）。计算治疗前后的 ADC 变化值（△）以及 ADC 变化率（△%）。全部患者随访 3 年以上，以总生存率（OS）和无复发生存率（RFS）作为预后指标。

结果：BEV 组治疗后 ADCmean 与 OS（p=0.001）和 RFS（p=0.008）显著相关，非 BEV 组仅与 RFS 显著相关（p=0.042）。BEV 组的 ADCmean-post（治疗后靶病灶的 ADC 均值）以 1.15×10-3mm2/s 为界值，ADC 反应组（ADCmean-post ＞1.15×10-3mm2/s）的 OS 明显好于无反应组（3 年 OS 91.5% vs 64.5%，P=0.001）。然而，在 BEV 组，RECIST 标准定义的有效组与无效组相应的 OS（3 年 OS: 60.2% vs 44.0%，P=0.104）和 RFS（3 年 RFS:26.2% vs 17.4%，P=0.129）均没有显著差异。

结论：DWI 相关参数，如治疗后 ADCmean，能准确反映靶向治疗组的疗效反应，应用治疗后 ADC 值能比 RECIST 标准更准确地预测患者的生存状况。

# PO-062
# 缺血性脑卒中磁共振 APT 成像表现及其与病情相关性研究

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缺血性脑卒中磁共振 APT 成像表现及其与病情相关性研究
目的：研究缺血性脑卒中患者卒中区的 APT 成像特点，分析不同时期缺血性脑卒中患者卒中区 APTW 值与对侧正常区 APTW 值的差异性；不同时期卒中区之间 APTW 值的差异及与发病时间的相关性；不同预后组之间 APTW 值的差异性；APTW 值与 NIHSS 评分、mRS 评分的相关性。
方法：选取我院卒中中心怀疑缺血性脑卒中的患者 58 例，所有患者均行常规头颅磁共振成像扫描，并行头颅 APT 成像扫描。包括超急性期（发病时间≤6 小时）8 例、急性期(6 小时＜发病时间≤48 小时)15 例、亚急性早期(48 小时＜发病时间≤96 小时)12 例、亚急性晚期（96 小时＜发病时间≤168 小时）14 例、慢性期(168 小时＜发病时间≤250 小时) 9 例。根据 90 天 mRS 评分将急性期、亚急性早期、亚急性晚期脑卒中患者分为两组，包括预后良好组（mRS 评分≤2 分）29 例和预后不良组（mRS 评分＞2 分）12 例。APT 成像选择 DWI 显示病变最大面积层面进行成像，进而获得缺血性脑卒中区 APTW 信号强度的平均值（APTWave）、最大值（APTWmax）、最小值（APTWmin）和对侧正常区的 APTW 信号强度（APTWcon）。应用 Wilcoxon 配对样本检验分析不同时期患者缺血性卒中区 APTWave、APTWmax、APTWmin 值与对侧正常区 APTWcon 值的差异性。应用单因素方差分析比较不同时期 APTWave、APTWmax、APTWmin、APTWcon 的差异性；应用回归分析比较 APTWave、APTWmax、APTWmin 值在不同时间的相关变化。应用独立样本 t 检验比较不同预后组之间 APTWave 值的差异性；应用 Spearman 相关性分析对 APTWave 值与 NIHSS 评分、mRS 评分之间的相关性进行分析。
结果：1、除慢性期外，其他不同时期患者卒中区 APTWave、APTWmax、APTWmin 值与对侧正常区 APTWcon 值均有显著性差异（P＜0.05）。慢性期患者卒中区 APTWmax、APTWmin 值与

对侧正常区 APTWcon 值有显著性差异（P＜0.05），APTWave 值与对侧正常区 APTWcon 值无显著性差异（P＝0.134）。2、不同时期患者卒中区的 APTWave、APTWmax、APTWmin 值有显著性差异（P＜0.05），不同时期患者对侧正常区 APTWcon 值无显著性差异（P＞0.05）；并且，五组不同时期 APTWave、APTWmax、APTWmin 值两两比较均有显著性差异（P＜0.05）,不同时期的 APTWcon 值两两比较均无显著性差异（P＞0.05）。APTWave、APTWmax、APTWmin 值与发病时间之间存在对数关系(r2：0.817、P＜0.001；r2：0.788、P＜0.001；r2：0.702、P＜0.001）。3、不同预后组之间 APTWave 值之间差异均有统计学意义（P＜0.05）。4、卒中区 APTWave 值与 NIHSS 评分、mRS 评分之间呈负相关（rs：-0.975、P＜0.001；rs：-0.726、P＜0.001）。

结论：APT 成像能够很好的鉴别卒中区与正常区；且可以在早期检测到卒中区 APTW 值的异常，并且在不同时期 APTW 值不同；卒中区 APTW 值在评估脑卒中严重程度和预测预后中有一定的价值。

PO-063

# Spatial changes of neuromelanin and iron content in substantial nigra pars compacta in early-stage idiopathic Parkinson's disease

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Introduction: Parkinson's disease (PD) is a common neurodegenerative disorder characterized by progressive loss of neuromelanin (NM) containing dopaminergic neurons mainly in the substantia nigra (SN)1 . The SN pars compacta (SNpc), the caudal part of the SN, contains 5 dense clusters of NM containing dopaminergic neurons (namely, Nigrosomes 1 to 5) and is mostly affected when PD is diagnosed2. In addition, iron accumulation has been verified along with the NM loss in SNpc3. These possibly pathological changes have been indirectly visualized in-vivo thanks to the development of NM and iron sensitive (via quantitative susceptibility mapping (QSM)) imaging. Previous studies have found that the signal intensity and size of the SN are both significantly reduced on NM imaging and increased iron deposition is seen in the lateral-dorsal part of the SNpc4,5. However, the spatial changes in the SNpc have not been fully investigated. Therefore, we explored spatial changes of iron and NM content in the SNpc via a voxel-wise analysis based on NM and QSM imaging.

Methods: Forty (40) early-stage idiopathic PD and 40 age- and sex- matched healthy controls (HCs) were enrolled and scanned using a single 3D magnetization transfer contrast (MTC) gradient echo sequence at 3.0T. The SN and NM boundaries were manually drawn based on the QSM and NM sequences, respectively. The individual segmented SNs were transformed to a standard SN template derived and segmented from a 7.0 T QSM model6. SNpc was defined as the overlap of these two boundaries. The SNpc probability mask was then generated and thresholded at 0.34 and 0.36 for PD and HC, respectively (this represents the mean ratio of overlap of NM to the whole SN) (Figure 1). The contrast-to-noise (CNR) of the NM (NMCNR) image was calculated with reference to the adjacent cerebral peduncle. As these two image types were derived from the same sequence, a paired voxel-wise Pearson's correlation analysis was done and a visualization map based on correlation coefficients was then generated.

Results: The susceptibility of the SNpc increased, while the NMCNR of SNpc decreased in early-stage PD, especially for the medial and ventral parts compared with the HCs (Figures 2,3). Further, paired negative correlation between NMCNR and QSM voxels was more frequently noticed in the ventral and medial part of SNpc. The negative correlation regions increased to

include the caudal and dorsal parts of the SNpc in PD compared to those in HCs, and the moderate to high negative correlation regions (r<-0.4) of PD were larger than those of HCs (Figure 4).
Discussion and Conclusion: Our preliminary results showed that the susceptibility reflecting the iron content of the SNpc increased and the NMCNR reflecting the NM content decreased in early-stage PD, which is consistent with previous studies4,5. Interestingly, this spatial change is prominent in the ventral and medial part of the SNpc, and there is a negative correlation between the increased iron content and decreased neuromelanin content, suggesting that the iron deposition is coincident with the NM containing neuron loss in this region during the pathological process of PD. The ventral and medial subregions of the SNpc might contain nigrosome 2 and nigrosome 4 according to a pathological and imaging control atlas7. The other subregions, especially, the dorsal and lateral part (presumably the nigrosome 1), have relatively less negative correlation, which suggests that there might be less iron accumulation in this subregion compared with that in the ventral and medial subregions of the SNpc for early-stage PD. In future work, it would be interesting to compare subregions with different correlations with clinical scores. In summary, iron deposition and NM containing neuron loss is prominent in the ventral and medial part of SNpc, especially, in early-stage PD. This region may correspond to nigrosome 2.

## PO-064

# 对比 SWIp、HPF-QSM 及 HPF-tSWI 图评估帕金森病黑质“燕尾征”

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**目的**：使用 SWIp、HPF-QSM 及 HPF-tSWI 三种方法评估帕金森（PD）患者黑质“燕尾征”的显示情况，以及对比三种评估方法的准确性。
**材料与方法**：收集我院 2020 年 5 月-2021 年 1 月行头颅 MRI 检查的 PD 患者，MRI 检查序列包括全脑 T2WI FLAIR、DWI、SWIp 以及一个多回波的 3D-GRE 序列，多回波 GRE 序列分辨率 0.67mm×0.67 mm ×1.34 mm，多回波 GRE 序列经 STAGE 后处理，并经过高通滤波（HPF）处理，得到 QSM 及 tSWI 图。首先在 SWIp 序列图上评估黑质双侧“燕尾征”显示情况，根据 SWIp 上“燕尾征”显示情况，共选取 60 例 PD 患者，分为 3 组，其中 20 例双侧“燕尾征”存在，20 例双侧“燕尾征”可疑存在，20 例双侧“燕尾征”未见显示。再分别在 HPF-QSM 及 HPF-tSWI 图上评估这 60 例 PD 患者黑质双侧“燕尾征”显示情况。
**结果**：对于 SWIp 序列图上黑质双侧“燕尾征”存在组，HPF-QSM 与 HPF-tSWI 图与 SWIp 序列显示一致，均可观察到双侧“燕尾征”存在；对于 SWIp 序列图上黑质双侧“燕尾征”可疑存在组，HPF-QSM 与 HPF-tSWI 图均可观察到双侧“燕尾征”存在；对于 SWIp 序列图上黑质双侧“燕尾征”未见显示组，其中 17 例 HPF-QSM、HPF-tSWI 图与 SWIp 序列显示结果一致，3 例 HPF-QSM、HPF-tSWI 图上可见双侧“燕尾征”显示。
**结论**：对于 PD 患者，SWIp、HPF-QSM 与 HPF-tSWI 图均能够用来评估黑质“燕尾征”显示情况，但 HPF-QSM 与 HPF-tSWI 图对黑质“燕尾征”的评估比 SWIp 图更准确、更有价值。

## PO-065

# MRI findings combined with texture analysis of primary ovarian granulosa cell tumors with focus on the differentiation with ovarian thecoma-fibrothecomas group

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Objective: To explore the value of Magnetic resonance imaging (MRI) and texture analysis (TA) in the differential diagnosis between ovarian granulosa cell tumors (OTCTs) and thecoma-fibrothecomas group (OTCA-FTCAs). Methods: The preoperative MRI data of 32 patients with OTCA-FTCA and 14 patients with OGCT confirmed by pathological examination from June 2013 to August 2020 were retrospectively analyzed. The texture Analysis of Three-Dimensional MRI Images based on T2 weighted imaging, Clinical and conventional MRI features were performed as well as compared between the tumors. Mann-Whitney U test, χ 2 test/Fisher and Multivariate logistics regression analysis were used to identify differences between OTCA-FTCA and OGCT group. A regression model was established by using binary logistic regression analysis, and receiver operating characteristic (ROC) curve analysis was carried out to evaluate diagnostic efficiency. Results: For T2WI, the texture parameters log-sigma-2-0-mm-3D_glszm_SmallAreaEmphasis,log-sigma-2-0-mm-3D_glszm_SmallAreaHighGrayLevelEmphasis,log-sigma-3-0-mm-3D_glcm_InverseVariance,wavelet-LLH_glcm_MCC,wavelet-HLH_glszm_SmallAreaHighGrayLevelEmphasis and wavelet-HLL_glszm_LowGrayLevelZoneEmphasis as well as imaging-based features Mean ADC (103 s/mm2), Enhancement degree(solid), Cystic form and Bleeding showed significant differences between the OTCA-FTCA group and OGCT group (all p<0.05). Multivariate analysis of the imaging-based features combined TA revealed that bleeding (OR = 0.037), Log-sigma-20mm-3D_glszm_SmallAreaEmphasis (OR = 4.40) and Log-sigma-20mm-3D_glszm_SmallAreaHighGrayLevelEmphasis (OR = 1.034) were independent features for discriminating between OGCTs and OTCAs-FTCAs (p < 0.05). Imaging-based diagnosis model, TA model and the Combination model were established. The AUCs of the three models in predicting OGCTs and OTCAs-FTCAs respectively were 0.935,0.944 and 0.969. The sensitivities respectively were 93.75%,93.75% and 96.87%. The specificities respectively were 85.71%,92.86% and 92.86%. DeLong test showed that the combination model held the highest predictive efficiency (P<0.05). The results of DeLong test showed that there was no statistical difference among the three models in predicting OGCTs and OTCAs-FTCAs (P>0.05). Conclusions: MRI features and TA features may assist in differentiating between OGCTs and OTCAs-FTCAs, which can provide a more comprehensive treatment plan for clinical preoperative treatment.

# PO-066

# 自由呼吸 StraVIBE 序列在胎儿腹部成像中的应用

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目的：T1 加权成像作为胎儿腹部 MR 检查的常规序列, 但因易出现运动伪影而应用受限，只有少部分运用于临床，因此探讨自由呼吸 StraVIBE 序列在胎儿腹部成像应用的可行性，评估其对胎儿肝脏及肾脏的生长发育的诊断中的临床价值。
材料和方法：前瞻性收集 2021 年 4 月至 6 月在安庆市立医院接受胎儿磁共振扫描的 10 名患者。采用西门子 Skyra 3.0T MRI 扫描仪，18 通道体部线圈及 32 通道脊柱线圈组合使用，扫描分别采用常规常规三维容积内插屏气检查序列与自由呼吸 StarVIBE 序列 T1WI 进行扫描，对比两次扫描结果，应用配对 t 检验检验对比分析肝脏及肾脏的各测量指标。
结果：StarVIBE 序列图像的各测量指标参数值常规 VIBE 序列一致; 而 StarVIBE 序列图像各器官清晰度、分辨率、伪影及脂肪抑制效果评分均高于常规 VIBE 序列(P 均<0.05)

结论：T1 加权成像主要用于评估胎儿腹部各器官发育解剖结构显示及显示出血性病变、钙化、蛋白质及脂肪，而 StraVIBE 序列在胎儿腹部成像切实可行，可明显提升图像质量,减少了呼吸运动、胃肠蠕动等引起的生理性运动伪影,为胎儿评估提供了重要价值。

# PO-067
# DKI 在鉴别小肾癌与乏脂血管平滑肌脂肪瘤中的应用价值

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目的
肾透明细胞癌(clear cell renal cell carcinoma，CCRCC)与乏脂血管平滑肌脂肪瘤(angiomyolipoma with minimal fat，MFAML)的磁共振扩散峰度成像(diffusion kurtosis imaging，DKI)鉴别诊断分析。
方法
1.病人
本研究经本机构审查委员会批准，为回顾性研究，放弃获得知情同意的要求。在 2015 年 12 月至 2020 年 7 月期间，收集进行腹部肾脏 MRI 检查的患者，并经手术病理证实为 ccRCC 或者 RAML，入组标准：①术前进行 MRI 检查；②手术病理证实为 ccRCC 或者 RAML；③病灶直径＜4cm，RAML 病灶内无肉眼可见的脂肪成分。排除标准：①患肾之前进行过手术；②DKI 序列憋气不佳或邻近肠道伪影较重，影响病灶测量。最终入组 1 的男性患者 11 例，女性患者 9 例，年龄 28～72；组 2 的男性患者 1 例，女性患者 3 例，年龄 21～60。
2.MRI 扫描协议
所有患者均采用 1.5TMR 扫描仪进行肾脏 MR 检查(SignaHDxt，GE 医疗系统，美国)，包括 T1WI,T2WI、DKI 和增强序列。DKI 参数如下：NEX2.00，TR/TE3000/90ms，FOV400mm，矩阵 128*128，切片厚/sp4.0/1.0，扫描持续时间为 3min33s。
3.MRI 数据分析
在不知病理结果的前提下，由两位有 1 年和 5 年经验的放射科医生独立审查 MR 图像。原始数据传到 GEAW4.6 工作站，使用 Functool 软件进行后处理。利用 DKI 数据进行计算，生成伪彩图及 DKI 参数。参考 T2WI 和增强 MRI 图像，在肿瘤内绘制感兴趣区(ROI)，避开囊性变性、坏死和出血。在所有病例中，每个病灶进行三次测量，分别由两位不同的成员进行，并进行平均参数值计算。
4.统计分析
所有统计分析均采用 SPSS23.0 软件(IBM)进行分析)。使用组内相关系数(ICC)测试两个观察者之间所有参数值的一致性。采用 Mann-WhitneyU 检验，比较两组的所有值，并用 ROC 曲线评价参数的诊断效果。结果
1.一致性结果
除 ccRCC 的 FAK 外，所有测量的 ICC 均在 0.75 以上。表 1 总结了每种肿瘤类型的两个观察者之间的测量一致性。
2.定量分析
ccRCCs 的 DA 值和 DR 值较高，而 MK 值和 Ka 值低于 MFAML(均 $p<0.05$)。但 FA 的差异 FAK 和 Kr 没有统计学意义($p>0.05$)。结果摘要见表 1，图 1 和图 2。
3.ROC 分析
表 2 报告了 ROC 确定的最佳截止值和重要参数的相应性能。
结论
总之，我们的结果表明，MD、DA、DR、MK 和 Ka 值是区分 ccRCC 和 MFAML 的参数

PO-068

# Reduced rate of brain waste clearance for TBI patients: glymphatic function assessed via MRI within a short time

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Purpose
Dementia is commonly observed in traumatic brain injury (TBI) patients, however, there is no consensus on the exact mechanism of how TBI promotes susceptibility to the development of dementia. Recent studies have shown that TBI significantly affects the glymphatic function on the rate of clearance of fluorescence tracer in TBI mice. In this work, the TBI glymphatic function was assessed via MRI within a short time (1 hour) by measuring the rate of brain waste clearance.
Materials and Methods
This study includes 16 TBI patients (5 females, mean age = 38, SD =3.7; rang 25-67 years) and 7 relative healthy controls (6 females, mean age=41, SD=2.5; rang 40-62) with no history of TBI. All the MRI experiments were performed on a 3.0 T Prisma scanner (Siemens, German) with a 64-channel head coil. Participants were instructed to keep awake and still during the scan on head-first supine position. 3D high resolution T1 weighted brain images were obtained three times with 20 min intervals using MP2RAGE sequences after 4 hours lumbar intrathecal injections of gadolinium. Along the pathway of cerebrospinal fluid propagation, 4 regions, including inferior frontal gyrus (IFG), parahippocampal gyrus (PHG), thalamus (THA), Pons (PO), in each hemisphere were predefined using standard atlas. And the signal intensity of CSF nearby above regions was extracted for analyses. The rate of T1 signal change of two time points was simply calculated using the following equations  and , where Ri is the rate and Si is the signal intensity of corresponding time point.
Results
As shown in Fig.1, significantly higher signal change rates were observed in 7 predefined CSF ROIs in TBI patients compared to controls within 1 hour scan after 4 hour injection gadolinium. The TBI patients show relatively slow clearance ability of gadolinium tracer for almost all predefined CSF regions.
Conclusion
Besides previously reported the delayed enhancement after 24 hours injection of tracer, this work proved the glymphatic dysfunction can be assessed by signal intensity dynamic change rate within 20 min after 4 hour injection of the tracer as well. The deduced rate of tracer clearance in TBI patients may reflect damage of brain glymphatic system.

PO-069

# DKI histogram analysis in prediction histopathological characteristics and FIGO stage of cervical cancer

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Objective: To investigate the value of DKI histogram analysis of whole tumor for predicting pathological features (subtypes, grade, Ki-67 expression) and clinical FIGO stage of cervical cancer (CC).

Materials and methods: Firstly, 107 patients with pathologically confirmed cervical cancer and 68 females with normal cervix confirmed by gynecological examination were analyzed. All the patients completed the magnetic resonance DKI sequence scan after signing an informed consent. The patients with cervical cancer were stratified and analyzed based on the pathological subtype, degree of differentiation, Ki-67 expression and Federation of Gynecology and Obstetrics (FIGO) staging. The average of ADC, MD, and MK parameters were obtained by delineating the region of interest (ROI) of the largest cross-section of the tumor. The histogram features of the whole tumor were extracted from the DKI-derived functional maps, including mean kurtosis (MK), mean diffusivity (MD) and apparent diffusion coefficient (ADC) maps with b values of 0 to 2500 s/mm². Independent sample t-test, one-way ANOVA, and Pearson correlation analysis were performed to filter out the histogram features. Stepwise regression analysis was performed to select the most representative histogram features, and the models based on individual and combined functional maps were constructed. Meanwhile, the ROC curves of the corresponding model were plotted.
Results: The average values of MD, MK, and ADC of the largest cross-section of cervical cancer have significant differences in the degree of differentiation, but there is not statistically significant in predicting tumor grading. The combined model based on MD, MK and ADC maps had the optimal performance for cervical carcinoma diagnosis, predicting pathological subtypes (cervical adenocarcinoma, squamous cell carcinoma and other rare pathological types), grade (low, medium and high differentiation), and FIGO stage (I-IV), with AUC of 1.000, 0.922, 0.687, and 0.976, respectively. The 10th and 90th percentile, entropy, root mean square (RMS), total energy, and uniformity of the model of single ADC function map was conducive to the differential diagnosis between cervical cancer and normal cervix, with an AUC of 1.000. The MD_skewness performed optimal ability of differentiating CC subtypes (AUC = 0.892). The model of MD map (Range, Median, Total Energy) reached optimal ability level in differentiating the various stages of FIGO staging of cervical cancer (AUC=0.930). The skewness of ADC map was statistically significant in distinguishing high and low expression of Ki-67 (P=0.049), while, its diagnostic performance was low (AUC=0.636, P=0.296).
Conclusion: DKI functional maps of whole-tumor histogram analysis could diagnose cervical cancer, predict its pathological subtypes and FIGO stage, and have a greater potential for pathological grading and Ki-67 expression prediction of cervical cancer.

PO-070

# Whole -Tumor Histogram Analysis of Apparent Diffusion Coefficient for Differentiating Adenosquamous Carcinoma and Adenocarcinoma from Squamous Cell Carcinoma in Patients with Cervical Cancer

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Abstract
Background: Differentiating adenosquamous carcinoma (ASC) and adenocarcinoma (AC) from squamous cell carcinoma (SCC) precisely is crucial for treatment strategy and prognosis prediction in patients with cervical cancer (CC).
Purpose: To differentiate ASC and AC from SCC in CC patients using the ADC histogram analysis.
Material and Methods: One hundred and eighteen patients with histologically diagnosed ASC, AC and SCC were included. The apparent diffusion coefficient (ADC) histogram parameters were extracted from ADC maps. Receiver operating characteristics (ROC) analysis was performed to

evaluate the diagnostic performance of each ADC histogram parameters in differentiating the subtypes of CC. The predictors for histologic subtypes were further selected using univariate and multivariate logistic regression analyses.
Results: The ADCmean, ADCmax, ADCP10, ADCP25, ADCP75, ADCP90, ADCmedian and ADCmode of the ASC were significantly lower than those of the AC in the; and ADCkurtosis and ADCskewness of the ASC lower than those of the SCC. The ADCmean, ADCmax, ADCP10, ADCP25, ADCP75, ADCP90, ADCmedian and ADCmode of AC were significantly higher than those of the SCC. The ADCP10 and ADCP10 + diameter yielded the AUCs of 0.753 and 0.778 in differentiating ASC from AC. The ADCmedian and ADCmedian + diameter yielded the AUCs of 0.807 and 0.838 in differentiating AC from SCC. The ADCskewness yielded the AUC of 0.713 in differentiating ASC from SCC.
Conclusion: The ADCP10 and ADCP10 + diameter, ADCmedian and ADCmedian + diameter performed well in differentiating ASC from AC and AC from SCC respectively. However, ADCskewness exhibited a limited ability in differentiating ASC from SCC.

PO-071

# X-ray and MRI evaluation of the stability of children's humeral lateral condyle fracture and the difference of the degree of fracture displacement

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Objective: to analyze the differences of X-ray and MRI in the evaluation of the stability of children's lateral humeral condyle fracture and the degree of fracture displacement.
Methods: from July 2018 to July 2020, 78 patients with acute elbow trauma were selected and hospitalized in our orthopaedic department. All patients were examined with X-ray and MRI. The sensitivity and specificity of X-ray and MRI in the diagnosis of lateral condylar fracture of humerus and the integrity of cartilage chain of trochlear of humerus were calculated. X-ray and MRI were measured respectively to check the value of lateral and posterior fracture space of lateral condylar fracture of humerus, and the two examination methods were evaluated Methods to evaluate whether there is difference in the degree of fracture displacement.
Results: according to the observation of fracture line during operation or the follow-up imaging examination of conservative treatment, it was found that callus repair was found. It was confirmed that 72 of 78 elbow joint trauma patients were diagnosed as the fracture of lateral condyle of humerus, and the other 6 patients were cured without fracture signs. The sensitivity of MRI in the diagnosis of children's lateral condylar fracture was 100%, which was significantly higher than that of X-ray (88.89%) (P<0.05). The results of X-ray and MRI in the diagnosis of children's lateral condylar fracture were generally consistent (kappa value = 0.465, P < 0.01). Among the 72 confirmed cases, 35 cases had the fracture of trochlear cartilage chain. The sensitivity of MRI in the diagnosis of children's fracture of lateral condyle of humerus was 97.14%, which was significantly higher than 62.86% of the X-ray examination (P < 0.05). The difference was statistically significant (P < 0.05). The consistency of X-ray and MRI in the diagnosis of children's fracture of lateral condyle of humerus was poor (KAPA = 0.122, P > 0.05). X-ray measurement of the fracture space of lateral and posterior humeral lateral condyle in children was significantly smaller than that of MRI, the difference was statistically significant (P < 0.05). The sensitivity of 3D-FS-FSPGR or 3D-FSPGR was significantly higher than that of FS-T2WI and FS-PDWI (P < 0.05). There was no significant difference (P > 0.05) in the diagnosis of children's lateral humeral condyle fracture with FS-T2WI in three directions: coronal, sagittal and axial.

Conclusion: MRI is superior to X-ray in the diagnosis of children's humeral epicondylar fracture stability and evaluation of fracture displacement.3D-FS-FSPGR or 3D-FSPGR is the best MR sequence to show children's humeral epicondylar fracture,which can provide theoretical basis for the establishment of clinical treatment plan.

## PO-072

# CE-T2 FLAIR 对颅内环形强化病灶的鉴别诊断价值

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目的：探讨 CE-T2 FLAIR“边缘强化征”对颅内环形强化病灶的鉴别诊断价值。
方法：收集桂林医学院附属医院 2019 年 1 月到 2020 年 12 月期间经神经外科手术病理或临床随访证实的颅内环形强化病灶患者 52 例，观察 CE-T1WI 和 CE-T2 FLAIR 两种方法在颅内环形强化病灶中的影像学表现，统计并分析颅内环形强化病灶 CE-T2 FLAIR 及其减影图像“边缘强化征”出现率，对不同医师关于“边缘强化征”的判定进行一致性检验，采用卡方检验分析不同病理类型病灶的征象出现率是否具有统计学差异。
结果：52 例环形强化病灶，其中炎性病变 15 例，肿瘤性病变 37 例。医师 1 判定两类病变在 CE-T2 FLAIR 上出现“边缘强化征”的病例数分别为 13 例（13/15）和 3 例（3/37），灵敏度达 87%、特异度达 92%；医师 2 判定两类病变在 CE-T2 FLAIR 上出现“边缘强化征”的病例数分别为 14 例（14/15）和 4 例（4/37），灵敏度达 93%、特异度达 89%。CE-T2 FLAIR“边缘强化征”在两类病变的出现率具有统计学差异（P＜0.05）。两名医师对 CE-T2 FLAIR“边缘强化征”的判定结果一致性强(Kappa 值为 0.913，P=0.000)。
22 例转移瘤及 15 例炎性病变在 T1WI 平扫显示病灶以及“边缘强化征”在各个序列的显示情况存在差异，差异有统计学意义(P＜0.05)。
结论：1.不同医师对于 CE-T2 FLAIR“边缘强化征”的判断一致性较好。2.炎症性病变更容易出现 CE-T2 FLAIR“边缘强化征”，能否通过观察“边缘强化征”提高炎性病变的诊断准确率仍需更大样本的数据进行试验。3.CE-T2 FLAIR 及其减影图像对转移瘤及炎性病变“边缘强化征”的显示存在差异

## PO-073

# Dynamic functional connectivity of attention impaired by smartphone "fragmented reading"

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Dynamic functional connectivity of attention impaired by smartphone "fragmented reading"
Objective: To explore whether short-term or long-term "fragmented reading" using smart phones leads to impaired attentional control, the characteristics of the impairment, and the underlying dynamic brain network characteristic changes. Methods: Collect 114 college undergraduates, through fragmentation reading research scale all subjects were divided into mild fragmentation reading habits group and severe fragmentation reading habits, ruled out is not in conformity with the conditions of the subjects, exclusion criteria including cigarettes, alcohol and drug addiction, mental illness and magnetic resonance contraindications and so on, after the subjects of into neural behavior scale test, Includes Continuous Attention Test (CPT), California Word Learning Scale (CVLT), Wisconsin Card (WCST), and Stroop Test. After that, DFC and DFNC were

extracted by functional magnetic resonance using sliding window technology, clustering technology, graph theory feature extraction and conditional functional connection, and then SPM12 was used for statistical analysis. These brain network characteristics were assessed again after eight weeks for self - control and intergroup comparisons. Results: the result of the survey questionnaire statistical linear regression, the results show that the smartphone excessive use for self control, negative emotions, has significant impact on academic achievement, dynamic brain networks based on fMRI study found that for a long period of time "fragmented reading" can significantly activated ventral pay attention to the network, and at the same time to activate the limbic system significantly. CONCLUSIONS: Based on fMRI analysis of the dynamic brain network of smartphone "fragmented reading" impaired attention, the study confirms that the ventral attentional limbic system brain network is an important structure of attentional control, which provides a useful reference for revealing the mechanism of attentional control impairment and further preventing attentional control in advance.

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PO-074

# High-risk habitat identification of edema region for glioblastoma: a multi-parametric MRI based data-driven approach

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Purpose: The composition and extent of the edema (ED) reflect the aggressive degree of glioblastoma (GBM), identify the heterogeneity pattern of this region could provide useful prognostic information. This study aimed to identify the high-risk habitats, to evaluated their survival prediction performance and to investigate its relationship with molecular characteristics.
Materials and Methods: We retrospectively analyzed 187 patients with primary GBM. The training cohort consisted of 122 patients from the cancer genome atlas. Another 65 patients from the local hospital were used for independent test. First, the enhanced (ET), non-enhanced and ED regions were automatically delineated using nnUNet. Then, the signal intensity of T1-weighted contrast-enhanced imaging (T1CE) and T2-weighted fluid-attenuated inversion recovery imaging (FLAIR) extracted from ED region was pooled together as a global vector. The data-driving method, K-means clustering, was performed on the global vector to partition the voxels into several habitats. Accordingly, radiomics features were extracted from each habitat. Radiomics scores (RadScores) were obtained using least absolute shrinkage and selection operator (LASSO) COX regression and were divided into low- and high-RadScore groups according to the calculated cut-off values. The high-risk habitat (HRH) within ED region was defined by cox regression analysis. Ultimately, the prognostic value and biological significance with genomic data of the HRH was evaluated and validated.
Results: After k-means clustering, four habitats were chosen as the optimal cluster number according to the Sum of Squared Error. On both training and test cohorts, the performances of the identified HRH in predicting overall survival (concordance index: 0.644 and 0.650, P = 0.033 and P = 0.001, respectively) performed better than the whole ED region (concordance index: 0.625 and 0.601, P = 0.031 and P = 0.020, respectively), even better than the performance of ET region (concordance index: 0.627 and 0.591, P = 0.035 and P = 0.033, respectively). After

combining clinical and enhanced tumor information, the concordance index was further improved to 0.733 for training cohort and 0.725 for test cohort. We also observed a negative correlation between the RadScores of HRH and KPS (r = -0.33, P = 0.001).
Conclusion: As a data-driven approach, the k-means clustering was adopted to identify the heterogeneity habitats on ED region of GBM based on multiparametric MRI. Its potential was demonstrated with an improved performance by predicting the survival stratification for GBM patients.

PO-075

# Application of magnetic resonance diffusion imaging biomarker in early renal injury with type 2 diabetes

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Objects: Diffusion tensor imaging (DTI) and intravoxel incoherent motion(IVIM) were used to explore the application value of magnetic resonance diffusion imaging biomarkers (MD, FA, D, D* and f) for early kidney function injury in type 2 diabetes.Methods: Forty-one inpatients with confirmed type 2 diabetes in our endocrinology department from October 2019 to September 2020 were recruited. Diabetic patients were classified according to albumin to creatinine ratio(ACR): normoalbuminuria group (NAU group=27, ACR<30mg/g) and microalbuminuria group (MAU=14, 30mg/g <ACR <300mg/g). 28 normal adult volunteers were recruited as control group during the same period. All participants were examined using DTI and IVIM with 3.0-T MRI. After post-processed to diffusion imagings, DTI parameters (mean diffusivity[MD], fractional anisotropy [FA]), and IVIM parameters (true diffusion coefficient [D], pseudo-diffusion coefficient [D*], and pseudo-diffusion component fraction [f]) were measured in the renal parenchyma (cortex and medulla) by two experienced abdominal radiologists independently. Diffusion parameters were compared among the groups using separate one-way analyses of variance. The above MR diffusion parameters were correlated among ACR, eGFR, and HbA1c. Diagnostic performances of various diffusion parameters for predicting diabetic renal damage were compared.Results: Cortical FA and D values in MAU group were significantly lower than those in control group (MAU group: FA value 0.253±0.176, D value 1.488±0.146×$10^{-3}$$mm^2$/s; control group: FA value 0.271±0.023, D value 1.641±0.135×$10^{-3}$$mm^2$/s ; FA value p=0.018; D value p=0.03). Medullary FA and D values were significantly different among the three groups($p<0.001$, $p<0.001$). The medullary FA and D values in MAU group(0.329±0.441, 1.268±0.160×$10^{-3}$$mm^2$/s) were lower than those in NAU
group(0.371±0.294, 1.406±0.096×$10^{-3}$$mm^2$/s) and than those in control group(0.399±0.020, 1.660±0.210×$10^{-3}$$mm^2$/s). Medulla D* in MAU group (13.512±3.696×$10^{-3}$$mm^2$/s) was lower than those in NAU group (19.270±7.423×$10^{-3}$$mm^2$/s). p =0.006) and control group (18.166±4.402×$10^{-3}$$mm^2$/s; p= 0.003). The renal medulla D value (r=-0.441, P <0.001) and FA value (r=-0.262, P <0.05) were slightly negatively correlated with HbA1c among the three groups. A mild negative correlation was observed among D values of renal cortex and medulla(cortex: r = -0.263, p < 0.05; medulla: r=-0.332, p<0.05), FA values of renal cortex and medulla(cortex: r = -0.273, p < 0.05; medulla: r=-0.563, p<0.001), medulla D* value(r=-0.291, p=0.015) with ACR. The AUC of medullary FA, D values in differentiating control and NAU group were 0.769, 0.878. The AUC of medullary FA, D, D* values in differentiating control and MAU group were 0.909, 0.952, 0.793. The FA+D of medulla was used to differentiate the control from NAU group and the control from MAU group, respectively; AUC was 0.935 and 0.985. The AUC of medullary FA+D+D* value was 0.913 in distinguishing NAU and MAU group.Conculsion: The D value of IVIM and the FA value of DTI were better than other diffusion parameters in the assessment of early renal injury in type 2 diabetes. D and FA values may be potential magnetic resonance imaging biomarkers for the detection of early renal injury in

diabetes. The single medullary D and FA Medulla had good diagnostic efficiency; while FA+D had the highest AUC value in differentiating the MAU group from the control group. **Our study supports the emerging hypothesis of tubular damage in diabetes.**

PO-076

# The Effect of Non-impact Dynamic Vibration on Cerebral Blood Flow

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**Purpose:** Repetitive Head Impact (RHI) is one of the causes of Traumatic Brain Injury (TBI). Athletes, especially those from combat sports, could have RHI over a long period. Although no obvious imaging biomarker of damage, the probability of chronic traumatic encephalopathy of the athletes was higher than that of healthy people. To understand the characteristic changes of brain at the beginning of RHI, it is necessary to know the transient response of brain during RHI. We propose to use a head vibrator as a tool to simulate RHI. Immediate changes in cerebral blood flow (CBF) was measured using Arterial Spin Labeling (ASL) after simulated RHI.

**Materials and methods:** In this study, 51 subjects (age 25.86±2.81 years old, 30F/21M) were recruited for imaging in a 3T magnetic resonance scanner (uMR 790, United Imaging Healthcare, Shanghai, China) with a 24-channel head coil. The experiment included two sessions: first, high-resolution T1-weighted (T1W) images and resting-state CBF maps were acquired; second, quantify the differences of CBF before and after 20Hz/30Hz/40Hz non-impact dynamic vibration. The CBF values after the vibration was measured twice to ensure the reliability of the results. The CBF after non-impact dynamic vibration was measured using a pseudo-continuous arterial spin-labeling (pCASL) sequence for 3D-ASL perfusion imaging. The following parameters was used: 12 tag-control image pairs, 34 transversal slice, TR/TE=4702/14.14ms, slice thickness=4mm, label duration=1.8s, post-labeling delay (PLD)=1.8s, FOV=224mm×224mm, voxel size=3.5×3.5×4mm. The CBF maps were first registered to standard MNI152 brain atlas using Advanced Normalization Tools (ANTs), then segmented using a standard atlas AAL3 (UNC adult brain atlas template, created by University of North Carolina at Chapel Hill) . After segmentation, CBF values after different non-impact frequency were compared with that from resting-state using paired student t-test.

**Results:** There is no significant difference between two CBF maps after applying same frequency vibration. Therefore, we used the average value of the CBF after two vibrations of the same frequency as the CBF maps of this frequency. Compared with the resting-state, CBF values at the frontal lobe, temporal lobe, cuneiform lobe decreased significantly after exposing to external vibration. With an increase of the vibration frequency, CBF decreased more significantly. Moreover, significant differences were observed between sexes.

**Conclusion:** Our observation of a significant decrease of CBF after external vibration is consistent with previous studies showing reduced CBF of TBI patients. When RHI occurs, the transient blood flow response of the brain is to reduce blood perfusion in part of the brain area. This may be a protective mechanism that could provide a basis for the prevention and timely treatment of RHI.

PO-077

# 磁共振酰胺质子转移成像在预测脑膜瘤硬度中的可行性研究

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目的 分析不同硬度的脑膜瘤的 APTw-MRI 信号特点，并对比其病理特征，探索 APTw-MRI 技术在评估脑膜瘤硬度中的可行性。材料与方法 回顾性分析术中获得肿瘤硬度判定结果的 48 例脑膜瘤患者的流行病学特征、常规 MRI 及 APTw-MRI 图像，测量瘤核心的 APTwmin、APTwmean、APTwmax 值；卡方检验分别比较质软、中等硬度、质硬三组之间 T1WI 和 T2WI 信号特点的差异；采用单因素方差分析比较质软、中等硬度、质硬三组患者年龄、水肿指数、APTwmin、APTwmean、APTwmax 参数之间的差异。两独立样本 t 检验比较质硬/非质硬两组病例患者 APTwmin、APTwmean 和 APTwmax 各参数之间的差异；如差异由统计学意义，运用受试者工作特征曲线评价 APTw 参数在区分脑膜瘤不同硬度组之间的诊断效能。结果 不同硬度脑膜瘤患者年龄、水肿指数、T1WI 和 T2WI 信号特点以及 APTwmax 参数值差异没有统计学差异（P 均＞0.05）；质硬组 APTwmin 和 APTwmean 参数值显著低于非质硬组（1.94%±0.70% vs. 2.86%±0.45%）和（2.47%±0.83% vs. 3.29%±0.35%），（P 均＜0.01）；质硬组 APTwmin 和 APTwmean 值显著低于中等硬度组和质软组（P 均＜0.01），但是中等硬度组 APTwmin 和 APTwmean 值和质软组差异没有统计学意义（P=0.13, P=0.34），APTwmin 为评估脑膜瘤硬度的最佳指标，当 APTwmin 小于 2.47%时，提示该脑膜瘤质硬的敏感度为 88.9%，特异度为 85.7%，准确度为 85.4%。结论 APTw-MRI 技术可以用于预测脑膜瘤硬度，其中 APTwmin 参数对脑膜瘤硬度的预测效能最好。

PO-078

# 磁共振指纹成像(MRF)技术在区分促性腺激素与非促性腺激素垂体大腺瘤方面的价值

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目的： 根据最新的 2017 年世界卫生组织垂体腺瘤分类标准对垂体大腺瘤进行分类。探索磁共振指纹成像 (magnetic resonance fingerprinting, MRF) 技术生成的定量 T1 和 T2 值在区分促性腺激素与非促性腺激素垂体大腺瘤方面的价值。
材料与方法： 纳入 27 例垂体大腺瘤患者进行分析，其中促性腺激素垂体大腺瘤 11 例，非性腺激素垂体大腺瘤 16 例。所有患者均在术前采用 3.0 T 磁共振成像仪 (MAGNETOM Skyra, Siemens Healthcare)进行常规磁共振成像和 MRF 序列扫描。使用 Mann-Whitney U 检验比较 MRF 生成的 T1 和 T2 值在促性腺激素与非促性腺激素垂体大腺瘤之间的差异。采用受试者工作特征曲线分析 MRF 生成的 T1 和 T2 值在区分促性腺激素与非促性腺激素垂体大腺瘤方面的诊断效能。
结果： MRF 生成的定量 T1 和 T2 值在促性腺激素垂体大腺瘤中显著高于在非促性腺激素垂体大腺瘤中（p < 0.01）。在区分促性腺激素与非促性腺激素垂体大腺瘤方面，T2 值的受试者工作特征曲线下面积 (0.82) 显著大于 T1 值 (0.71) (p = 0.03)。
结论： MRF 技术有助于在术前区分促性腺激素与非促性腺激素垂体大腺瘤，在指导垂体大腺瘤的治疗方面具有潜力。

PO-079

# Standardization of the Intracranial Atherosclerotic Plaque Enhancement Measurement by Using Multi-phase Contrast-enhanced Vessel Wall MRI

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Purpose：Plaque enhancement is a marker of intracranial plaque instability related to stroke risk. However, there have no unified method to quantify intracranial plaque enhancement (IPE). We aim to explore optimal reference structure to normalize IPE and the optimal post-contrast timing using multi-phase contrast-enhanced MRI.
Methods：Patients with acute stroke prospectively underwent vessel wall MRI (SPACE with MSDE blood suppression module, whole brain coverage, 0.6mm isotropic) with 1 pre-contrast phase and 4 consecutive post-contrast phases using 3.0T MRI scanner. Each scan was 9 minutes. The total scan time of 4 post-contrast phases was 36 minutes. The signal intensity (SI) values of intracranial structures (including white matter, grey matter, middle infundibulum, low infundibulum, muscle, cavernous sinus, choroid plexus, cerebrospinal fluid) on both pre- and post-contrast phases were measured to select an optimal reference structure to normalize IPE. Intracranial plaque enhancement index (PEI) of each post-contrast enhanced phase was calculated with the following formula: PEI = ([SIPlaque-post/SIreference-post] − [SIPlaque-pre/SIreference-pre])/(SIPlaque-pre/SIreference-pre) (where “pre” indicates pre-contrast and “post” indicates post-contrast). The trend of PEI after contrast enhancement was analyzed for both culprit and non-culprit plaques. Enhancement was also graded into 0 (none), 1(higher than normal vessel wall) and 2(similar or higher than low infundibulum).
Results：30 acute stroke patients (30 culprit plaque and 83 non-culprit plaque) were included in this study. The SI values of white matter of brain, grey matter of brain and infundibulum, muscle, cavernous sinus and choroid plexus changed significantly in the 4 post-contrast phases (changes up to 30%, $p<0.05$), while cerebrospinal fluid showed no significant difference in SI values for post-contrast phases ($p>0.05$) and was selected as reference structure to standardize the PEI. The mean PEI of culprit plaque increased during the first 3 post-contrast enhanced phases and reached its maximum in the 3 post-contrast enhanced phases (in about 27 mins), while mean PEI of non-culprit plaque kept constant during the 4 post-contrast enhanced phases (in about 36 mins). The percentage of grade 2 tends to increase during 4 post-contrast enhanced phases in culprit and non-culprit plaque, while the percentage of grade 1 gradually decreased during 4 post-contrast enhanced phases.
Discussions：Cerebrospinal fluid should be considered as an optimal reference structure for quantifying plaque enhancement, and using other structures will lead to significant variability. Protocols should be designed to maximize the post-contrast delay up to 27 minutes after contrast administration to best demonstrate the enhancement of culprit plaques. Pooling results from multiple studies with different timing should be cautious. It is critical to standardizer the post-contrast timing in multi-center studies because the plaque enhancement changed significantly over time. Our study provided a basis for designing future multi-center studies targeting intracranial plaque and stroke risk.

PO-080

# 基于多参数 MRI 影像组学模型鉴别原发性黏液性卵巢癌与转移性卵巢癌

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【目的】 基于多参数 MRI 影像组学模型鉴别原发性黏液性卵巢癌与转移性卵巢癌。
【材料与方法】回顾性分析 2013 年 11 月至 2021 年 3 月经病理证实的原发性黏液性卵巢癌(n=57)与转移性卵巢癌(n=57)患者的临床病理资料和 MRI 图像，所有患者术前均接受盆腔 MRI 检查,包括 T2WI FS 序列及延迟期 CE-T1WI 序列。在横轴面 T2WI FS 及 T1-VIBE 上选取病灶最大层面沿肿瘤边缘勾画 ROI，对影像组学特征进行提取，然后采用 Lasso logistic 回归模型从 T2WI FS 特征、延迟期 CE-T1WI 特征及联合特征(T2WI FS 序列及延迟期 CE-T1WI 序列)中筛选原发性黏液性卵巢癌与转移性卵巢癌相关特征,构建三个影像组学预测模型:模型 1(T2WI FS)、模型 2(延迟期 CE-T1WI)、模型 3(T2WI FS+延迟期 CE-T1WI)。通过准确度、敏感度、特异度和曲线下面积(AUC)评估影像组学模型的预测性能。
【结果】训练集中三个影像组学模型鉴别原发性黏液性卵巢癌与转移性卵巢癌的 AUC 分别为 0.7、0.85、0.88，验证集中的 AUC 分别为 0.62、0.73、0.73，联合 T2WI FS 序列及延迟期 CE-T1WI 序列比单一序列预测效能更佳。
【结论】基于多参数 MRI 影像组学模型能有效鉴别原发性黏液性卵巢癌与转移性卵巢癌。

# PO-081
# ESWAN 联合 DTI 鉴别胰腺实性假乳头瘤和胰腺神经内分泌瘤

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目的
评价 ESWAN 序列联合 DTI 序列多定量参数在胰腺实性假乳头瘤（SPTP）和胰腺神经内分泌瘤（PNET）鉴别诊断中的价值。
方法
15 例 SPTP 和 23 例 PNET 患者，采用带相控阵线圈的 1.5T MR 扫描仪（Ge signa hdxt）。ESWAN：TR/TE，16.4ms/2.1ms，角度，20°，矩阵，256×192，FOV，38cm×38cm，层厚，2mm。DTI：层厚/层距，7mm/1mm，FOV 35cm×35cm，矩阵 96×128，激发次数（nex）=4，相位 FOV=0.8。传输至 GE AW4.6 工作站，两名放射科医生双盲法测量幅度值、相位值、R2*值和 T2*值、ADC、FA、Iso、VRA、EA、T2-T。将三个圆形 ROI 放置在病灶实性部分，面积约为 25-100mm$^2$，采用 SPSS26.0 分析，使用类内相关系数（ICC）测试两名观察者测量结果的一致性。Kolmogorov-Smirov 试验用于测试正态分布。两组之间的差异通过独立样本 T 测试或曼惠特尼 U 测试进行分析。应用受体操作器特征曲线（ROC）分析诊断疗效，获得曲线下面积（AUC）、阈值、敏感性和特异性。
结果
SPTP 组 R2*值明显高于 PNET 组，T2*值低于 PNET 组（P<0.05）。SPTP 中 DTI 的 FA 值和 VRA 值明显高于 PNET（P<0.05）。R2*的 AUC 为 0.707（敏感性 91.3%，特异性 46.7%，阈值≥22.44），T2*的 AUC 为 0.829（敏感性 73.9%，特异性 86.7%，阈值≤48.44），FA 为 0.711（敏感性 100%，特异性 47.8%，阈值≥0.33），VRA 为 0.711（敏感性 100%，特异性 47.8%，阈值≥0.12），ESWAN 联合 DT 序列 AUC 为 0.922（敏感性 80%，特异性 95.7%）。
结论
ESWAN 联合和 DTI 序列是鉴别 SPTP 和 PNET 的有效方法。

PO-082

# Evaluation of depth of myometrial invasion of endometrial carcinoma: comparison of orthogonal pelvis-axial contrast-enhanced and uterus-axial dynamic contrast-enhanced MRI protocol

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Purpose: To compare the diagnostic performance of orthogonal pelvis-axial (OPA) contrast-enhanced (CE) and orthogonal uterus-axial (OUA) dynamic contrast-enhanced (DCE) MRI protocols in assessing the depth of myometrial invasion (MI) of endometrial carcinoma (EC).
Method and materials: From September 2018 to June 2020, 398 consecutive patients with EC underwent MRI preoperatively. Of which 197 patients were scanned with OPA CE-MRI protocol and 201 patients were scanned with OUA DCE-MRI protocol. Two radiologists independently interpreted the depth of MI, with postoperative histopathology as the reference standard. Statistic methods include Kappa statistics for inter-observer agreements, Chi-square test, Fisher exact test, and receiver operating characteristic curve analysis for diagnostic performance comparison.
Results: Inter-observer agreements were substantial for both OPA CE-MRI and OUA DCE-MRI protocols (k = 0.610 and 0.629, respectively). OUA DCE-MRI protocol showed significant larger area under the curve than OPA CE-MRI in detecting the presence of MI for radiologist 1 (0.71 versus 0.49, P < 0.05), but not for radiologist 2 and deep MI (all P > 0.05). Compared with OPA CE-MRI protocol, OUA DCE-MRI protocol significantly improved the diagnostic accuracy of non-MI and superficial MI (radiologist 1: 45.5% versus 0 and 88.7% versus 86.4% , P = 0.045 and 0.567, respectively; radiologist 2: 45.5% versus 12.5% and 88.7% versus 78.8%, P = 0.177 and 0.027, respectively), as well as for EC with adenomyosis/submucous myomas, cornual tumor, and antero-posterior diameter ≤ 10 mm (radiologist 1: 86.4% versus 71.4%, 91.2% versus 67.7%, and 90.1% versus 81.1%, P = 0.048, 0.018, and 0.081, respectively; radiologist 2: 86.4% versus 64.3%, 88.2% versus 64.5%, and 87.0% versus 71.6%, P = 0.006, 0.023, and 0.019, respectively).
Conclusion: OUA DCE-MRI protocol has superior diagnostic accuracy in assessing the depth of MI compared with the OPA CE-MRI protocol.

PO-083

# 基于磁共振扩散加权成像及血清学指标的虚拟弹性成像技术定量评估肝纤维化的临床研究

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目的：评估磁共振扩散加权成像联合血清学指标定量评估不同类型肝纤维化患者的组织强度变化的潜力，并比较其与磁共振弹性成像的方法间一致性。
材料和方法：这项研究得到了两个参与机构的机构审查委员会的批准。其收集了来自上海曙光医院 2020 年 5 月至 2020 年 12 月的 73 例肝纤维化患者，其中 20 例为非酒精性脂肪肝病，40 例为乙肝，13 例为其他疾病（平均年龄 53.67±13.48 岁 ）。 所有 DWI 及 MRE 检查在 3T 扫描仪 (UMR780，联合成像医疗，中国上海)上进行，扫描后获取相同感兴趣区的 MRE 值和 ADC 值，所

有患者均获得胆红素，天门冬氨酸氨基转移酶 AST，丙氨酸氨基转移酶 ALT，γ 谷氨酰氨基转移酶 GGT 及天门冬氨酸氨基转移酶/丙氨酸氨基转移酶 AST/ALT 等血清学资料，从而寻求磁共振扩散加权成像及血清学指标与 MRE 之间的相关性，并建立精准表达式。
结果：随着肝纤维化的进展，ADC 值明显降低，其中当 b 值采用 200 和 500 sec/mm2 时，ADC 与 MRE 之间存在显著相关性（$R^2 = 0.870$）；其次 AST 及 AST/ALT 随着肝纤维化的进展而升高，两者与 MRE 之间存在中度相关性（$R^2 = 0.337$，0.519）；将 ADC 及血清学指标联合构建多元线性回归方程，得到精准表达式 MRE=9.88-8.43ADC×103+0.392AST/ALT（$R^2 = 0.785$）。而不同病因的纤维化患者之间在不同的纤维化阶段无明显差异。
结论：在不使用外部机械装置的前提下，基于扩散加权成像和血清学指标的虚拟弹性成像技术可以表征组织弹性状态，提供肝纤维化程度的信息，并且与 MRE 具有高度一致性。综上所述，本研究表明联合磁共振扩散加权成像及 AST/ALT 可以具有替代磁共振弹性成像的潜力，从而定量评价肝纤维化患者的纤维化程度。

## PO-084

# 高原慢性吸烟者伏隔核静息态功能连接研究

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研究目的：先前已有研究证明慢性吸烟者存在功能连接的改变，本文探讨高原慢性吸烟者在静态状态下双侧伏隔核到全脑功能连接的改变；研究方法：通过对收集的生活在高原状态下的 30 例长期慢性吸烟者和 30 例正常对照进行磁共振扫描，以双侧伏隔核为种子点做全脑的功能连接（functional connectivity，FC）。对实验组和对照组进行双样本 t 检验。研究结果：以左侧伏隔核为种子点，与对照组相比，慢性吸烟者功能连接增强的脑区包括右侧中央前回、右侧中央后回、右侧额中回（GRF 校正，体素<0.005，团块<0.05），不存在功能连接降低的脑区；以右侧伏隔核为种子点，与对照组相比，慢性吸烟者功能连接增强的脑区包括左侧中央迂回、左侧背外侧前额叶（GRF 校正，体素<0.005，团块<0.05），不存在功能连接降低的脑区。结论：高原地区慢性吸烟者成瘾的原因可能与奖赏环路的关键脑区伏隔核的功能连接异常有关，该差异可作为高原慢性吸烟人群成瘾的生物标记。

## PO-085

# Measurement of interstitial fluid pressure based on magnetic resonance elastography

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**Purpose:**

Interstitial fluid, as the direct environment for cell growth, plays an important role on the status of cell. Interstitial fluid pressure (IFP) is the fluid pressure existed in the interstices of the tissue cells. Studies have showed that IFP in tumor tissues was higher than normal tissues. IFP was also believed to be a key factor affecting tumor drug treatment. However, current measurement of IFP is interventional that needs placement of pressure sensor inside the tissue.

Magnetic resonance elastography (MRE) is a non-invasive imaging method to measure tissue biomechanical properties. We propose to use MRE for non-invasive measurement of IFP.

**Method:**

Simulation model using linear elastic material was constructed for MRE measurement. The apparent shear modulus was estimated with a prestress ranged from -0.45kPa to 0.45kPa. A prestress application instrument was designed to mimic different levels of IFP for tissue sample test. Porcine liver tissue was acquired for MRE tests on a 3T MRI scanner (uMR 790, United Imaging Healthcare, Shanghai, China). The apparent shear modulus was estimated with different prestress levels.

**Result:**

Simulation results showed that the apparent shear modulus measured using MRE increased with the externally applied prestress. The positive correlated apparent shear modulus and prestress can be fitted with an exponential function. The actuation frequency of MRE did not influence the results. Experiments on liver tissue agreed with that of the simulation results. The measured apparent shear modulus increased as the compressive stress increased.

**Conclusion:**

Simulation and experiments results indicated that external stress condition could influence the measured shear modulus using MRE. Therefore, using MRE method to study the difference of intrinsic and apparent biomechanical properties of tissue under different stress conditions could provide useful information for IFP estimation.

# PO-086

## 磁共振评估乳房水肿与浸润性导管癌分子亚型的相关性分析

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目的：探讨磁共振图像上乳腺浸润性导管癌（Invasive ductal carcinoma, IDC）患者不同乳房水肿分型与病理分子亚型的相关性。

材料与方法：回顾性分析 2017 年 1 月至 2018 年 12 月期间经手术或穿刺活检病理证实为 IDC 的病例。在脂肪抑制 T2 加权图像上由两名经验丰富的高年资影像诊断医师共同商讨达成一致决定患侧乳房水肿分型，将其分为无水肿型、瘤周水肿型、前胸壁水肿型和皮肤水肿型，其中后三者归为水肿型。使用 SPSS 软件对数据进行统计学分析，评估不同乳房水肿分型与 IDC 分子亚型的相关性。

结果：共 196 个病例纳入研究，其中无水肿型为 91 例，瘤周水肿型为 49 例，前胸壁水肿型为 19 例，皮肤水肿型为 37 例，水肿型共 105 例。本次研究发现与 Luminal 型（Luminal A 和 Luminal B）相比，非 Luminal 型（HER2 阳性和三阴性）的病例患侧乳房水肿的发生率较高，具有显著的统计学差异（$p < 0.05$），但是瘤周水肿型、前胸壁水肿型和皮肤水肿型三型之间没有显著差异。

结论：本次研究表明，在脂肪抑制 T2 加权图像上评估患侧乳房水肿与非 Luminal 型 IDC 有关，可作为其一个潜在的生物侵袭性指标。

# PO-087

# Intravoxel incoherent motion imaging evaluates different pathological types of lung cancer and Ki-67 expression level: A comparative study with 18F-FDG PET

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**Purpose** $^{18}$F-FDG PET/MR was used to compare the value of intravoxel incoherent motion imaging (IVIM) and $^{18}$F-FDG PET in distinguishing different pathological types of lung cancer and to evaluate the relationship between each parameter and the expression level of Ki-67 correlation.

**Methods** This study prospectively selected patients who were clinically suspected of pulmonary occupancy for PET/MR scanning. The IVIM and $^{18}$F-FDG PET images of 48 patients were analyzed, and the maximum standard vertebral uptake value (SUVmax), metabolic tumor volume (MTV), total lesion glycolysis (TLG), and diffusion coefficient (D), false diffusion coefficient (D*), and perfusion fraction (f) values were measured respectively.Taking pathological results as the gold standard, they were divided into 14 cases in the small cell lung cancer (SCLC) group and 34 cases in the non-small cell lung cancer (NSCLC) group. In the non-small cell lung cancer group, there were 21 cases in the adenocarcinoma (AC) group and 13 cases in the squamous cell carcinoma (SCC) group. The independent-sample t-test and U test were used to compare the differences between the SCLC group and NSCLC group, SCC group, and AC group. Data analysis uses SPSS 23.0 and Medcalc 15.0 software. The correlation between $^{18}$F-FDG PET and IVIM parameters and the correlation between each parameter and Ki-67 were analyzed by Pearson correlation coefficient. ROC curves were generated to evaluate the diagnostic accuracy of each parameter. The Delong method is used to compare the difference of AUC under different parameters. P<0.05 was considered statistically significant.

**Results** Parameter comparison: The MTV and TLG values of the SCLC group were significantly higher than those of the NSCLC group [(70.22±59.47)，(397.95±346.68)vs(11.99±16.60)，(84.73±143.04)，（all P<0.05）]. The f value of the SCLC group was significantly lower than that of the NSCLC group[ (18.37±9.89)%vs (27.57±11.24)%]. There was no significant difference in SUVmax, D, and D* values between the two groups. The SUVmax and TLG values of the SCC group were significantly higher than those of the AC group [(15.42±7.57)，(167.93±220.26) vs(7.17±4.37)，(43.13±49.17)，(all P <0.05）]. The D and f values of the SCC group were significantly lower than those of the AC group[(0.98±0.15) × $10^{-3}$mm $^2$/s，(20.08±10.92)% vs(1.26±0.29) × $10^{-3}$mm $^2$/s，(31.32±9.55)%，(all P<0.05)]. There was no significant difference in MTV and D* values between the two groups. Diagnostic performance: The AUC of MTV, TLG, and F values in the diagnosis of SCLC and NSCLC was 0.926, 0.863, and 0.729 respectively, but the difference between them was not statistically significant (P<0.05). The AUC of D, SUVmax, f, and TLG values for diagnosis of SCC and AC was 0.834, 0.828, 0.790, 0.704, but there was no statistically significant difference between them (P>0.05). Relevance: SUVmax, MTV, TLG were moderately positively correlated with Ki-67 (r=0.300, 0.378, 0.372, P<0.05), and D value was moderately negatively correlated with Ki-67 (r=-0.345, P<0.05). The f value was weakly negatively correlated with SUVmax (r=-0.290, P<0.05), and moderately negatively correlated with MTV and TLG (r=-0.375, -0.382, P<0.05). There is no significant correlation among the other parameters.

**Conclusion** Both $^{18}$F-FDG PET and IVIM are beneficial for the diagnosis of different pathological types of lung cancer and have similar diagnostic efficacy, and they are correlated with the level of Ki-67 in lung cancer.

## PO-088

# Quantitative Image Features of Gadoxetic Acid–enhanced MRI for Predicting Glypican-3 Expression of Small Hepatocellular Carcinoma ≤3 cm

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Purpose: To explore the value of quantitative image features of Gadoxetic Acid–enhanced magnetic resonance imaging for predicting glypican-3 (GPC3) expression of single hepatocellular carcinoma (HCC) ≤3 cm.
Materials and Methods: 149 patients with pathologically confirmed HCC (training cohort: n=117; validation cohort: n=32) were retrospectively included. Quantitative image features, conventional MR features and clinicopathological parameters were analyzed. Univariate and multivariate logistic regression analyses were used to identify the significant predictors for GPC3 expression, then nomograms were constructed based on the prediction model. Progression-free survival (PFS) analysis was performed by the Kaplan–Meier method.
Results: Tumor-to-liver signal intensity (SI) ratio on hepatobiliary phase (HBP) (odds ratio [OR]= 0.003; p=0.034) and serum alpha-fetoprotein (AFP) > 20 ng/mL (OR=5.213; p=0.004) were independent significant factors for GPC3 expression. Combined with the two factors, the diagnostic specificity of the training cohort and validation cohort was 87.9(29/33) and 90.0(9/10) respectively. The nomogram based on the predictive model showed satisfactory prediction performance in training (C-index: 0.856) and validation (C-index: 0.877) cohort. Kaplan–Meier curves showed that patients with GPC3-positive HCC have a lower PFS rate than those with GPC3-negative HCC in both training cohort (Log-rank test, p=0.034) and validation cohort (Log-rank test, p=0.042).
Conclusion: Tumor-to-liver SI ratio on HBP combined with serum AFP > 20 ng/mL are potential predictive factors for GPC3 expression of HCC ≤3cm. GPC3-positive is correlated with a poor prognosis in HCC patients.

## PO-089

# 基于弥散峰度成像对脑桥梗死患者脑白质微结构变化的研究

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目的：弥散峰度成像（DKI）以非高斯分布模型为基础，较传统的弥散张量成像（DTI）对组织微结构的改变更为敏感。本研究利用 DKI 技术对慢性期脑桥梗死患者白质微结构的变化进行探索
方法：本研究共纳入 60 例梗死大于 6 个月的慢性期脑桥梗死患者（左侧 33 例，右侧 27 例）以及 30 例匹配的正常被试，所有被试均行全脑 DTI 及 3DT1MRI 扫描，采用基于纤维束示踪的空间统计分析（TBSS）的方法分别对左侧和右侧脑桥梗死患者的 DKI 参数值（FA, MD, AD, RD, MK, AK, RK）进行统计分析，并分析梗死组差异性纤维束的 DKI 参数与运动（FMT）和认知（RAVLT 以及数字 1-back）功能评分的相关性

结果：与正常对照相比，左侧脑桥梗死组表现出广泛的白质纤维的破坏主要表现为小脑中脚、脑桥交叉道、胼胝体、穹窿、左侧皮质脊髓束、双侧内侧丘系、双侧小脑下脚、双侧小脑上脚、双侧大脑脚、双侧内囊前肢、双侧内囊后肢、双侧内囊晶状体后部、双侧前冠、上冠及后冠、双侧丘脑后辐射、双侧矢状层、双侧外囊、双侧扣带回、双侧上纵束、双侧上额枕束、双侧勾束的 FA 值明显降低以及 MD 值、RD 值明显升高；左侧内囊后肢、左侧前冠、上冠、后冠和左侧上纵束 MK 值明显降低（TFCE 及 FWE 校正，$p<0.01$）。右侧脑桥梗死组在小脑中脚、脑桥交叉道、胼胝体膝部和体部、右侧皮质脊髓束、双侧内侧丘系、双侧小脑上脚、双侧小脑下脚、右侧大脑脚、右侧内囊前肢、右侧内囊后肢、右侧内囊晶状体后部、双侧前冠、双侧上冠、右侧外囊及右侧上纵束表现出明显的 FA 值的降低以及 RD 值的升高，小脑中脚和右侧小脑下脚表现为 MD 值的升高，右侧内囊后肢、右侧上冠、后冠、右侧外囊及右侧上纵束表现为 MK 值明显降低（TFCE 及 FWE 校正，$p<0.01$）。相关性分析证实多条纤维束的 DKI 参数值与运动和认知功能评分存在明显的相关性（$p<0.05$）。
结论：慢性期脑桥梗死存在着较为广泛幕上和幕下脑白质纤维束 DKI 参数值的改变，而这些参数值的改变与患者运动和认知功能的评分有明显的相关性，这可能是慢性期脑桥梗死患者行为功能受损的神经机制。

PO-090

# Locus coeruleus degeneration is associated with disorganized functional topology in Parkinson's disease

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**Objectives:**

Parkinson's disease (PD) is a common neurodegenerative disease with prominent degeneration of dopaminergic neurons in the substantia nigra.[1] In addition to the loss of substantia nigra neurons, studies have reported 20 - 90% locus coeruleus (LC) cell loss in PD patients.[2, 3] The LC is the major source of noradrenaline in the brain and is involved in cognitive and motor impairments in PD.[4, 5] In the past decades, a major emphasis has been placed on the symptom related brain alterations caused by dopamine deficiency in PD patients. The brain alteration resulting from noradrenergic deficiency is largely unknown.

Dysregulation of the LC-noradrenaline system has been implicated in numerous cognitive and behavioural symptoms of neurodegenerative diseases.[4, 6, 7] Researchers suggested that the modulation effects of LC-noradrenaline system on behavior was closely linked with neuronal activity, because of the abundant projection from the noradrenergic neurons to other brain regions.[8] While pharmacological study depicted the influence of LC-noradrenaline system on cognitive performance, it is still largely unknown how LC degeneration contribute to the process by interacting with other brain regions in PD patients.[7]

Therefore, the aim of our study was to (1) assess the relationship among LC degeneration, brain network organization, and clinical manifestations in PD patients; (2) explore the potential mediating effect of network disruption in LC degeneration and cognitive/motor impairment.

**Methods:**

1. Demographics

This study included 94 idiopathic PD patients and 68 healthy controls (HCs). Disease severity was assessed using the Unified Parkinson's Disease Rating Scale (UPDRS) and Hoehn-Yahr (H-Y) stage. Cognitive status was assessed using the Montreal Cognitive Assessment (MoCA) scale.

2. LC integrity measurement

LC degeneration was assessed using the neuromelanin sensitive magnetic resonance imaging (NM-MRI). One author performed manual measurements twice with a time interval of one month (intra-rater agreement was 0.827). Another author performed manual measurement once (inter-rater agreement was 0.856). Round like regions of interest were placed at the bilateral LC and mid portions of the pontine (PT, reference region for LC).[9] The CNRLC was calculated using the following equation: CNRLC = (SILC - SIPT) / SDPT. Detailed methods of LC and SN measurements could be found in Fig. 1.

3. Graph theory-based network analysis

In this study, nodal attributes, including nodal degree centrality (DC), nodal betweenness centrality (BC), and nodal efficiency (NE) were used to explore the nodal topological characteristics.[10]

Considering that the network topological organization is significantly determined by network sparsity, we thresholded constructed 10 weighted connectivity matrixes with different sparsity (from 5% to 50% with an interval of 5%) before calculating network attributes. The area under the curve (AUC) of network attributes under 10 different sparsity, which is a summarized indicator of network attributes, was used to measure the group difference and perform correlation analysis.

4. Statistical analysis

The difference of CNRLC and network attributes between two groups were analyzed using the General linear model with age, gender, and education as covariates. Bonferroni correction was used for multiple comparisons of nodal attributes between HC and PD. The partial correlation analysis was performed between CNRLC, damaged network attributes, and clinical variables (UPDRS III and MoCA) in PD group. Age, gender, and education were used as covariates.

Mediation analysis was used to test whether LC degeneration related clinical features can be explained by network disruption (the mediator). The analyses were performed using the SPSS with 10,000 bootstraps. A standard three-variable path model was used here. Age, gender, and education were used as covariates of no interest.

**Results:**

1. Demographics, clinical and CNRLC characteristics

PD group showed significant reduced CNRLC ($P<0.001$; Figure 1D) and MoCA score ($P = 0.001$; Table 1) when compared with HC group. Detailed demographic, clinical, and CNRLC characteristics were shown in Table 1.

2. Group comparisons of network attributes between HC and PD.

Compared with HC group, significantly reduced DC of the superior frontal gyrus (SFG), middle frontal gyrus (FMG), precentral gyrus (PrG), postcentral gyrus (PoG), paracentral lobule (PCL), and cingulate gyrus (CG) were found in PD group. Reduced NE of vast regions, including the superior frontal gyrus (SFG), middle frontal gyrus (FMG), precentral gyrus (PrG), postcentral gyrus (PoG), paracentral lobule (PCL), inferior parietal lobule (IPL), cingulate gyrus (CG), superior temporal gyrus (STG), fusiform gyrus (FuG), insular gyrus (INS), cuneus (Cun), and occipital gyrus (OcG) were also found in PD group (Figure 2). No difference was found in BC between PD and HC groups. Therefore, The BC was not involved in further correlation analyses.

3. Relationships between the CNRLC, nodal attributes, and clinical data in PD patients

In PD group, the CNRLC was positively correlated with the MoCA score (Fig. 3A). The CNRLC was positively associated with the NE of several cognitive related regions (Fig. 3B) including the right STG, right INS, right Cun), and left Cun. We also observed significant positive correlations between the CNRLC and the NE of sensorimotor cortex including the left PrG, and left PoG.

Moreover, the NE of right STG and right INS were significantly correlated with the MoCA score (Fig. 3C). Mediation analysis demonstrated that the relationship between CNRLC and MoCA was totally mediated by the NE of STG (Fig. 3D).

**Conclusions:**

This study provided the evidence that LC degeneration associated with extensive network disruption in PD patients. LC degeneration was an important pathway for PD cognitive impairment through associating with the disorganization of functional topology.

PO-091

# 整个肿瘤区域 DWI 纹理特征对肝外胆管癌病理分级的预测价值

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目的：评估整个肿瘤区域扩散加权成像（DWI）纹理特征对肝外胆管癌（ECC）病理分级的预测价值。

材料与方法：回顾性分析 2012 年 5 月至 2021 年 4 月，101 例经病理诊断为肝外胆管癌的患者，将其分为高分化组（n=31）和中低分化组（n=70）。所有患者均行术前 MR 检查，包括常规扫描（T1WI,T2WI）序列和附加 DWI 序列。在 T1WI 中解析扫描顺序和参数：TR/TE:200ms/1.4ms、矩阵:288×170、NEX1、切片/间隙、6.0mm/1.5mm、FOV:40cm×40cm、扫描时间:17s;T2WI: TR/TE:6300ms/93.8 ms，矩阵 256×256，NEX3，切片/间隙，6.0 毫米/1.5 毫米，FOV:40cm×30cm，扫描时间：150s;DWI:TR/TE:6300ms/93.8ms，b 值=0，600 (s/mm2)，矩阵 128×128, nex 4, 切片/间隙：6.0mm/1.5mm, FOV: 40cm×40cm,扫描时间:120s。DWI 图使用 GE AW46 工作站导出。放射科医生复查 MRI 图像，在信号强度图上手动勾勒出病变各层的感兴趣区域（ROIs），然后在覆盖整个肿瘤的 3D ROL（图 1）、纹理参数后自动生成纹理特征。纹理参数：获得了如能量、熵、峰度、最大值、平均值、中值、最小值、偏度、均匀性、团凸度、团阴影、相关度、长程强调、长程非均匀归一化（RLNUN）、短跑强调、大面积强调和小面积强调。数据分析采用 spss26.0 统计软件，用 Kolmogorov-smirov 检验法检验其正态分布。采用独立样本 T 检验或 Mann-Whitrey U 检验分析两组间的差异。通过受试者操作（ROC）分析评价诊断性能。

结果：ECC 高、中、低分化组在能量、熵、均匀度、簇凸度等方面有显著性差异（P<0.05，表 1）。结果表明，均匀性（AUC:0.645，敏感性：52.9%，DWI 信号强度特异性：74.2%）是最佳策略（表 2，图 2）。

结论：在目前的研究中，我们提出了一种基于 DWI 的纹理策略来预测 ECC 的病理分级。为临床肿瘤的鉴别诊断提供了一种更有前途的方法，有利于临床治疗。

PO-092

# 磁共振扩散峰度成像和 18F-FDG PET 在鉴别实性孤立性肺病变良恶性中的价值

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目的： 探讨磁共振扩散峰度成像(diffusion kurtosis imaging , DKI )和氟代脱氧葡萄糖(18F-fluro deoxy glucose , 18F-FDG)的正电子发射型计算机断层显像（Positron Emission Computed Tomography , PET）在鉴别实性孤立性肺病变（solitary pulmonary lesions , SPLs）良恶性中的价值，并分析各参数与 Ki-67 表达的相关性。

材料与方法： 对 68 例实性 SPLs 患者进行 18F-FDG PET-MR 扫描，计算表观扩散系数(apparent diffusion coefficient, ADC)、平均扩散系数(mean diffusivity, MD)、平均扩散峰度 (mean kurtosis, MK)和最大标准摄取值（maximum standard uptake value , SUVmax）。运用独立样本 t 检验或 U 检验对比良性和恶性组间各参数的差异；受试者工作特征曲线 (receiver operating characteristic curve, ROC)被用于评估诊断效能，Delong 检验被用于对比诊断效能的差异；Logistic 回归分析被用于独立预测因子的评估。各参数与 Ki-67 指数的相关性用 Pearson 相关来描述(r≥0.75，高度；0.50≤r＜0.75，中度；0.25≤r＜0.50，轻度；r＜0.25，很小或无)。P<0.05 为差异有统计学意义。

结果： 参数对比方面：良性组的 MK 值和 SUV（max）值显著低于恶性组[ (0.65 ± 0.10) vs (0.91 ± 0.15)，（1.68±1.33） vs（5.31±2.15）]；ADC 和 MD 值均显著高于恶性组[(1.40 ± 0.16) vs (1.19 ± 0.18)×10−3mm2/s, (3.26± 0.82) vs (2.52 ± 0.91)×10−3mm2/s]。诊断效能方面：良性 vs 恶性，MK、MD、ADC 和 SUV 值的 AUC 分别为 0.816、0.782、0.776 和 0.885，且 MK 和 ADC 之间 AUC 的差异有统计学意义；MK 和 SUV 值是实性 SPLs 良恶性的独立预测因子。MK 和 SUVmax 分别与 Ki-67 指数呈中度正相关(r＝0.688、0.739，P＜0.05)。MD 和 ADC 值分别与 Ki-67 指数呈中、轻度负相关(r＝- 0.635，-0.452)。

结论： DKI 和 18F-FDG PET 用于实性 SPLs 良恶性鉴别是可行的，MK 和 SUV 值是其独立预测因子。

# PO-093

# 门静脉 4D flow 定量参数评估肝硬化侧枝循环

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目的:
探讨 4D flow 定量参数评估肝硬化患者门脉高压侧枝循环是否开放的可行性。
材料和方法:
回顾性收集 2019 年 9 月至 2020 年 10 月，因肝硬化于我院就诊，并行 3.0T 磁共振检查的患者。排除标准:a .不能配合，常规图像有呼吸运动伪影者；b .肝脏术后患者；c.肝内具有占位性病变患者。最终入组 15 例患者(平均年龄 55.8±12.1 岁；7 名男性，8 名女性)。结合胃镜检查和影像学表现(T1-TFE、T2WI-SPIR 和 mDIXON 四期增强)，将肝硬化患者分为正常组和侧支循环组。所有患者均在 3.0T MRI（Ingenia CX）行磁共振扫描。扫描序列包括常规 T1-TFE，T2WI-SPIR，DWI，mDIXON 四期增强，2D Q-flow 和 4D-flow 序列。其中扫描 2D Q-flow 以测量门静脉中的流速作为速度编码的参考。4D-flow 参数如下：TR/TE = 5.0/3.2 ms，FOV = 300×350 mm2，分辨率= 2.5×2.5×2.5 mm3，PC 方向= RL-AP-FH，CS=8，扫描时间= 4 分 37 秒。扫描完成后通过主机进行 4D flow 重建。将重建后的数据拷出，由临床诊断经验丰富的放射科医师（具有 5 年腹部 MRI 诊断工作经验）在 CVI 42 软件包上处理图像，以获得 3D 血管图像。首先在门静脉起始位置放置参考平面，其次在门静脉的近端、中间部和远端分别放置一个测量平面用于血流定量分析。测量的定量参数包括目标血管段的流量、流速、壁切应力和压力梯度。采用 Mann-Whitney U 检验比较两组间各参数差异性，P＜0.05 为差异具有统计学意义，选择有统计学差异参数绘制受试者工作特征曲

线，计算曲线下面积（area under curve，AUC），应用二元 logistics 回归分析进行参数联合诊断，比较各参数及联合诊断效能，计算最佳阈值的敏感性和特异性。
结果:
有侧枝循环组门静脉中部的血流量和压力梯度值高于无侧支循环组（P＜0.05）。两组间其余定量参数无统计学差异（P＞0.05）。流量、压力梯度和流量与压力梯度联合的曲线下面积分别为 0.911、0.833 和 0.956。当联合流量、压力梯度时，诊断侧枝循环组的敏感性为 88.9%，特异性为 100%。
结论:
门静脉 4D flow MRI 定量参数能够初步评估肝硬化患者侧枝循环是否开放。

## PO-094

# 高流量吸氧对磁共振腹部成像质量的影响

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**目的** 比较高流量吸氧状态下与正常呼吸状态下 MR 腹部成像质量，探讨高流量吸氧对磁共振腹部成像质量的影响。**资料与方法** 收集我科 200 例采用西门子 Aera 1.5T 磁共振以及用 18 通道相控阵表面线圈行腹部检查的患者，其中 100 例给予高流量吸氧直至检查结束，另外 100 例嘱咐正常呼吸。两组患者采用相同序列及参数进行扫描，扫描结束后评价其图像质量。**结果** 将两组病例进行盲评法由 2 名副主任医师以上的 MRI 诊断医师阅片，对图像的分辨率，图像信噪比、对比噪声比以及伪影控制情况进行分析，一致认为采用 18 通道相控阵表面线圈同时给予高流量吸氧患者的腹部检查成功比例、伪影控制情况及图像质量评分明显高于正常呼吸者（P<0.05），但两组图像信噪比及对比噪声比差异无统计学意义（P>0.05）。**结论** 应用高流量吸氧 1.5T 磁共振腹部成像可以在提高腹部磁共振检查成功率的同时提高腹部磁共振检查图像质量，图像质量高，扫描技术要求低，便于主治医生掌握丰富的疾病信息，利于患者后期诊断和治疗。

## PO-095

# 肝硬化患者深部灰质 QSM 测量与认知功能的相关性研究

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目的：基于定量磁敏感图（QSM）比较肝硬化患者与健康对照的不同脑深部灰质的磁敏感值差异，并探讨磁敏感值与认知功能的相关性。
材料和方法：32 例肝硬化患者和 31 例性别、年龄、受教育程度匹配的健康对照被纳入研究。所有受试者均接受数字连接试验（NCT-A）、数字符号试验（DST）和蒙特利尔认知评估量表（MoCA）评估。MRI 检查采用西门子 Skyra 3.0T 磁共振仪获取 QSM 图像，并对受试者的双侧丘脑、苍白球、壳核、尾状核、红核、黑质和齿状核进行 QSM 测量。肝硬化患者与健康对照的深部灰质磁敏感值比较采用 t 检验，磁敏感值与认知功能的相关性采用多元线性逐步回归分析。
结果：肝硬化患者双侧丘脑、尾状核头和红核的磁敏感值显著低于健康对照（P＜0.05）。左侧红核磁敏感值可作为患者 MoCA 评分的独立预测因子（R=0.561，P=0.001），是命名评分的独立预测因子（R=0.452，P=0.018）；右侧壳核磁敏感值可作为注意评分的独立预测因子（R=0.527，

P=0.005），是定向评分的独立预测因子（R=0.511，P=0.006）；左侧黑质是语言评分的独立预测因子（R=0.512，P=0.006）。
结论：肝硬化患者深部灰质的磁敏感值测量和分布异常可能影响患者的认知功能。

## PO-096

# 基于功能磁共振成像的夜发额叶癫痫患者脑动态功能连接改变研究

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目的 探讨夜发额叶癫痫（sleep-related hypermotor epilepsy，SHE）患者静息状态下大脑动态功能连接的改变。
材料与方法 自 2013 年 12 月至 2021 年 3 月在四川大学华西医院纳入夜发性额叶癫痫患者 62 名，通过海报广告招募纳入 55 名年龄、性别、受教育程度、利手等相匹配的健康志愿者。所有受试者在西门子 3.0T 扫描仪上进行 T1WI-3D 结构像及静息态功能磁共振扫描。数据经预处理后使用组空间独立成分分析（group independent component analysis，GICA）获取独立成分（independent component，IC），滑动窗口法生成动态功能连接（dynamic functional connectivity，dFC）矩阵。使用 k 均值聚类算法（k-meansalgorithm）以评估重复出现的 dFC 模式。
结果 dFC 模式被聚类为两种重复出现的活动状态。状态 1 代表局部网络内或网络间功能连接增强，占 25%；状态 2 代表局部网络内或网络间功能连接减弱，占 75%。相比正常对照，SHE 患者平均居留时间在状态 1 中更长（p=0.0042），状态 2 更短（p=0.0066）（图 1a），表明患者在各状态中的时间分布异常。其次，SHE 患者在状态 1 的发生率上升了 12.5%，而在状态 2 的发生率成比例下降（图 1b）。此外，SHE 患者在两种状态之间的转换明显增加（p<0.05，FDR 校正，图 1c）。
结论 结果表明夜发性额叶癫痫患者存在着异常动态大脑活动，对大脑动态功能连接状态的研究有助于理解癫痫发作的神经基础，为进一步探索大脑深层活动改变提供影像学参考依据。

## PO-097

# 2 型糖尿病患者大腿肌肉和腹部脂肪改变的多模态 MRI 研究

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**目的：**探讨 2 型糖尿病（Type 2 Diabetes Mellitus，T2DM）患者与健康对照组大腿肌间、肌内脂肪及腹部皮下脂肪分布的差异及其与临床代谢指标间的关系。**材料与方法：**前瞻性收集经临床确诊的 T2DM 患者共 43 例（男性 23 例，女性 20 例），同时收集与 T2DM 组年龄相匹配的健康对照组 40 例（男女各 20 例）。所有受试者均在 3.0T MR 上行大腿及腹部扫描。人工分割计算腹部及大腿皮下脂肪、肌肉区域间脂肪面积，据肌肉脂肪分数计算肌肉区域内脂肪面积及单纯肌肉面积。将大腿肌肉分为前外侧群、后群、内收肌群，计算各肌群肌内脂肪及单纯肌肉面积。比较 T2DM 与正常组各区域脂肪面积、各肌群单纯肌肉面积及大腿肌肉 $R_2$*、$T_2$*值的差异；比较各区域脂肪面积、各肌群单纯肌肉面积性别间的差异。分析各区域脂肪面积与临床代谢指标间的相关性。**结果：**T2DM 患者大腿及腹部皮下脂肪、肌间、肌内脂肪面积绝对值均大于正常组（*p* 分别为：0.004；0.000；0.000；0.000），肌内脂肪面积相对值大于正常组（*p*=0.000），肌肉面积相对值小于正常

组（*p*=0.044），且前外侧群肌肉的减少是主要原因（*p*=0.003）。大腿后群肌肉脂肪浸润较同层面前外侧群及内收肌群明显。T2DM 患者各个区域脂肪面积与胰岛素抵抗指数无明显相关性。女性腹部及大腿皮下脂肪面积大于男性（all *p*=0.000），肌肉内脂肪沉积无明显性别差异；女性各肌群单纯肌肉面积均小于男性（all *p*=0.000），但肌肉面积相对值后群大于男性（*p*=0.001），内收肌群小于男性（*p*=0.015），前外侧群无差异（*p*=0.551）。**结论：**1.T2DM 患者大腿骨骼肌内脂肪与肌肉的比例发生改变，脂肪增多，肌肉减少；且前外侧群肌肉减少是主要原因。2.腹部及大腿皮下脂肪面积，大腿后群及内收肌群肌肉面积存在性别差异，但肌肉内脂肪沉积无性别差异。

PO-098

# Evaluation of successful recanalization for chronic internal carotid artery occlusion by non-enhanced 3D MR vessel wall imaging

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Synopsis
Visualization of the extent and components of internal carotid artery chronic total occlusion (CTO) may play an important role in deciding whether patients can undergo the endovascular intervention successfully or not. This study sought to investigate the characteristics of internal carotid artery CTO for successful endovascular intervention by 3D MR Vessel Wall Imaging. We found that patients with lower extent of occlusion and IPH at the proximal occlusion site had a higher success rate of recanalization. The results suggest 3D MR vessel wall imaging might be useful of patient selection for more possibly successful endovascular intervention.

Introduction
Endovascular recanalization in patients with carotid chronic total occlusion (CTO) has been reported to be technically challenging[1]. The patient selection criteria for the treatment of CTO are currently decided by conventional intra-arterial digital subtraction angiography (DSA). 3D MR vessel wall imaging techniques have been developed to accurately visualize and quantify both the lumen and the vessel wall components of large arteries[2]. In this study, we retrospectively analyzed the pre-procedural 3D MR vessel wall imaging in patients with internal carotid artery CTOs and its relationship to technical success rates.

Methods
Study Sample: Patients who were diagnosed and confirmed with internal carotid artery CTOs by ultrasound or conventional CT angiography were included in the study.
MR imaging: 3D vessel wall images were acquired using a whole body clinical scanner (Philips Achieva TX, the Netherlands) and a dedicated 8-channel phased-array carotid coil. 3D vessel wall sequences were acquired with the following parameters: (1)3D MERGE: the improved motion-sensitized driven-equilibrium (iMSDE) prepared rapid gradient echo sequence[3], TR/ TE 9.3/4.4 ms, flip angle 6°, FOV 250[FH] ×160[RL]×64[AP] mm3, acquisition matrix 312×200×80, acquired resolution 0.8×0.8×0.8mm3, Rec resolution 0.4×0.4×0.4mm3, acquisition time 2 minutes 42 seconds; (2) 3D SNAP[4]: phase sensitive Inversion recovery enabled 3D inversion recovery turbo field echo, TR/TE 10/4.8 ms, flip angle 11°, field of view 160×32×160mm3, spatial resolution 0.8×0.8×0.8mm3, and scan time 2min 17sec.

Endovascular recanalization: The patients subsequently underwent endovascular recanalization within 1 week of the 3D MR vessel wall imaging. Patients were divided into two groups according to technical success or not of the endovascular recanalization.
Data analysis: An experienced radiologist reviewed the carotid vessel wall images. The morphological and composition characteristics regarding the stump conditions, extent of occlusion, tortuosity, collapse, intraplaque hemorrhage (IPH) and calcification at the proximal occlusion site and residual true lumen visibility in C1 segment were recorded.

Results
A total of 48 patients (42 men; age: 62.5 years old) were included in the final statistical analysis. 33 patients underwent successful recanalization. Table 1 summarized the characteristics of internal carotid artery CTOs on 3D MR vessel wall images. Compared with the failure group, patients in the success group had significantly higher prevalence of extent of CICAO limited to C1 segment (75.8% vs 20.0%, p<0.001) and hyperintense signal in the occluded C1 segment (57.6% vs 20.0%, p=0.027) but lower prevalence of calcification (36.4% vs 86.7%, p=0.002), tortuosity (6.1% vs 33.3%, p=0.024) and collapse (33.3% vs 80.0%, p=0.004) in the occluded C1 segment.

Discussion and conclusions
Our study investigated the characteristics of internal carotid artery CTO on 3D MR vessel wall images between successful and failure recanalization. It finds patients with successful recanalization, compared to patients with failed recanalization, to have a higher prevalence of extent of CICAO limited to C1 segment, hyperintense signal as well as a lower prevalence of calcification, tortuosity and collapse in the occluded C1 segment. It is intuitively reasonable that a CICAO with a large extent of occlusion or tortuosity or collapse is difficult for guidewire crossing and easy to result in false lumen creation and a higher chance of vessel injury due to the various vessel course. Visualization of the morphological characteristics of internal carotid artery CTO by 3D MR vessel wall imaging not only provides clear reference for wiring procedure, but also implies lumen patency in distal segment. Meanwhile, 3D MR vessel wall imaging has the advantage for determine the compositions of the occlusion. It is well established that calcification is relatively hard and may hinder the guidewire when crossing the chronic occlusions. Interestingly, the success rate in occlusions with IPH in our analysis was in fact higher. The potential reason is that IPH may actually provide a roadmap, and thus facilitate wiring procedures. Our study had several limitations including its small sample size, and other factors (such as the hemodynamic status) were not evaluated. In conclusion, our findings indicate that 3D MR vessel wall imaging may play a role in patient selection of endovascular recanalization in patients with carotid CTO, and this potential benefit should be proven to outweigh the risk of procedural complication in further investigations.

Acknowledgements
None.

# PO-099
# 心脏 MR 评估梗阻性室间隔肥厚型心肌病化学消融术近期疗效的价值

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目的 探讨心脏磁共振（CMR）对梗阻性室间隔肥厚型心肌病化学消融术后近期疗效评估的价值。

方法 收集 2019 年 1 月至 2021 年 3 月在河南省胸科医院临床确诊的梗阻性室间隔肥厚型心肌病患者的临床及影像学资料，其中共计 12 例行化学消融术的患者，于术前、术后 7 天、术后 3 个月均行 CMR 检查。比较同一患者术前与术后 7 天、术后 3 个月的左心室流出道压力阶差、基底段左室间隔壁厚度、收缩期左室流出道宽度、SAM 征、左心房内径、左心室舒张末期内径、左室舒张末期容积（EDV）、左室收缩末期容积（ESV）、每搏输出量（SV）、左心室射血分数（EF）、左心室心肌质量（MASS）、黑血序列心肌水肿范围、心肌灌注缺损的范围、延迟强化的范围。
结果 化学消融术后 7 天左心室流出道压力阶差、SAM 征、左心室心肌质量、心肌炎性水肿、心肌灌注缺损、心肌延迟强化与术前比较，差异有统计学意义(P<0.05)；术后 3 个月相比术后 7 天，基底段左室间隔壁厚度、收缩期左室流出道宽度、左心房内径、左心室舒张末期内径、左心室射血分数、心肌水肿、心肌灌注缺损、心肌延迟强化，差异有统计学意义(P<0.05)；左室舒张末期容积（EDV）、左室收缩末期容积（ESV）、每搏输出量（SV），三组间以上指标变化差异无统计学意义(P>0.05）。
结论 CMR 对于检测梗阻性肥厚型心肌病，评价化学消融术的疗效是一个无创的、有价值、更精准的检查方法。

## PO-100
# 高分辨 MRI 与 PET 图像融合技术在癫痫病灶定位中的应用

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摘要：目的：探讨高分辨 MRI 与 PET 图像融合技术对癫痫灶定位诊断中的应用价值。方法：回顾性分析经手术治疗的顽固性癫性患者 26 例，术前患者均实施癫痫发作间期 18F-PET 和高分辨率 MR 检查，并于术前、术中行脑电检测。结果：26 例患者发作间期头部 18F-PET 检查 19 例阳性，阳性率 73%，MR 检查 15 例阳性，阳性率 58%，PET 与术前脑电监测癫痫灶完全一致率 42%，部分一致率 13%，PET/MR 融合检查与术前脑电监测癫痫灶完全一致率 80%，部分一致率 20%。26 例均行手术病理证实，其中海马硬化 12 例，局灶性皮层结构发育不良 14 例，2 例为双重病理，为局灶性皮层结构发育不良并海马硬化。结论联合应用 18F-FDG PET 和高分辨率 MR 图像融合技术有助于癫痫灶的定位。

## PO-101
# 吸烟对认知正常老年人和轻度认知障碍患者 Meynert 基底核静息态功能连接的影响

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目的：轻度认知障碍 (MCI) 被认为是阿尔茨海默病（AD）的前驱期阶段，进展为 AD 的风险很高。其中，吸烟是 MCI 进展中可调控的高风险因素，其通过损伤 Meynert 基底核 （NBM）的结构与功能影响人脑的认知。本研究将以 NBM 为感兴趣区，研究状态（吸烟 vs.不吸烟）和诊断（认知正常老年人（CN）vs.MCI）的交互效应对 NBM 功能连接的影响。
材料与方法：本研究纳入 304 例非吸烟 CN、44 例吸烟 CN、130 例非吸烟 MCI 和 33 例吸烟 MCI，应用倾向得分匹配（PSM）分析来平衡 CN/MCI 亚组之间的差异。所有受试者都进行结构和

功能磁共振扫描和神经心理学测试。以 NBM 为感兴趣区，计算 NBM 与全脑体素功能连接，并进行混合效应分析。采用 Pearson 相关分析 NBM 功能改变与认知测试的关系。
结果：PSM 后，86 例非吸烟 CN、44 例吸烟 CN、62 例非吸烟 MCI 和 32 例吸烟 MCI 纳入进一步分析。状态×诊断交互效应的脑区主要位于右侧前额叶皮质（PFC）、左侧辅助运动区（SMA）和右侧楔前叶/枕中回。事后检验显示，与非吸烟 CN 相比，吸烟 CN 中左侧 NBM 与右侧 PFC 的功能连接显著降低，而与左侧 SMA 的功能连接显著增加。与非吸烟 MCI 相比，吸烟 MCI 中左、右侧 NBM 分别与左侧 SMA 和右侧楔前叶/枕中回的功能连接降低。此外，吸烟 CN 中 NBM 与 SMA 之间的功能连接与 WMS-LM 即时回忆呈显著负相关（r=-0.332，p=0.027）。
结论：吸烟亚组（CN 和 MCI）中 NBM 功能连接的改变提示 NBM 是连接吸烟与认知重要的功能脑区。此外，吸烟 CN 和吸烟 MCI 患者 NBM 功能连接改变模式不同，提示吸烟和 AD 相关的神经病理学沉积可能在不同的认知阶段分别起主导作用。

## PO-102

# Does premotor connectivity reflect stereotyped behavior in ASD children Evidence from resting fMRI study

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Objective Stereotyped behavior relates to one of the most typical characteristics in children with autism spectrum disorders (ASD）.Methods 39 children with ASD and 42 age, sex, and IQ-matched healthy children were recruited. All the 81 subjects performed scaling with behavior scale index and underwent resting-state fMRI scans. After the fMRI data preprocessing, the left and right side premotor were selected as ROI seeds to perform functional connectivity. Results Compared with healthy controls, children with ASD showed significant increased connectivity between the left premotor area and the posterior cingulate cortex, as well as decreased functional connectivity between the left premotor area and the left insula. In addition, a negative linear correlation exists between the connectivity of the left premotor and the insula and the behavioral scores.Conclusion Imbalanced premotor functional connectivity may be one possible mechanism of stereotyped behavior in ASD, representing an attention deficit and/or impaired sensory preception to the external salient stimuli.

## PO-103

# 首发精神分裂症静息态脑白质功能活动及早期药物治疗应答研究

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目的：探究首发未用药精神分裂症（SZ）脑白质的功能活动改变及其与抗精神病药物早期治疗应答的关系。
材料与方法：将 44 例首发未用药 SZ 患者（SZ 组）和 44 例年龄、性别及教育水平匹配的健康对照（HC 组）纳入本研究，对所有受试者均进行了高分辨 T1 加权和静息态功能磁共振扫描，采集患者组的入院阳性与阴性症状量表（PANSS）评分、抗精神病药物治疗情况、出院 PANSS 评分，根据 PANSS 减分率公式定义总分减分率大于 30%为治疗应答。基于 MATLAB，在 DPABI 软件包下根据 JHU ICBM-DTI-81 白质模板计算 48 个感兴趣区（ROI）之间的脑白质功能连接（FC），采用两样本 t 检验比较 SZ 组和 HC 组间 FC 的差异，采用两样本 t 检验比较与 HC 组存在统计学差异的 FC 在 SZ 组的应答组和无应答组间的差异，采用 Pearson 或 Spearman 相关分析对患者组存在统计学差异的 FC 与病程、治疗前后的 PANSS 评分进行相关分析。
结果：SZ 组抗精神病药物治疗应答有 19 例，无应答有 17 例（其中 8 例患者接受了电休克治疗未纳入），治疗时间（16.9±6.0）天，抗精神病药物剂量换算为奥氮平当量（10.7±4.9）mg/d。与 HC 组相比，SZ 组脑白质在 13 个 ROI 间存在 FC 减低（P＜0.05），主要表现在左侧小脑上脚和胼胝体膝部；在 26 个 ROI 间存在 FC 增强（P＜0.05），主要表现在脑桥交叉束，双侧皮质脊髓束以及左侧穹隆/终纹。与无应答组相比，应答组右侧皮质脊髓束和左侧丘脑后辐射异常增强的 FC 较低（t＝－2.435，P＝0.020）。相关性分析结果显示，治疗前的病程与左侧小脑下脚和左侧小脑上脚异常减低的 FC 呈负相关（r＝－0.316，P＝0.036），治疗前的阴性症状评分与左侧小脑上脚和右侧后辐射冠异常减低的 FC 呈负相关（r＝－0.365，P＝0.015），药物治疗后的阳性症状评分与小脑中脚和左侧皮质脊髓束异常增强的 FC 呈正相关（r＝0.351，P＝0.036）。
结论：首发 SZ 患者的脑白质在多个脑区间的功能活动存在减低或增强，为进一步研究本病的病理生理机制提供了证据；早期抗精神病药物治疗后，应答组与无应答组的 FC 存在差异，为临床预测药物治疗效果提供了新思路；异常改变的 FC 与 PANSS 评分具有相关性，提示脑白质的功能异常对患者的临床症状有一定影响。

## PO-104

# 磁共振 DWI 序列 ADC 值在鉴别直肠癌微卫星稳定性和高不稳定性中的应用研究

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**目的** 探讨磁共振 DWI 序列在鉴别直肠癌微卫星稳定性和高不稳定性中的可行性。
**材料与方法** 回顾性分析 78 例经病理证实的直肠癌，所有患者术前均行直肠 MRI 常规扫描序列及 DWI 序列检查。根据病理结果进行分组为微卫星稳定性直肠癌和高不稳定性直肠癌。在 AW Server 2.0 工作站上对 ADC 图像进行肿瘤病灶区域的 ROI 勾画，自动生成 ADC 值，应用 SPSS 软件对两组 ADC 值进行正态分析、独立样本 t 检验以及 ROC 曲线分析。
**结果** 共纳入微卫星稳定性直肠癌（MSS）41 例，微卫星高不稳定性直肠癌（MSI-H）37 例。微卫星高不稳定性直肠癌平均 ADC 值（1.047±0.198×10-3mm2/s）高于微卫星稳定性直肠癌的平均 ADC 值（0.832±0.096×10-3mm2/s）。ADC 值在微卫星稳定性和高不稳定性直肠癌中的差异具有统计学意义（*P*<0.05）。根据 ROC 曲线分析，ADC 值在鉴别直肠癌微卫星稳定性和高不稳定性时的曲线下面积（AUC）值为 0.84。当 ADC 值以 0.880×10-3mm2/s 作为临界值时，其敏感性和特异型分别为 81%和 78%。
**结论** 磁共振 DWI 序列 ADC 值有助于鉴别直肠癌微卫星稳定性和高不稳定性。
**关键词** 直肠癌； 微卫星稳定性； DWI； ADC

## PO-105

# Amygdalar and hippocampal morphometry abnormalities in first-episode schizophrenia using deformation-based shape analysis

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Purpose: To explore amygdalar and hippocampal morphometric abnormalities in terms of both volume and shape in first-episode schizophrenia (FES) patients.

Methods: We recruited 92 patients and 106 healthy control (HC) subjects. Magnetic resonance imaging based automated segmentation was conducted to obtain the amygdalar and hippocampal segmentations. To better identify the key relevant areas in the pathology of FES, each structure was divided into four subregions; CA1, CA2, CA3 combined dentate gyrus for the hippocampus in each hemisphere and basolateral, basomedical, centromedical, and lateral nucleus for the amygdala in each hemisphere. Statistics were therefore computed at all vertices, and p-values were corrected for multiple comparisons by controlling the family-wise error rate (FWER) at a level of 0.05. The statistical significance of a difference between FES and HC was quantified via Fisher's randomization and permutation tests; we used Monte Carlo simulations to generate 10,000 uniformly distributed random permutations.

Results: We observed significant global volume reduction and localized shape atrophy in each of the four structures of interet. The amygdalar shape abnormalities mainly occurred at the basolateral and centromedical subregions, whereas the hippocampal shape abnormalities mainly concenterated on the CA1 and CA2 subregions(left amygdala: $P < 0.0001$, right amygdala: $P < 0.0001$, left hippocampus: $P = 0.0116$, right hippocampus: $P = 0.0229$).

Conclusion: These findings confirm the presence of amygdalar and hippocampal atrophies at an early phase in the pathology of schizophrenia. Therefore, the observed morphometric alterations in those structures in FES may be considered as key factors in the deficits of episodic memory and emotional learning in schizophrenia, which is also keeping in line with general hypotheses.

PO-106

# Ki-67 proliferation status assessment in lung adenocarcinoma using 18F-FDG PET/MR-based monoexponential, biexponential exponential diffusion-weighted imaging and glucose metabolism

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Purpose: To assess the potential of monoexponential and biexponential diffusion-weighted imaging parameters and SUVmax based on 18F-fluorodeoxyglucose positron emission tomography and magnetic resonance imaging systems ($^{18}$F-FDG PET/MR) to assess the proliferative status of Ki-67 in lung adenocarcinoma.
Materials and Methods: This prospective study was approved by the ethics committee and informed consent was obtained from all subjects. The final 58 patients with pathologically confirmed lung adenocarcinoma were included (25 males and 33 females, 62.21±10.41 years old) and underwent $^{18}$F-FDG PET/MR before treatment.The parameters obtained were: maximum standard uptake value (SUVmax), standard apparent diffusion coefficient (sADC), true diffusion coefficient (D), perfusion fraction (f) and perfusion-related diffusion coefficient (D*).We divided the Ki-67 proliferation index of lung adenocarcinoma into high proliferation index (Ki-67 PI ≥ 25%) and low proliferation index (Ki-67 PI < 25%) by summarizing the experience of previous studies. The Mann-Whitney U test was used to distinguish the differences between high and low Ki-67 proliferation status groups. Spearman rank correlation was used to analyze the correlation between all biomarkers and the Ki-67 proliferation index. Receiver-operating characteristic analysis was performed for all parameters. DeLong test was used to compare and analyze whether there was a significant difference in the area under the curve.
Results：There was a positive correlation between SUVmax values and Ki-67 PI (r = 0.568). The correlation between sADC and Ki-67 (r=-0.374, p < 0.01) and the correlation between D values and Ki-67 PI (r = -0.415, p < 0.01) were negative. SUVmax values were significantly higher in the low Ki-67 PI group than in the high Ki-67 PI group (Z = -2.416,p < 0.05), while sADC values (Z = -2.924, p < 0.05) and D values (Z = -3.124, p < 0.05) were significantly higher in the high Ki-67 PI group than in the low Ki-67 PI group. The ROC curve analysis revealed that the maximum area under the AUC curve for D value was 0.754 (95% CI: 0.622 - 0.859), which was significantly larger than the area under the curve for f value (p < 0.05), but the difference was not statistically significant compared to the area under the AUC curve for sADC, SUVmax and D* values (all p ＞ 0.05). In addition, the area under the ROC curve for the sADC value is 0.730 (95% CI: 0.596 - 0.839), which is higher than SUVmax value.
Conclusion：SUVmax, sADC, and D were correlated with Ki-67 PI. The biexponential exponential parameters had a similar diagnostic performance for Ki-67 PI compared to conventional sADC values and SUVmax values.

# PO-107

# 高级别胰腺神经内分泌肿瘤的 MRI 特征与病理对照

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目的 探讨高级别胰腺神经内分泌肿瘤（high-grade pancreatic neuroendocrine neoplasms,HG-pNEN）的 MRI 特征，并与病理对照研究。方法 回顾性收集并分析 2015 年 1 月至 2021 年 1 月于复旦大学附属中山医院行胰腺手术且术后病理确诊为高级别胰腺神经内分泌肿瘤的病例 18 例，术前均行上腹部 MRI 平扫及增强检查，且临床、影像和病理资料完整。参照 2019 年《世界卫生组织消化系统肿瘤分类》标准，依据病理分级将高级别胰腺神经内分泌肿瘤分为胰腺神经内分泌瘤 G3 组（pancreatic neuroendocrine tumor G3,pNET G3）和胰腺神经内分泌癌 G3 组（pancreatic neuroendocrine cancer G3，pNEC G3），分析两组病例的临床及 MRI 影像资料的差异。结果 两组病例性别、年龄、发生部位及有无内分泌功能等差异无统计学意义（P>0.05）。两组病例肿瘤的形状、MRI 平扫信号均质性以及强化峰值差异有统计学意义（P<0.05），肿瘤的大小、边界、DWI、rADC、强化方式、腊肠样强化、肿瘤内血管影、囊变、胰周脂肪浸润、主胰管扩张、淋巴

结转移及肝转移等差异无统计学意义（P>0.05）。结论 高级别胰腺神经内分泌肿瘤具有一定的MRI 特征表现，肿瘤形状、MRI 平扫信号和强化峰值有助于鉴别 pNET G3 和 pNEC G3。

## PO-108

# 慢性下腰腿痛患者动态疼痛连接组的功能连接及其时间变异性的 fMRI 研究

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目的：探讨慢性下腰腿痛(low-back-related leg pain,LBLP)患者组成动态疼痛连接组的几个大脑网络间及网络内的功能连接和时间变异性在低频段和高频段的变化，及其差异脑区的功能连接值与临床评估的关系。
方法：使用静息态功能磁共振成像，分别从静态功能连接（static functional connectivity,sFC）及动态功能连接（dynamic functional connectivity，dFC）两个方面分析典型频段（0.01–0.1 Hz）及五个特定频段(slow 6 至 slow 2)LBLP 患者的功能磁共振数据。对 24 名 LBLP 患者和 23 名健康对照（healthy controls，HCs）进行了扫描及临床评估，并将差异脑区的 sFC 值和 dFC 的变异系数分别与临床参数进行偏相关分析。
结果：（1）在典型频段，1）与 HCs 相比，LBLP 患者突显网络内（右侧颞顶交界-中扣带回，P=0.024）和上行疼痛通路内（左侧初级躯体感觉皮层-后岛叶，P=0.011；左侧次级躯体感觉皮层-后岛叶，P=0.011）存在着功能连接的减低，而网络间的功能连接减低主要是位于突显网络和上行疼痛通路间；2）LBLP 患者突显网络内（右侧颞顶交界-中扣带回，P=0.04）的时间变异性增加，网络间的时间变异性减低也主要是在突显网络和上行疼痛通路间。
（2）在五个特定频段，1）LBLP 在特定亚频段突显网络和上行疼痛通路关键节点间的功能连接既有增加也有减低；2）在 slow 4 频段，突显网络和上行疼痛通路的关键节点间的时间变异性既有增加也有减低；3）偏相关分析发现在特定亚频段（slow 3、slow 4 和 slow 6）突显网络和上行疼痛通路间（中扣带回-左侧初级躯体感觉皮层）的功能连接减低与日本骨科协会下腰痛评定量表亚指标日常活动受限呈正相关。
结论：在 LBLP 患者中，动态疼痛连接组存在频率相关的网络内及网络间交流障碍，选择特定的频率和 dFC 变异性对检测 LBLP 相关的脑活动有潜在的临床价值。

## PO-109

# 磁共振黑血技术在矢旁脑膜瘤术前分型的应用

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目的：探讨磁共振黑血技术在矢旁脑膜瘤术前分型中的应用，术前准确判断矢旁脑膜瘤分型可以为手术策略制定提供可靠参考信息。
材料与方法：对 56 例矢旁脑膜瘤患者术前行增强三维 CUBE T1 检查，所有患者均行脑膜瘤全切、伴或不伴矢状窦重建。两位放射科医生术前分别根据黑血序列对脑膜瘤进行分型，包括 CUBE I 型（脑膜瘤紧贴上矢状窦外侧壁）、CUBE II 型（脑膜瘤侵犯矢状窦一侧壁）、CUBE III 型（脑膜瘤侵犯上矢状窦顶壁）、CUBE IV 型（矢状窦闭塞、伴或不伴对侧壁侵犯），并与手术结果相对照。

结果：增强后 CUBE T1 序列可以为矢旁脑膜瘤术前分型提供可靠依据。观察者间一致性好（κ= 0.831,95％置信区间 0.706-0.955），讨论后的结果与手术结果一致性好（κ= 0.755,95％置信区间 0.602-0.908）。
结论：增强后 CUBE T1 序列可为矢旁脑膜瘤分型提供可靠信息，并且基于黑血序列的 CUBE 新分型较传统 Sindou 分型更为简洁。

PO-110

# Focal white matter microstructural alteration after anthracycline-based systemic treatment for long-term breast cancer survivors: a structural MRI study

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Objective:
Neuropsychological cross-sectional studies and emerging longitudinal work of the breast cancer (BC) long-term survivors have found significant evidence supporting the side effect of chemotherapy on cognitive functioning. However, previous neuroimaging studies that assessed neurotoxicity and cognitive impairment after systematic treatment of BC patients received inconsistent chemotherapy and diverse hormone therapy regimens, which were unable to assess the damage to the brain structure caused by particular systematic treatment regimen. Anthracycline-based systemic treatment (AST) is a standard approach for adjuvant treatment for early BC patients based on the survival advantage and improved outcomes. We aim to investigate the detrimental effects of the anthracycline-based systemic treatment (AST) regimen (epirubicin and cyclophosphamide + docetaxel + tamoxifen) on brain grey matter (GM) and white matter (WM) microstructural alteration with structural MRI in long-term breast cancer (BC) survivors.
Materials and Methods
Thirty-six BC long-term survivors had received the AST regimen (AST group) and 40 healthy controls (HC group) participated in this study. Voxel-based morphometry (VBM) were used to evaluated the whole-brain voxel-wise GM volume, while DTI technique with tract‐based spatial statistics (TBSS) analysis were used to evaluated whole-brain WM microstructural alteration in BC survivors. Partial least squares regression (PLSR) was used to evaluate the relationship between the cognitive impairment and brain microstructural alteration.
Results:
Compared with HC group, The AST group demonstrated lower verbal working memory, attention, and executive function. The AST group showed significantly lower fractional anisotropy (FA), higher radial diffusivity (RD) and lower axial diffusivity (AD) in multiple brain regions compared with HC group. Specifically, the overlap of lower FA and higher RD was found in the body of corpus callosum (CC) and bilateral superior corona radiata (SCR). The overlap of lower FA and AD was found in the body of CC and right SCR. There was no significant difference in GM volume between-group. The PLSR results suggest the overlap regions of the lower FA and higher RD may play an important role in executive dysfunction (FA: $F = 47.585$, $p<0.001$, $R2=0.812$; RD: $F = 44.725$, $p<0.001$, $R2=0.803$).
Conclusion:
Our results suggest that microstructural WM abnormalities in the AST regimen-exposed brain may underlie cognitive impairment in long-term BC survivors.

PO-111

# 多 b 值表观扩散系数直方图分析预测乳腺癌分子分型及预后因素研究

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**目的** 探讨多 b 值表观扩散系数（apparent diffusion coefficient，ADC）直方图定量参数在预测乳腺癌分子分型及预后相关因素的价值。**材料与方法** 回顾性分析本院 2018 年 1 月至 2020 年 12 月术前行乳腺 MRI 检查且经手术病理证实为浸润性乳腺癌的 83 例患者。通过对 b 值为 200、600、1000s/mm$^2$时基于肿瘤全域的 ADC 直方图参数分析，得到 ADC 最小值（$ADC_{min}$）、ADC 最大值（$ADC_{max}$）、ADC 平均值（$ADC_{mean}$）、ADC 中位数（$ADC_{median}$）、$ADC_{10\%}$、$ADC_{90\%}$、偏度及峰度。采用 Spearman 相关分析去除特征冗余，应用 Logistic 回归构建乳腺癌分子分型及预后因素的预测模型。采用受试者工作特征曲线（receiver operating characteristic curve，ROC）评价模型预测能力，并使用 DeLong 检验比较模型间的效能。**结果** 对于 LuminalA 型与非 LuminalA 型乳腺癌，b 值为 200s/mm$^2$及三个 b 值联合时建立的模型诊断效能最高（AUC=0.887、0.905）；对于 LuminalB 型与非 LuminalB 型乳腺癌，三个 b 值联合时建立的模型诊断效能最高（AUC=0.747）；对于 HER2 过表达型与非 HER2 过表达型乳腺癌，b 值为 1000s/mm$^2$时建立的模型诊断效能最低（AUC=0.500）；对于组织学分级的预测，b 值为 600s/mm$^2$时建立的模型较 b 值为 1000s/mm$^2$时所建立的模型诊断效能高（AUC=0.902）。对于 KI67 表达的预测，三个 b 值联合时建立的模型诊断效能最高（AUC=0.947）。**结论** 基于多 b 值 ADC 直方图参数及 Logistic 回归分析构建的预测模型对乳腺癌的分子分型及部分预后因素具有良好的鉴别价值，综合多 b 值的 ADC 直方图参数构建的模型较单 b 值模型具有更高的诊断价值。

PO-112

# 肥厚型心肌病 T1mapping 与特征追踪的相关性分析

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摘要 目的 探究肥厚型心肌病 T1mapping 与特征追踪的相关性 方法
回顾性分析 2016 年 1 月-2021 年 6 月于云南省第一人民医院住院治疗的肥厚型心肌病患者的临床资料，按照是否出现分析钆对比剂延迟增强（LGE)分为两组病人，分析两组病人 T1mapping 与特征追踪的相关性。结果 本研究共收集到近 5 年 6 个月内入住且具有完整临床资料的肥厚型心肌病患者 86 例，其 HCM 患者男性 68 例，女性 18 例，年龄 48.2±19.5 岁，LGE（+）患者 59 例（68.6%），LGE%为 31.5±13.7%，年龄 41.4±15.2 岁，NYHAⅢ-Ⅳ级患者 36 例（61%），不明原因晕厥 32 例(54.2%），呼吸困难 37 例（62.7%），LGE（-）组患者 27 例（31.4%），年龄 50.7±17.1 岁，LGE（+）组患者年龄更小，NYHAⅢ-Ⅳ级比例更高，舒张末期最大室壁厚度更大，左心室质量指数更大，出现不明原因晕厥和呼吸困难更多（p 均＜0.05），两组患者的血清 NT-proBNP 与 CTnI 值具有统计学差异。两组患者的纵向应变（Llongitudinal Sstrain,，LS）、环周应变（cCircumfrential Sstrain，,CS）、及径向（radial）应变（rRadial sStrain，,RS）和以及应变率均具有统计学差异（p＜0.05）。LGE（+）组患者增强后 T1 值较 LGE（-）组患者更大[（893.23±165.42）ms vs （765.71±103.40）ms，p＝0.027]、LGE（+）患者与 LGE（-）ECV 值患者有统计学差异[（0.49±0.06 vs 0.24±0.07）ms，p＝0.014]，增强前 T1 值无统计学差异。LGE（+）组患者中整体纵向应变（GLS）与左心室质量指数、舒张末期最大室壁厚度、LGE%、

增强后 T1 值、ECV 具有明显相关性（分别为，r=0.418，P=0.008；r=0.711，P＝0.021；r=0.621，P= 0.015；r＝0.372，p＝0.020；r＝0.583，p＝0.010）。LGE（-）组患者中 GLS 与 ECV 相关（r=0.518，P=0.031）。两组患者中 GLS 与左心室射血分数、增强前 T1 值无确切关系。结论 HCM 患者的心肌增强后 T1 值和 ECV 值增高，HCM 患者 LGE（+）组 GLS 降低，LGE（+）组 GLS 与左心室质量指数、舒张末期最大室壁厚度、LGE%、增强后 T1 值、ECV 值具有明显相关性。

## PO-113

# 透明细胞可能性评分（ccLS）在鉴别肾脏上皮样血管平滑肌脂肪瘤与肾透明细胞癌中的价值

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**目的** 基于 mpMRI 探讨透明细胞可能性评分（ccLS）在鉴别肾脏上皮样血管平滑肌脂肪瘤(EAML)与肾透明细胞癌（ccRCC）中的价值。
**材料与方法** 回顾性分析解放军总医院第一医学中心 2010 年 6 月至 2021 年 5 月间经病理证实 23 例肾脏上皮样血管平滑肌脂肪瘤(26 个肿瘤)和 26 例肾透明细胞癌（26 个肿瘤）患者的临床资料和 MRI 检查资料。两种疾病的临床资料利用两独立样本 t 检验比较两组值之间的差异。采用 ccLS 进行评分，ccLS≤2，诊断为 EAML；ccLS≥4，诊断为 ccRCC，以病理结果为金标准，计算两组准确度、灵敏度、特异度、阳性预测值（PPV）和阴性预测值（NPV），两种疾病的 ccLS 利用卡方检验（Phi and Cramer's V）比较两组值之间的差异。以最大径 4cm 为界值重新划分组别，利用卡方检验（Phi and Cramer's V）比较两组值之间的差异。
**结果** 49 例患者共 52 个肿瘤（1:1），EAML 组男 10 例（43.5%），女 13 例（56.5%），平均年龄 46±9.96，ccRCC 组男 20 例（76.9%），女 6 例（23.1%），平均年龄 52.85±8.71，差异有统计学意义（P=0.004，P=0.002）。对 EAML 诊断的汇总分析显示，当 ccLS≤2 时，诊断的准确度 85%，灵敏度 69%，特异度 100%，阳性预测值 100%，阴性预测值 79%；当 ccLS≥4 时，诊断的准确度 15%，灵敏度 19%，特异度 12%，阳性预测值 18%，阴性预测值 12%。EAML 的阳性预测值（PPV）随 ccLS 分值增加而降低[ccLS1-2：100％（18/18），ccLS3：50％（3/6），ccLS4-5：18％（5/28）]，ccRCC 则相反，差异有统计学意义（P<0.05）。不同最大径的 EAML 与 ccRCC 的 ccLS 差异无统计学意义（P=0.833）。
**结论** 基于 mpMRI 的 ccLS 有助于 EAML 与 ccRCC 的鉴别诊断，但部分表现不典型的病灶（ccLS=3）仍需穿刺活检进一步明确诊断。

## PO-114

# 肿瘤坏死因子-α 拮抗剂治疗中轴型脊柱关节病疗效监测-基于 MRI 生化成像技术的初步研究

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目的：探讨运用 MRI 生化成像技术监测肿瘤坏死因子-α 拮抗剂治疗中轴型脊柱关节病(axial spondyloarthritis,SpA)疗效的可行性，以期对 SpA 治疗监测提供有效的定量指标。资料与方法：纳

入 114 例研究对象，其中 15 例排除 SpA 诊断的正常骶髂关节受检者为对照组，99 例经临床确诊的 SpA 患者为病例组，病例组中 20 例患者经过系统的 TNF-α 拮抗剂治疗为治疗组。病例组中依据强直性脊柱炎疾病活动度评分(ankylosing spondylitis disease activity score，ASDAS)分为活动组和非活动组，活动组中分为中度活动组、活动度提高组、活动度非常高组三个亚组；治疗组根据治疗的不同时间分为治疗前组、治疗 3 周组、治疗 6 周组和治疗 12 周组。所有对象均行磁共振生化成像技术（T1-mapping、T2-mapping、T2*-mapping）检查，比较对照组、病例组以及病例组各亚组之间骶髂关节软骨下骨髓区域 T1-mapping、T2-mapping、T2*-mapping 值的差异，ROC 曲线分析诊断效能，运用诊断效能好的定量指标对治疗组不同治疗周期的疗效进行监测。结果：1、各组骶髂关节骶侧、髂侧关节软骨下骨髓区域 3 种弛豫时间值的差异均无明显统计学差异，均 P>0.05；2、与对照组相比，病例组骶髂关节软骨下骨髓区域 3 种不同的弛豫时间值都表现为不同程度的上升，其中 T1-mapping 值具有最佳的诊断效能，且对活动度提高组和活动度非常高组具有很好的诊断效能；3、治疗组中不同治疗周期骶髂关节软骨下骨髓区域 T1-mapping 值的下降率对疗效监测具有较好的效能。结论：磁共振生化成像技术可以评估 SpA 骶髂关节软骨下骨髓水肿改变，量化诊断上优先选择 T1-mapping 技术，T1-mapping 值对强直性脊柱炎骶髂关节软骨下骨髓水肿的诊断效能优于 T2*-mapping、T2-mapping 值，能对治疗过程中的炎症改变提供定量监测，有益于临床个体化治疗、及时调整治疗方案。

# PO-115

# 探究定量磁化率图像纹理特征与帕金森患者 DBS 手术疗效的相关性

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目的
对帕金森病（Parkinson’s disease，PD）患者的高分辨定量磁化率图像进行纹理分析以探究图像纹理特征与脑深部电刺激（deep brain stimulation，DBS）手术疗效之间的关系。
材料与方法
本研究共纳入 31 例行双侧 DBS 手术的 PD 患者，手术前在 3T 磁共振成像系统（GE Signa HDxt）上使用双极读出梯度的多回波梯度回波序列扫描获取模图和相位图，其体素大小为 0.9 mm×0.9 mm×0.9 mm3。利用 MEDI toolbox 工具箱重建得到定量磁化率图像，在定量磁化率图像上，手动勾画出黑质以及丘脑底核。3D 纹理参数采用 MaZda 软件进行计算分析，一阶纹理特征为磁化率平均值，二阶纹理参数包括角二阶矩、对比度、相关性、方差、反向不同矩、熵、熵和、熵差、平均和、方差和以及平方和共 11 个特征。
手术前，使用 UPDRSⅢ评估患者的运动症状。手术后，在关闭脉冲发生器状态下，术后关期 UPDRSⅢ评分记为术后基线评分。随后开启脉冲发生器进行程控，调整刺激参数至患者达到最佳状态，进行 UPDRSⅢ评分，记为术后关期开机评分，基于上述两个参数计算得到患者的术后关期开机改善率。采用皮尔逊相关分析评价纹理特征参数与患者术前运动症状评分以及 DBS 术后改善率之间的相关性。
结果
黑质和丘脑底核磁化率图的一阶纹理参数与患者术前 UPDRSⅢ运动症状评分（黑质：r=0.159，p=0.394；丘脑底核：r=0.194，p=0.295）或手术改善率（黑质：r=0.183，p=0.325；丘脑底核：r=-0.011，p=0.954）之间未见线性相关。在黑质磁化率图中，二阶纹理参数平方和（r=0.416，p=0.02）、方差和（r=0.358，p=0.048）与患者术前 UPDRSⅢ运动症状评分之间呈线性相关；二阶纹理参数角二阶矩（r=-0.417，p=0.02）、对比度（r=-0.361，p=0.046）与手术改善率呈负相

关，相关性（r=0.365，p=0.043）、平方和（r=0.414，p=0.02）、方差和（r=0.390，p=0.03）、熵和（r=0.389，p=0.031）、熵（r=0.37，p=0.04）与手术改善率呈正相关。在丘脑底核磁化率图中，二阶纹理参数角二阶矩（r=-0.372，p=0.039）、平方和（r=-0.371，p=0.04）与手术改善率呈负相关，熵和（r=0.413，p=0.021）、熵（r=0.411，p=0.022）与手术改善率呈正相关。
结论
高分辨定量磁化率图像的二阶纹理特征可为 PD 患者 DBS 手术预后的疗效预期提供参考指标。

PO-116

# 基于多参数 MRI 的肾脏混合上皮-间质肿瘤 2019 版 Bosniak 分类评估

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目的：
对比 2005 版 Bosniak 分类标准，探讨 2019 版 Bosniak 分类标准评估肾脏混合上皮-间质肿瘤的效能。
方法：
回顾性收集中国人民解放军总医院第一医学中心放射诊断科 2009 年 1 月至 2020 年 8 月期间病理结果诊断为肾脏混合上皮-间质肿瘤家族同时符合 2019 版 Bosniak 分类的肾脏囊性病变共 14 例。所有病例均由两位泌尿生殖方向放射科医生（经过正规、系统的 Bosniak 评估培训）分别应用 2005 版及 2019 版 Bonsiak 分类标准对所有病变进行分类评估，当意见不一致时则由第三位泌尿生殖方向放射科专家进行共同会诊，最终三者达成一致。将所有类别划分为低级别（I、II、IIF 类）及高级别（III、IV 类），最后，统计并分析混合上皮-间质肿瘤在各类别中的分布情况。
结果：
本次研究共纳入肾脏混合上皮-间质肿瘤 14 例（共 14 个病灶），平均年龄 37.14 岁。其中男性 10 例（71.4%），女性 4 例（28.6%）。2005 版 Bosniak 分类结果显示： Bosniak I 类 0 例；Bosniak II 类 0 例；Bosniak IIF 类 1 例（7.1%）； Bosniak III 类 12 例（85.7%）；Bosniak IV 类 1 例（7.1%）；低级别 13 例， 高级别 1 例，诊断准确率 7.1%。2019 版 Bosniak 分类结果显示：Bosniak I 类 0 例；Bosniak II 类 1 例（7.1%）；Bosniak IIF 类 10 例（71.4%）； Bosniak III 类 2 例（14.3%）；Bosniak IV 类 1 例（7.1%）；低级别 11 例， 高级别 3 例，诊断准确率 78.6%。所有肾脏混合上皮-间质肿瘤中 4 例（28.6%）在 2005 版和 2019 版 Bosniak 分类标准中评估结果一致（IIF 类 1 例，III 类 2 例，IV 类 1 例），10 例（71.4%）在 2019 版 Bosniak 分类标准中降级，其中 9 例（90%）从 III 类降为 IIF 类，1 例（10%）从 III 类降为 II 类。
结论：
相较于 2005 版 Bosniak 分类标准，2019 版 Bonsiak 分类系统提高了诊断肾脏混合上皮间质肿瘤为良性肿瘤的准确性，进而有助于避免过多的良性肿瘤被过度诊治。

PO-117

# Development and validation of nomogram for prediction of pathologic response after neoadjuvant chemotherapy in

# triple-negative breast cancer using pretreatment Dynamic Contrast-enhanced MRI

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Purpose: To develop a nomogram based on pretreatment dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) to predict pathologic complete response (pCR) to neoadjuvant chemotherapy (NAC) in patients with triple-negative breast cancer (TNBC).
Methods: A total of 108 female patients with TNBC who underwent completed neoadjuvant chemotherapy followed by surgery between January 2017 and October 2020 were enrolled. The patients were divided into the primary cohort (n=87) and the validation cohort (n=21). The pretreatment DCE-MRI and clinicopathological features were reviewed and recorded. Univariate analysis and multivariate logistic regression analyses were used to determine the independent predictors of pCR in primary cohort. A nomogram was developed based on the predictors, and its predictive performance was evaluated by the area under the curve (AUC) of receiver operating characteristics (ROC). The validation cohort was used to test the predictive model.
Results: Tumor volume measured on DCE-MRI, time to peak (TTP), and androgen receptor (AR) status was identified as an independent predictor of pCR. The AUC of the nomogram was 0.84 (95% CI: 0.75-0.93) and 0.79 (95% CI: 0.59-0.99) in the primary cohort and validation cohort, respectively.
Conclusion: Pretreatment DCE-MRI could predict pCR to NAC in TNBC. The nomogram can be used to predict the probability of pCR and might apply for individualized treatment approach-making.

## PO-118

# SyMRI 技术研究脊柱结构改变对退行性腰椎滑脱症的影响

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目的：采用合成磁共振成像（synthetic magnetic resonance imaging，SyMRI）技术研究退行性腰椎滑脱症（degenerative lumbar spondylolisthesis，DLS）患者椎旁肌肉、椎间盘及椎体的改变，并分析椎旁肌肉、椎间盘及椎体的定量值与滑脱程度之间的关系。
方法：本研究收集来自山西医科大学第二临床医院确诊为 DLS 的患者，并纳入同期在本院性别、年龄及身体质量指数相匹配的健康体检者。所有参与者均行腰椎 SyMRI 检查及腰椎侧位 X 线片，在所得图像上观测所有参与者的椎间盘、椎体和双侧腰大肌、竖脊肌、多裂肌的 T1 值、T2 值、PD 值、椎体相对缘是否出现 Modic 改变以及 DLS 患者的滑脱比。采用独立样本 *t* 检验或 Mann-Whitney *U* 检验分析 DLS 患者与对照组椎旁肌肉、椎间盘及椎体的 T1 值、T2 值、PD 值差异；采用 *pearson* 或 *Spearman* 相关性检验分析 DLS 患者椎旁肌肉、椎间盘及椎体的 T1 值、T2 值、PD 值与滑脱比的相关性；采用多因素 Logistic 回归模型分析 DLS 的独立影响因素。$P < 0.05$ 差异有统计学意义。
结果：最终纳入分析研究的 DLS 患者 41 例，男 10 例，女 31 例，年龄范围为 47-81 岁。对照组选取 41 例性别、年龄及身体质量指数相匹配的健康体检者。82 例参与者椎旁肌肉各参数的研究值为左、右肌肉的平均值。DLS 患者多裂肌的 T1 值小于对照组（$U$=565.00，$P$=0.01），多裂肌的 T2 值大于对照组（$t$=2.57，$P$=0.01）；而 DLS 患者与对照组相比，多裂肌的 PD 值，腰大肌、竖脊肌、椎间盘和椎体的 T1 值、T2 值、PD 值差异均无统计学意义（$P$ 均>0.05）。DLS 患者组的滑脱比与多裂肌的 T1 值存在中等程度负相关性（$r$ =-0.33，$P$ =0.04），与多裂肌的 T2 值存在中等程度正相关性（$r$ =0.48，$P$ =0.001），而与多裂肌的 PD 值，腰大肌、竖脊肌、椎间盘和椎体的

T1 值、T2 值、PD 值均无相关性（*P* 均>0.05）。将性别、年龄、滑脱椎相对缘 Modic 改变、多裂肌 T1 值及多裂肌 T2 值纳入多因素 Logistic 回归分析显示多裂肌 T2 值是 DLS 的独立影响因素。结论：SyMRI 技术定量参数值能反映 DLS 患者脊柱相关解剖结构变化的特点。DLS 患者的滑脱比与多裂肌 T1 值、T2 值相关，T2 值是 DLS 的独立影响因素；多裂肌 SyMRI 技术定量参数值变化可能与脂肪浸润相关。

PO-119

## Monoexponential, Biexponential, and Stretched-Exponential Diffusion Models in Differentiating malignant and benign lesions in the gallbladder

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Objectives: To primarily evaluate the diagnostic performance of the mono-exponential, bi-exponential, and stretched-exponential diffusion weighted imaging (DWI) models in differentiating benign and malignant gallbladder lesions.
Materials and Methods: 25 patients with gallbladder carcinoma (GBC) and 29 patients with benign gallbladder lesions were retrospectively enrolled and underwent multi-b value DWI scan. The multimodel parameters of apparent diffusion coefficient (ADC), true diffusion coefficient (D), pseudo-diffusion coefficient (D*), perfusion fraction (f) distributed diffusion coefficient (DDC), and diffusion heterogeneity (a) were obtained and compared between the GBC and benign gallbladder lesions using the independent sample t test and the Mann-Whitney U test. The diagnostic performance was evaluated using receiver operating characteristic (ROC) analysis.
Results: ADC, D, and DDC values of the GBC were significantly lower than those of benign gallbladder lesions (all $P < 0.001$). D*, f, and a showed no statistically significant differences between the two groups. D showed a higher AUC of 0.832, followed by ADC and DDC (0.822 and 0.820, respectively), although none of these differences reached statistical significance (P=0.836 between D and ADC; P=0.837, between D and DDC; P=0.954 between ADC and DDC). D had the highest sensitivity of 92.0%, with an optimum threshold of 1.38.
Conclusion: the diffusion-related parameters (ADC, D, and DDC) from monoexponential, IVIM, and stretched-exponential models could discriminate GBC from benign gallbladder lesion, D may be the most promising parameter.

PO-120

## Enlarged perivascular spaces in veterans with traumatic brain injury: Association with CSF p-tau and Aβ

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shanghaijiaotongdaxuefushudiliurenminyiyuan

Objective: To investigate the association between MRI-visible enlarged perivascular spaces (EPVS) and CSF tau and Aβ in veterans with traumatic brain injury (TBI).
Methods: We included 61 Vietnam War veterans with a history of TBI and 53 non-TBI Vietnam War veterans from the Department of Defense Alzheimer's Disease Neuroimaging Initiative (ADNI) database. All the subjects had brain MRI, CSF tau, and CSF Aβ examinations. EPVS

were rated on MRI using a five-point scale in the basal ganglia (BG-EPVS) and the centrum semiovale (CSO-EPVS). Logistic regression was used to evaluate the association between CSF tau, CSF Aβ and high degree of BG-EPVS and CSO-EPVS.
Results: High degree of CSO-EPVS was more common in Vietnam War veterans with a history of TBI than non-TBI subjects (P=0.003). Among all the subjects, severe PWMH (P=0.001) and DWMH (P=0.001) were more common in subjects with a high degree of BG-EPVS than a low degree of BG-EPVS subjects. Subjects with high degree of CSO-EPVS had higher CSF p-tau (P=0.001) than low degree of CSO-EPVS subjects. In logistic regression analysis, high degree of BG-EPVS was associated with age (OR 1.21, 95% CI 1.07, 1.36) and severe DWMH (OR 3.76, 95% CI 1.45, 9.77). High degree of CSO-EPVS was associated with a history of TBI (OR 4.01, 95% CI 1.66, 9.65) and CSF p-tau (OR 1.09, 95% CI 1.03, 1.17). CSF p-tau was significantly associated with high degree of CSO-EPVS even adjusting for clinical characteristics and other neuroimaing markers in the whole subjects and TBI group but not non-TBI group
Conclusions: High degree of CSO-EPVS was more common in Vietnam War veterans subjects with a history of TBI and was associated with CSF pt-tau.

PO-121

## Alterations in intrinsic functional networks in hypertensive patients：A resting-state functional magnetic resonance imaging study

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Aims: The aim of this research was to investigate the alterations in functional brain networks and to assess the relationship between depressive symptoms and topological network changes in hypertensive patients.
Methods: Twenty- eight hypertensive patients and thirty- six matched healthy controls (HCs) were enrolled. All participants were examined by resting-state functional magnetic resonance imaging. Graph theoretical analysis methods was used to analyze brain network topological properties.
Results: In nodal metrics analyses, the left olfactory cortex (OLF.L), right media superior frontal gyrus (SFGmed.R), right middle occipital gyrus (MOG.R), right fusiform gyrus (FFG.R), right pallidum (PAL.R) of nodal clustering coefficient were surviving in the FDR correction for multiple comparisons. Meanwhile, the nodal clustering coefficient of the left olfactory cortex and right superior frontal gyrus were positively and negatively correlated with the HAMD scores in hypertensive group respectively.
Conclusions: These results suggest that hypertension is associated with disruptions in the topological organization of functional brain networks, mainly involved the olfactory cortex and superior frontal gyrus and may advance our current understanding of the pathophysiological mechanisms underlying hypertension.

PO-122

## Influence of sleep disruption on brain networks in prodromal and clinical Alzheimer's disease

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Introduction: Alzheimer's disease (AD) is a neurodegenerative disorder associated with large-scale brain structural and functional network dysfunctions. Using intrinsic functional connectivity approaches that measure correlated spontaneous activity between brain regions, several intrinsic connectivity network have been consistently identified in healthy individuals and demonstrated to show aberrant changes in AD and its prodrome. Of these, decreased functional connectivity in the DMN is the most prominent in patients with AD. More recently, aberrant loss of functional connectivity in other intrinsic connectivity networks have also been documented in AD patients, such as executive control network (ECN) .

On the other side, structural brain networks have been characterized by analyzing the co-varying GM volume or cortical thickness between different brain regions across individuals. SCN derived using this technique have been shown to corroborate with intrinsic connectivity networks in both health and disease. Using SCN, several studies demonstrated convergent intrinsic connectivity network and structural covariance network patterns in healthy individuals, which mirrored GM atrophy patterns in distinct neurodegenerative disorders. Given that cure lifestyle factors might reduce or increase the risk of developing dementia, clinicians are paying more attention to modifying the reversible high-risk factors to delay the onset and progression of AD. However, few studies have examined structural network changes in Alzheimer's disease patients that have comorbid sleep disturbance.

In view of this gap, our study sought to use structural covariance approaches to compare large-scale brain network changes between preclinical, prodromal and clinical AD patients with and without sleep disturbance. We focused particularly on three high-order cognitive networks, DMN and ECN. Given the proposed additive effects of AD and sleep disturbance on cognitive decline, we predict that AD patients with and without sleep disturbance would feature divergent connectivity changes across the networks. Specifically, given the same clinical severity, AD patients with sleep impairment would feature greater sleep-related changes in the ECN and SN, as well as less AD-related changes in the DMN than those without sleep disorder.

Methods:
Participants from 7 groups [AD with poor sleep (AD + PS), AD with normal sleep (AD + NS), MCI with poor sleep (MCI + PS), MCI with normal sleep (MCI + NS), preclinical AD with poor sleep (preclinical AD + PS), preclinical AD with normal sleep (preclinical AD + NS), and healthy controls without amyloid positive] were selected. MRI data were acquired in 3T scanners. Briefly, the ADNI protocol includes T1-weighted acquisition based on a sagittal volumetric magnetization-prepared rapid gradient echo sequence collected from a variety of MR systems with protocols optimized for each type of scanner. Representative imaging parameters were as follows: repetition time (TR) =2300 ms; echo time (TE) =3 ms; within plane FOV = 256 × 256 mm2; voxel size = 1.1 × 1.1×1.2 mm3; flip angle = 9° or 11°.

To investigate the SCNs, we chose regions of interest (ROIs) as previously: left posterior cingulate cortex (PCC, MNI coordinates: −2, −36, 35) and right dorsolateral prefrontal cortex (DLPFC, MNI coordinates: 44, 36, 20) , anchoring DMN and ECN respectively. To achieve SCN t-maps, we performed the general linear analysis on modulated GM images. Specifically, we extracted the GM volume from a 4-mm radius sphere around those coordinates on modulated images. Then, we performed four separate correlation analysis by entering the GM volumes of each ROI as a regressor and the total intracranial volume, gender, age, and education as covariates.

Both structural covariance networks featured divergent connectivity change between normal sleep and poor sleep AD patient groups. Specifically, in the DMN, preclinical AD-NS had greater structural association in left precentral gyrus relative to controls; MCI-NS patients showed no change in the structural association of the DMN compared to controls; while AD-NS patients featured greater structural association in left precuneus compared to controls. On the other hand, preclinical AD-PS had greater structural association in right posterior cingulum; MCI-PS patients

showed greater structural association in right frontal superior gyrus than controls while AD-PS patients featured less structural association in left parahippocampus gyrus than controls. In agreement with these findings, structural association decreases in right superior parietal gyrus was also found in AD + PS compared to AD + NS patients.

Results and Discussion:
Regarding ECN, patients of preclinical AD-NS and MCI-NS showed no change in the structural association of the ECN compared to controls; In contrast, AD-NS patients showed increased structural association in left middle frontal gyrus and left precuneus compared to controls. On the other hand, no change in the structural association of the ECN was found in MCI + PS patients and preclinical AD. However, AD-PS patients showed decreased structural association in right supplementary motor area compared to controls, Similarly, AD-PS patients had decreased structural association in the left paracentral lobule and right precuneus compared to AD-NS patients; while MCI + PS patients had increased structural association in the left frontal medial ORB than MCI + NS patients.

Conclusively, emerging evidence suggests that sleep disturbance may precede dementia onset and exacerbate cognitive symptoms. Understanding the underlying neural mechanism of the sleep disturbance interacting with AD may shed light on future clinical interventions. there is still a lack of in vivo study that aims to tackle the question of how sleep disturbances influence brain function in AD subjects.

## PO-123
## 心脏磁共振成像对去势雌性大鼠阿霉素早期心肌毒性的研究

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目的：心脏磁共振(CMR)成像对阿霉素(DOX)诱导的卵巢切除大鼠早期心肌毒性的影像研究。方法：采用 6-8 周双侧卵巢切除雌性 SD 大鼠,随机分为阿霉素高剂量组（高剂量组）、阿霉素低剂量组（低剂量组）、卵巢切除组、假手术组,每组 12 只,尾静脉注射阿霉素建立心肌病模型（高剂量组 2.5mgkg-1，低剂量组 1.5mgkg-1，每周 1 次，共 6 周），其余两组注射生理盐水作为对照。心脏磁共振扫描分别在术后一周、每周打药后及给药结束后的每两周进行，共 10 次，获取左心室射血分数（LVEF）、左心室整体径向应变（LVGRS）、左心室整体周向应变（LVGCS）、左心室整体纵向应变（LVGLS）和左心室标准化心肌 T2 值。扫描完成后处死大鼠取出心脏标本进行组织病理检查。结果：与卵巢切除组相比,假手术组无统计学意义，而高剂量组和低剂量组的 LVEF 分别在第 8 周、第 12 周开始降低（P<0.05），LVGRS、LVGCS、LVGLS 分别在第 6 周、第 8 周开始降低（P<0.05），左心室标准化心肌 T2 值分别在第 6 周、第 8 周达到峰值（P<0.05）；心脏组织病理学显示卵巢切除组和假手术组心肌细胞未见明显异常，高剂量和低剂量组大鼠心肌细胞肥大、排列紊乱、溶解坏死消失，被增生的结缔组织取代，炎性细胞浸润，局部心肌间质纤维化明显。结论：心脏磁共振成像可以对阿霉素诱导的卵巢切除大鼠心肌毒性进行的初步评估。

## PO-124
## Increased ventromedial and dorsomedial prefrontal cortex connectivity of depression vulnerability and relapse

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**Objective:** Major depressive disorder (MDD) is a highly prevalent mood disorder, characterized by depressed mood, reduced capabilities to concentrate, impaired cognition, as well as a high risk of relapse. Unaffected siblings who have high risks for MDD development and yet without clinical symptoms may be helpful for understanding the neural mechanisms of MDD traits. Here, we examine the intrinsic brain activity and functional connectivity (FC) in MDD patients at remitted state, unaffected siblings and healthy controls so as to clarify the neural mechanisms of MDD traits.
**Methods:** We investigated both regional fluctuation and inter-regional synchronization in 31 fully remitted MDD patients, 29 unaffected siblings and 43 age, gender, educational level matched healthy controls using resting-state functional magnetic resonance imaging (rs-fMRI). The 17-item Hamilton Depression Rating Scale (HAMD) and neurocognitive scales were performed. Fractional amplitude of low-frequency fluctuation (fALFF) and FC strength were investigated.
**Results:** Compared with healthy control group, patients with remitted MDD and unaffected siblings showed increased fALFF in the left dorsomedial prefrontal cortex (dmPFC) and increased FC between the left dmPFC and the right ventromedial prefrontal cortex (vmPFC). In addition, a negative correlation was observed between the fALFF value in the left dmPFC and the speed of Trail Making Test (TMT, both A and B) in the remitted MDD patients. Higher vmPFC-dmPFC FC was positively correlated with Wisconsin Card Sorting Test total correct, and negatively correlated with WCST random errors.
**Conclusions:** In the absence of clinical symptoms, individuals with remitted MDD and unaffected siblings showed increased fALFF in left dmPFC as well as the vmPFC-dmPFC connectivity. These results suggest a specific trait abnormality in the default-mode network associated with vulnerability to MDD, which may have implications for developing effective therapies using this network as a target.

PO-125

# 颈动脉易损斑块 MRI 高危特征及临床危险因素与伴发急性脑梗死相关分析

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【摘 要】目的 探讨高分辨 MRI 颈动脉易损斑块高危特征及临床危险因素与伴发急性脑梗死相关分析。方法对 30 例 MR 诊断的颈动脉易损斑块患者,根据是否发生同侧急性脑梗死分成两组，对临床危险因素及斑块体积、斑块内坏死脂质核心、斑块内出血、溃疡等 MRI 高危特征进行统计，做二者相关性分析。结 果 30 例患者中共计发现 34 处颈动脉斑块，其中 15 例患者（17 处斑块）伴同侧急性脑梗死灶，两组间患者年龄、性别、吸烟、冠心病、血清 TC、TG 及 LDL 等差异均无统计学意义（P＞0.05）；颈动脉易损斑块体积在伴急性脑梗死发生组大于无急性脑梗死组，二者之间具有显著性差异（F=13.873，P＜0.05），颈动脉易损斑块中大的坏死脂质核心、斑块内出血、溃疡及三者同时出现频次与有无伴发急性脑梗死频次有统计学意义（P＜0.05），但易损斑块中大的坏死脂质核心、斑块内出血及溃疡两两比较，与有无伴发急性脑梗死频次均无统计学意义（P＞0.05）。结 论 颈动脉易损斑块的斑块体积和同时出现 IPH、LRNC 及溃疡在检查时伴发急性脑梗死中更具高风险因素。

PO-126

# T2/FLAIR 错配征的定量参数在评价较低级别胶质瘤分子分型的诊断价值

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目的：探讨 $T_2$/FLAIR 错配征在预测较低级别胶质瘤分子分型中的诊断价值，并提取肿瘤区整体特征（如瘤周水肿、肿瘤边缘、强化）和错配区影像参数（如相对错配面积、$T_2$/FLAIR 错配率）进行定量分析，进一步明确错配征的图像识别标准，提高该磁共振征象在预测较低级别胶质瘤分子亚型中的诊断效能。
材料与方法：回顾性分析 2017 年 1 月~2020 年 10 月之间在大坪医院经术后病理证实为 WHO Ⅱ-Ⅲ 级、且具有 $T_2$/FLAIR 错配征（整个瘤体或瘤体部分区域在 T2WI 呈高信号，FLAIR 呈相对低信号，错配区域不包括明显囊变、坏死及水肿）的 19 例较低级别胶质瘤患者临床及影像资料。依据分子分型特征将 19 例患者分为阳性组（n=9）与假阳性组（n=10）。
结果：两名医师对常规磁共振成像独立评估显示，所提取的影像特征具有较高的观察者间一致性，Kappa 值为 0.776~0.855（$p<0.05$）。假阳性组出现瘤周水肿较阳性组更多见，差异有统计学意义（$p<0.05$）。两组在肿瘤边缘情况及有无强化方面差异无统计学意义（$p>0.05$）。阳性组最大层面相对错配面积大于假阳性组，差异有统计学意义（$p<0.05$）。阳性组 $T_2$/FLAIR 错配率大于假阳性组，差异具有统计学意义（$p<0.05$）。相对错配面积、$T_2$/FLAIR 错配率联合诊断诊断 IDH 突变伴 1p/19q 未联合缺失型较低级别胶质瘤的特异度最高为 100%，其敏感度与 AUC 分别为 77.78%、0.878。
结论：本研究显示，整体或部分 $T_2$/FLAIR 错配征都可作为预测 IDH 突变伴 1p/19q 未联合缺失型较低级别胶质瘤的影像标志物。肿瘤区整体影像特征联合错配区定量参数有助于提高对 IDH 突变伴 1p/19q 未联合缺失型较低级别胶质瘤的诊断效能，对较低级别胶质瘤的治疗及预后评估具有指导意义。

PO-127

# 多模态磁共振联合临床指标预测宫颈癌新辅助治疗短期疗效的价值

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目的：探讨多参数 MRI 联合临床指标预测 IB1-IIA2 期宫颈癌新辅助治疗疗效的价值。
资料与方法：回顾性分析了 64 例接受新辅助治疗的宫颈癌病例，根据治疗反应将患者分为显著反应组和非显著反应组，对两组患者的临床指标、肿瘤的 ADC 值和 DCE-MRI 参数(Ktrans、Kep、Ve)进行分析比较。分析两组患者治疗前的临床及影像指标与宫颈癌新辅助治疗疗效的关系，建立可靠的疗效预测模型。
结果：单因素分析显示两组患者的临床分期（FIGO 2009）、年龄、肿瘤最大径、病理类型、鳞状上皮细胞癌抗原无显著差异（$P>0.05$）；两组患者治疗前的 ADC 值和 Ve 值的差异无统计学意义（$P>0.05$）；显著反应组中治疗前 Ktrans 和 Kep 大于非显著反应组（$P<0.05$）。多因素分析显示，由年龄、病理类型及 Kep 的第 50 百分位数三个指标所构建的预测模型诊断效能最高，AUC 为 0.891（0.812,0.971），特异度为 86.3%，敏感度为 91.3%。

结论：MRI 参数联合临床指标预测宫颈癌新辅助治疗短期疗效有一定的价值。

## PO-128

# Kaiser 评分在乳腺良恶性病变诊断中的研究价值以及对临床决策的影响

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目的：评价 Kaiser 评分对乳腺良恶性病变的诊断效能，并探讨是否可避免不必要的乳腺活检。
方法：回顾性收集本院 2017 年 1 月-2020 年 6 月术前行乳腺 3.0 T MRI 检查的乳腺病变患者的临床资料，所有病例均经术后病理或穿刺活检证实。三位不同经验水平的影像科医生在不知道病理结果的情况下根据 Kaiser 评分系统给出从 1 到 11 的最终分数。根据受试者工作特征(ROC)分析得出的曲线下面积(AUC)来确定所有病变的总体诊断性能，并分别确定肿块和非肿块样强化病灶的诊断性能。3 名评估者间的一致性通过组内相关系数（ICC）进行分析。在 Kaiser 评分>4 的临界值下，获得诊断和排除恶性肿瘤的敏感度、特异度和似然比。
结果：612 例患者，共 650 个病灶，其中，恶性病灶 393 个，良性病灶 257 个，肿块样病变 490 个（恶性 284 个，良性 206 个），非肿块样病变 160 个（恶性 109 个，良性 51 个）。对于所有病变，Kaiser 评分的准确性以曲线下面积(AUC)表示，范围在 0.915 至 0.950 之间。Kaiser 评分对所有病灶的敏感性均较高，范围在 95.4%至 98.47%。设定 Kaiser 评分>4 为恶性肿瘤临界值，可以潜在地避免 155 例(60.31%)至 181 例(70.42%)不必要的活检。
结论： Kaiser 评分可以作为辅助决策手段用于乳腺良恶性病变的诊断，以减少不必要的活检。Kaiser 评分系统在肿块和非肿块病变中显示出很高的诊断准确率，对于经验较少的影像科医生尤其受益。

## PO-129

# 肝吸虫病合并肝内胆管细胞癌的影像学表现

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[摘要]目的：探讨肝吸虫病合并肝内胆管细胞癌的影像学表现。方法：回顾性分析 2010 年至 2020 年柳州市人民医院及广西医科大学第一附属医院经手术及病理证实的 29 例肝吸虫病合并肝内占位患者的临床及影像资料，所有患者进行了腹部 CT 和（或）MRI 检查。分为 A、B 两组：A 组肝吸虫病合并肝内胆管细胞癌 18 例，B 组肝吸虫病合并肝内其他占位 11 例。采用连续校正 $\chi 2$ 检验比较组间计数资料的差异。结果：两组患者的胆道感染、肝包膜皱缩、Ca199 升高、渐进性强化、肿块近端整棵胆管树扩张，差异均有统计学意义（P 均＜0.01），胆道结石和淋巴结增大差异无统计学意义（P 均＞0.05）。结论：肝吸虫病合并肝内胆管细胞癌相对于合并肝内其他占位具有一定的特征。

## PO-130

# A Pilot Evaluation of Intravoxel Incoherent Motion (IVIM) in Characteristics and Diagnosis of Ovarian cancer of p53 status

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Introduction Ovarian cancer (OC) is a common tumor, accounting for 23% of female reproductive malignancies, and its incidence is increasing year by year[1]. Because ovarian cancer has no obvious clinical symptoms in the early stage, even if there are symptoms, there is no specificity, and the role of screening is very limited. Moreover, the development is relatively fast, and many patients have advanced ovarian cancer at the time of treatment. The expression of mutant p53 or loss of p53 allows ovarian cancer cells to continue to proliferate. In various genetic related diseases and malignant tumors, there are deletions or mutations in the P53 gene, which are closely related to the growth and development of malignant tumors. p53 plays an important role in tumor formation. This study aims to explore the relationship between IVIM quantitative parameters and P53 protein and OC ovary, study the expression of P53 protein in ovarian cancer tissues, and analyze its relationship with the clinical characteristics of ovarian cancer. IVIM technology is a novel MRI tool. This is an emerging non-invasive technology that can simultaneously obtain information about the diffusion and perfusion of living tissue. Previous studies have shown that IVIM technology can be used as an imaging biomarker during steroid therapy to identify the high risk of early recurrence of CCRT. In this study, we used stand ADC, D, D* and f several typical parametersvalue of IVIM for analysis to explore the difference between P53 positive and negative OC wild-type and wild-type.
Methods A total of 32 patients of ovarian cancer confirmed by surgery and pathology from 2015 to 2020 were retrospectively collected. Including Patients or volunteers:
A total of 18 P53-positive patients (age： with ovarian cancer were 51.71±11.08 (35,74) years old; range：(35,74) 49.5 (41.75,70.00) years oldand.14 negative patients were(age 60.82±8.65 (47,76) years old; range：(47,76) years old; 60 (55.50,67.50) years old). All patients underwent abdominal MR examinations (Signa HDxt, GE Medical Systems, USA) included T2WI, IVIM and LAVA(Scan parameters show in table 1). The original axial digital images from the IVIM sequence were transmitted to the GE SDC-ADW 4.6 workstation (Sun Microsystems, Santa Clara, Calif) and the post-processing was performed by Functool software. Referring to the anatomical location of lesion obtained on T2-weighted or DWI images, The stand ADC, D, D* and f maps were automatically constructed, and were reviewed by two observers who were blinded to clinical information and histopathologic results with 10 and 15 years of experience in pelvic imaging, respectively. The manual regions of interest (ROIs) were drawn along the edge of tumors on the slice with maximal solid area (we choose the solid in tumors), according to fat s uppression T2WI and T1WI (Fig. 1). The measurement was repeated for three times, and the averages of three measurements were calculated. The stand ADC, D, D* and f were recorded. Intra-group correlation coefficient (ICC) was used to test the measurement consistency between the two observers. Difference between above values and the expression of P53 in OC was compared by Mann-Whitney U test. Receiver operating characteristic (ROC) analysis was performed to evaluate diagnostic performance.

Results The stand ADC value of the positive group was significantly higher than that of negative group ($p < 0.05$, Table 2). The ROC curve of the stand value in the mutant and wild-type groups showed an AUC value of 0.723 (Figure 1). When the threshold of stand ADC value is set to 0.999×10-3/min, the corresponding diagnostic sensitivity and specificity will be 58.8% and 92.9%.

Discussion And conclusion p53 is a tumor suppressor protein. When p53 becomes mutated, it loses its function, resulting in abnormal cell proliferation and tumor progression[2]. The shrunken

extracellular space due to abnormal proliferation of cancer cells and following incremental local cell density in malignant tumor tissues generates more severe diffusion limitation in malignant lesions than in benign lesions[3]. In the present study, we proposed that stand ADC value could be a promising imaging biomarker in evaluation of P53 expression.

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## PO-131

# 应用自动纤维量化技术探究中重度阻塞性睡眠呼吸暂停低通气综合征脑白质改变特性

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目的：基于 AFQ 分析方法探究中重度阻塞性睡眠呼吸暂停低通气综合征（Obstructive sleep apnea hypopnea syndrome,OSAHS）脑白质改变特性，并且与常用 TBSS 分析方法结果相对比。
材料与方法：本研究收集了 33 名未经治疗的中重度 OSAHS 患者及 28 名与其相匹配的无睡眠障碍志愿者（No Sleep Disorder,NSD），所有受试者均行 3.0T 核磁共振头部扫描以获得 DTI 数据，经过 FSL 软件处理获得每位受试者的各个弥散张量指标：FA、MD、AD、RD；然后采用 TBSS 方法基于所有受试者构建白质纤维骨架以便于比较两组间平均弥散张量指标的差异；之后再对两组数据采用 AFQ 方法进行处理分析，高效地提取全脑 20 条主要纤维束，并将每条纤维精细分为 100 个节段（Node），以判断出白质纤维束发生改变的具体节段。
结果：基于 TBSS 的分析方法并未没有在两组间发现任何差异具有统计学意义的纤维束。然而在采用 AFQ 分析方法后，相比于 NSD 组，OSAHS 组胼胝体枕部第 77-78 节段 FA 值减低，右侧丘脑辐射第 23-24 节段 MD 值增高，右侧下额枕束第 54-57 节段、右侧上纵束第 66-68 节段 AD 值增高，而所提取的纤维束各节段 RD 值差异无统计学意义。
结论：采用 AFQ 的分析方法使我们可以发现在 TBSS 分析方法上无法发现的 OSAHS 患者脑白质的变化，并且还可以精确到纤维束损伤的特定部位，这可以为探究 OSAHS 患者白质纤维束改变提供新的思路，同时为临床工作开展提供更好的神经影像学帮助。

## PO-132

# Diagnosis, Characterization of Fetal Sacrococcygeal Teratomas (Type IV) with Prenatal MRI and Its Outcome

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**Objectives** The purpose of this study was to determine the diagnosis, characterization of fetal sacrococcygeal teratomas (SCTs) (Type IV) with prenatal MRI and its outcome.
**Materials and Methods**

This retrospective study was approved by the local ethics review board; written consent was obtained from all subjects. Thirty pregnant women with fetal sacrococcygeal teratoma underwent prenatal MRI (mean age, 35 years ) between Dec.2015 and Nov. 2019. The MRI examinations were performed on a 1.5T MAGNETOM Amira (Siemens, Shenzhen Magnetic Resonance, Ltd., Shenzhen, China) with an 18-channel spine coil and a 13-channels body coil positioned over the lower pelvic area. Susceptibility-weighted imaging (SWI), T2-Weighted Imaging (T2WI), T1-Weighted Imaging (T1WI), Diffusion Weighted Imaging (DWI) were obtained in axial, coronal, and sagittal plane. The size, mass characteristics, and compressive effects of the tumors were determined and correlated with fetal MRI and postnatal findings.

**Results**

In total, based on the MRI findings, sixteen type IV SCT fetus (mean age, 30 weeks) were enrolled in this study. The diagnosis of sacrococcygeal teratoma was accurate in all cases assessed at our center using prenatal MRI and were confirmed at surgery. The SCT appeared entirely cystic in thirteen fetuses (macrocystic with a few septa in two (Fig 1), microcystic in nine (Fig 2)), mixed cystic and solid in two (Fig 3), and solid in one (fig 4). The mean sizes of the SCTs were 1.8±0.5 cm. Signs of oppression of adjacent rectum and bladder can be seen (fig 2-4). All fetuses underwent MRI and surgical excision within 2 months after birth. All the infants recovered well after surgery except the solid one, with high AFP values. Fetuses with predominantly solid and highly vascularized masses have a poorer prognosis than fetuses with tumors that are mainly cystic and avascular in appearance.

**Conclusion** Type IV SCTs could be diagnosed accurately with the prenatal MRI, and have an excellent prognosis after early surgical resection.

# PO-133

# MRI 预测子宫剖宫产瘢痕妊娠清宫术中风险的价值

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目的：探讨术前 MRI 预测剖宫产切口瘢痕妊娠（CSP）清宫手术风险的价值。方法：回顾性分析 135 例经手术及病理证实的 CSP 患者的临床及术前 MRI 资料，分析各临床及 MRI 特征与术中大出血（≥200ml）、术中转变手术方式及宫腔球囊填塞压迫止血的关系。单因素分析采用 Mann-Whitney U 检验或 c2 检验，将单因素分析中有统计学差异的指标进行多因素 Logistic 回归分析，筛选出预测手术风险的独立危险因素。绘制受试者工作特性曲线（ROC）评价各独立危险因素的预测效能。结果：术中大出血的相关危险因素包括停经时间、β-hCG、憩室深度、憩室长度、瘢痕厚度、妊娠物体积、瘢痕肌层外凸、孕囊胚芽显示、孕囊主体位于憩室内、孕囊与肌层分界不清及动脉期瘢痕处胎盘组织显著强化，独立危险因素为瘢痕厚度（P =0.002, OR=0.038, 95%CI: 0.005~0.306）、β-hCG（P=0.002, OR=1.021, 95%CI: 1.008~1.035）及孕囊主体位于憩室内（P =0.009，OR=12.549, 95%CI: 1.864~84.460），ROC 下面积（AUC）分别为 0.932、0.815 及 0.697，瘢痕厚度及术前 β-hCG 的最佳截断值分别为 2.15mm 及 82.443×103mIU/ml；宫腔球囊填塞压迫止血的相关危险因素包括停经时间、β-hCG、CSP 次数、妊娠物体积、憩室深度及憩室长度、瘢痕厚度、瘢痕肌层外凸、孕囊胚芽显示、孕囊主体位于憩室内、孕囊与肌层分界不清及动脉期瘢痕处胎盘组织显著强化，独立危险因素为瘢痕厚度（P =0.015, OR=0.046, 95%CI: 0.004~0.544）与术前 β-hCG（P =0.08, OR=1.019, 95%CI: 1.005~1.033），AUC 及最佳截断值分别为 0.923、0.856 及 1.95mm、104.831×103 mIU/ml；术中转变手术方式的相关危险因素包括憩室深度、憩室长度、妊娠物体积、瘢痕厚度、瘢痕肌层外凸、孕囊主体位于憩室内、孕囊与肌层分界不清及动脉期瘢痕处胎盘组织显著强化，独立危险因素为瘢痕肌层厚度（P＜0.001, OR=0.093, 95%CI: 0.026~0.325），AUC 及最佳截断值分别为 0.853 及 2.05mm。结论：术前 MRI 对于评估 CSP 患者清宫手术风险有重要价值。

# PO-134
# 定量磁敏感图检测帕金森伴 2 型糖尿病患者静脉血氧水平变化

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目的
本研究采用定量磁敏感成像(Quantitative sensitivity Mapping, QSM)定量测定帕金森病伴 2 型糖尿病(PDDM)患者脑静脉血氧水平变化，分析各磁敏值(MSV)与临床实验室指标的相关性。
材料与方法
收集 35 例 PDDM 患者和 35 例帕金森病无 2 型糖尿病(PDND)患者，均获得知情同意。临床实验室指标收集情况见表 1。所有患者均采用常规 MRI 方案，采用 GE signa HDXT 3.0T MRI 扫描仪，8 通道头线圈，梯度回波 T2 星加权血管造影(ESWAN)。ESWAN 参数保持一致(TR=36ms,TE=3.6ms, 7.8ms, 11.9ms, 16.1ms, 20.3ms, 24.4ms, 28.6ms, 32.8ms,FV = 24x24cm2，层厚=1mm，层间距=0mm，矩阵=256x256)。采用美国韦恩州立大学馈赠的核磁共振信号处理(SPIN)软件在 QSM 图像上测量大脑静脉的 MSV 值，包括双侧大脑内静脉(ICV)、丘脑静脉(TV)、透明隔静脉(SV)、基底静脉(BV)和齿状核静脉(DNV)，如图 1 所示。采用独立样本 t 检验和 Mann-Whitney U 检验比较各组间平均 MSV 值及临床实验室指标(年龄、总胆固醇、甘油三酯、高密度脂蛋白、低密度脂蛋白、同型半胱氨酸、尿酸、空腹血糖、收缩压、舒张压)。PDDM 组临床实验室各项指标与脑静脉 MSV 的相关性采用 Pearson 相关分析和 Spearman 相关分析(P<0.05 为显著性差异)。
结果
由表 2 可知，PDDM 组所有脑静脉 MSV 均高于 PDND 组，且在右侧 ICV 差异有统计学意义(P < 0.05)，其他脑静脉组间差异无统计学意义。右侧 DNV(r =-0.344, P =0.043)、左侧 BV(r =-0.453, P =0.006)、右侧 BV(r =-0.452, P =0.006)的 MSV 值与高密度脂蛋白(HDL)含量呈负相关;左侧 BV(r =-0.363, P =0.032)的 MSV 值与总胆固醇含量呈负相关;右侧 BV MSV (r =-0.341, P =0.045)、右侧 ICV 的 MSV 值 (r =-0.415, P =0.013)与空腹血糖呈负相关;右侧 ICV (r =0.363, P =0.035)、左侧 ICV (r =0.448, P =0.008)的 MSV 值与尿酸含量呈正相关。

# PO-135
# Radiomics features from conventional MRI in predicting the TERT promoter mutation status of low-grade gliomas

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Objective: To explore the predictive value of the radiomics models based on ADC and contrast-enhanced MRI for predicting the TERT promoter mutation status of low-grade gliomas(LGGs). Methods: 109 LGG patients confirmed by pathology were retrospectively analyzed. All patients underwent the magnetic resonance imaging(MRI) scan before surgery. On the ADC and isotropic volumetric magnetization prepared rapid acquisition gradient echo(MPRAGE) contrast-enhanced T1-weighted(T1CE) images, ROIs were delineated in each tumor along its edge at the slice with the the maximum diameters and radiomics features were extracted. The features were selected by triad method(Fisher, POE+ACC, MI) and 5-fold crossvalidation and least absolute shrinkage selection operator (LASSO) analysis. Then, multivariate logistic regression analysis was used to construct radiomics prediction models. Receiver operating characteristic(ROC) analysis was used

to evaluate the performance of models. Results: From ADC and T1CE images, 558 radiomics features including 18 first order(gray level histogram, GLH), 490 second order[gray level concurrence matrix(GLCM); run length matrix; absolute gradient], and 50 high order[autoregressive(AR) model; wavelet transform(WT)] were extracted. Finally, 11 radiomics features were selected out to construct radiomics models named ADC model, T1CE model and conjunct analysis(ADC+T1CE) model, all of which displayed good performance. Among them, the conjunct analysis model showed the best prediction performance with AUC of 0.928(95%CI: 0.859-0.996) and 0.878(95%CI：0.758-0.997) in the training and validation datasets, respectively. Youden's indexs were 0.836 (p<0.001) and 0.666 (p<0.001) in the training and validation datasets, respectively.
Conclusions: The radiomics models based on ADC and contrast-enhanced MRI can predict the TERT promoter mutation status in LGG patients. The combination of radiomics features from different sequences may improve the prediction performance.

## PO-136

# 3 种颅内动脉钙化评价方法评估脑小血管病效能的对比研究

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目的 探讨颅内动脉钙化（IAC）在评估脑小血管病（CSVD）的最优方法。方法 回顾性分析 2018 年 12 月至 2020 年 7 月本院住院的 303 例研究对象的资料。根据 CSVD 总体负担评分，将实验组分为 4 组（1～4 分），无 CSVD（0 分）人群作为对照组，采用 Agatston、改良 Woodcock、Babiarz 这 3 种钙化评价方法，在头颅 CT 评价 IAC 情况，在头颅 MRI 计算 CSVD 总体负担评分；采用受试者工作特征曲线（ROC）比较 3 种方法评估 CSVD 的效能。结果 Agatston、改良 Woodcock 及 Babiarz 这 3 种方法鉴别诊断有无 CSVD、CSVD1 分和 2 分、1 分和 3 分、1 分和 4 分、2 分和 3 分、3 分和 4 分的曲线下面积分别为：0.899 VS 0.911 VS 0.921、0.579 VS 0.629 VS 0.690、0.622 VS 0.701 VS 0.716、0.706 VS 0.763 VS 0.783、0.549 VS 0.625 VS 0.635、0.644 VS 0.687 VS 0.696、0.605 VS 0.577 VS 0.648，其中 Babiarz 方法曲线下面积最大。结论 在 3 种 IAC 评价方法比较中，Babiarz 方法评估 CSVD 的效能最好，该评价方法快速、实用，可用于脑血管病的大型流行病学研究。

## PO-137

# Utility of relative cerebral blood volume and mean apparent diffusion coefficient for the differentiation of primary central nervous system lymphoma and glioblastoma

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Abstract
Purpose: This study aimed to investigate the utility of relative cerebral blood volume (rCBV) and mean apparent diffusion coefficient (mADC) for the differentiation of primary central nervous system lymphoma (PCNSL) and glioblastoma (GBM).

Materials and methods：This retrospective study comprises 24 patients with GBM and 27 patients with PCNSL confirmed by histopathology. The rCBV derived from DSC-PWI and mADC derived from DWI were compared using Mann Whitney U test. The area under the curve (AUC) from receiver operating characteristic (ROC) curve and logistic regression model (LRM) was depicted to show the diagnostic performance of the two types of tumors.
Result: The rCBV and mADC parameters were significantly higher in patients with GBM than those with PCNSL (P < 0.01). On ROC analysis, rCBV and mADC showed the significantly diagnostic performance for differentiation of PCNSL and GBM with an area under the ROC curve (AUC) of O.993 and 0.881, respectively. When rCBV is more than 23.2900 ml / 100g, GMB can be diagnosed, with sensitivity of 95.8%, specificity of 100%, positive predictive value of 100%, negative predictive value of 96.6% and accuracy of 98.1%. When mADC is more than 0.6550×10 -3 mm 2 / s, GMB can be diagnosed, with sensitivity of 79.2%, specificity of 85.7%, positive predictive value of 82.6%, negative predictive value of 82.8 % and accuracy of 82.7%. The combination of rCBV and mADC improved the differentiation between PCNSL from GBM.
Conclusion: Multiparametric MRI evaluation using rCBV and mADC may contribute to reliable differentiation between PCNSL from GBM，which provides an important reference mark of non-invasive imaging.

## PO-138

# MR 平扫及增强扫描联合 DWI 及 ADC 值定量分析对直肠癌术前 T 分期的诊断价值

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一、研究目的：通过此项研究，鉴别直肠癌肠周侵犯与直肠周围纤维反应增生，更准确的进行直肠癌术前 T 分期，制定更有效合理的治疗方案，避免不必要的放化疗，更好的掌握手术时机。二、研究方法：本项研究选取 本院胃肠外科收治的 77 例直肠癌患者的临床资料。采用美国ＧＥ 公司 3.0 Ｔ 静音 MRI 系统进行扫描，GE 公司 AW４.6 版本后处理工作平台进行后处理。病理学 Ｔ 分期标准根据 UICC（国际抗癌联盟）发布的第八版恶性肿瘤 TNM 分期，将采集的 DWI 图使用工作站专用分析软件进行后处理，生成表观扩散系数( ADC) 图。避开坏死区，测量所有直肠癌壁外侵犯的肿瘤、纤维反应增生的 ADC 值，与术后病理结果进行比较分析。分别计算常规 MR 及常规 MR 结合 DWI 及 ADC 值定量分析对直肠癌术前 T 分期的诊断符合率，对比分析其诊断价值。评估纤维反应增生与直肠癌周围侵犯 DWI 的信号特征和 ADC 值的最佳分界值。使用 SPSS19,0 统计软件进行统计学分析。对每组数据均行独立样本ｔ检验。P ≤0． 05 为差异有统计学意义。三、结果：肠周侵犯的直肠癌与纤维反应增生的 ADC 值分别为 1.13±0.43×10-3mm2/s、1.56±0.48×10-3mm2/s、前者明显低于后者，差异具有统计学意义。可是 ADC 值存在重叠，本研究的 ADC 值的最佳分界值为 1.25×10-3mm2/s。MRI 平扫及增强扫描对直肠癌术前 T 分期的诊断符合率为 72.72%（56/77)；MRI 平扫及增强扫描联合 DWI 及 ADC 值的定量分析对直肠癌术前 T 分期的诊断符合率为 90.90%（70/77)。四、结论：DWI 及 ADC 值的定量分析可以有效的鉴别直肠癌肠周侵犯与纤维反应增生，MRI 常规扫描联合 DWI 及 ADC 值的定量分析对直肠癌术前 T 分期的准确率明显提高，值得在临床上推广。

## PO-139

# DCE-MRI 和 IVIM-DWI 对胶质瘤分子病理学分型血管生成及分化程度的研究

毛一朴

目的:对比 DCE-MRI 和 IVIM-DWI 定量分析参数指标与胶质瘤血管生成及分化程度的相关性，评价 DCE-MRI 和 IVIM-DWI 参数对胶质瘤术前分级及分期的价值。比较 DCE-MRI 和 IVIM-DWI 对胶质瘤血管生成及分化程度评价高低的差异及评价效能。
材料与方法：纳入患者分别行 DCE-MRI 和 IVIM-DWI 检查，并将手术所见和病理结果进行对照分析。计算 DCE-MR 参数：容量转移常数(Ktrans)、血管外细胞外容积分数（Ve）及速率常数(Kep)和 IVIM-DWI 参数：慢速扩散运动系数（D）、快速扩散运动系数（D*）和微循环灌注分数（ｆ）。以血管内皮因子 CD34 标记胶质瘤微血管，并计算肿瘤微血管密度（MVD）。应用 Spearman 秩相关分析 DCE-MRI 参数与病理分级及微血管密度的相关性。采用受试者工作特征(ROC)法分析对比所得各参数值，评估胶质瘤病理分级组别及微血管密度的评价效能。
结果: 经手术及病理证实为胶质瘤患者 104 例。IDH1 突变型和 IDH1 野生型各 52 例。免疫组化血管内皮因子 CD34 染色标本中，微血管密度分布为 5.2~38.4。不同病理分级胶质瘤患者 Ktrans 值、Ve 值和 Kep 值差异有统计学意义（P<0.05）。Spearman 相关性分析结果显示，Ktrans 值、Ve 值及 Kep 值与胶质瘤微血管密度（MVD）呈正相关（r 值分别为 0.835，0.593 及 0.593，P＜0.01）。Ktrans 值具有最佳的相关性（r=0.835，P＜0.01）。ROC 显示 DCE-MR 药代动力学各参数对胶质瘤微血管密度评价效能的高低排列的是 Ktrans 值＞Ve 值＞Kep 值。IVIM-DWI 灌注相关参数 D*和 f 与 DCE-MRI 参数 Ktrans 和 Ve 呈正相关，其中 D*、f 与 Ktrans 相互间具有良好的相关性(r=0.690、0.649,P<0.001)，D*、f 与 Ve 间具有中度相关性 (r=0.529、0.522，P<0.001)。ROC 曲线图直观显示 IVIM-DWI 与 DCE 参数对胶质瘤病理基因分级的评价具有较高的敏感性和特异度，评价效能从高到低的是 Ktrans＞D*＞f＞Ve。
结论：DCE-MRI 参数 Ktrans 值评估胶质瘤微血管密度和血管通透性优于 IVIM-DWI，而 IVIM-DWI D*值和 f 值在毛细血管占比方面评估上高于 DCE-MRI，两种影像技术结合应用可以对不同分子病理类型胶质瘤血管生成及分化程度方面进行更加精准的评价。
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PO-140

# Intramammary Edema of Invasive Breast Cancers on MRI T2-Weighted Fat Suppression Sequence: Correlation with Molecular Subtypes and Clinical-pathologic Prognostic Factors

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Objective: To investigate the associations between different subtypes of intramammary edema on preoperative 3.0T magnetic resonance imaging (MRI) T2-weighted fat suppression sequence and invasive breast cancer molecular subtypes and clinical-pathologic prognostic factors.
Methods: Between May 2014 and December 2020, 191 patients with invasive breast cancer who had undergone preoperative MRI and mastectomy or breast-conserving surgery were retrospectively enrolled. The relationships between different subtypes of intramammary edema and invasive breast cancer molecular subtypes and clinical-pathologic features were evaluated using the Student’s T-test or Mann–Whitney U test and the χ2 test or Fisher’s exact test.
Results: Patients with luminal B (HER2 positive), HER2-enriched and triple negative breast cancers respectively had different subtypes of intramammary edema (P < 0.001). Also, a significant association between intramammary edema and clinical-pathologic factors, including

larger tumor size, higher Ki-67 index, lymph node metastasis and lymphovascular invasion (all P < 0.001), was found in our study.
Conclusions: Intramammary edema may provide added values of predicting molecular subtypes and clinical-pathologic prognosis, enhancing the ability to individualize the treatment of patients with invasive breast cancer.

## PO-141

# 强直性脊柱炎患者多裂肌脂肪浸润的磁共振 T2-mapping 和 IDEAL 水脂分离成像研究

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目的：
采用 T2-mapping 和 IDEAL 水脂分离成像技术测量 AS 患者多裂肌的脂肪浸润情况，并探讨与部分相关临床指标的关系。

方法：
40 名 AS 患者和 41 名年龄、性别、BMI 匹配的健康对照组进行常规 T1WI、T2WI、T2-mapping 抑脂和不抑脂序列及 IDEAL 成像扫描；使用常规 T2WI 序列对 L3 椎体下终板层面多裂肌脂肪含量进行 Goutallier 分级，同时采用 T2-mapping 及 IDEAL 分别测量其 T2 值（脂肪）和脂肪分数。采用 Kruskal-Wallis H 检验分析所有研究对象不同 Goutallier 分级多裂肌脂肪浸润的 T2 值（脂肪）及脂肪分数的差异。采用独立样本 t 检验分析 AS 组与对照组两组间 CSA、T2 值（脂肪）及脂肪分数 η 的差异；采用独立样本 t 检验依次分析各个 Goutallier 分级中 AS 组与对照组 T2 值（脂肪）和脂肪分数的差异；采用 Pearson 相关分析 AS 组 T2 值（脂肪）及脂肪分数分别与病程、ESR、CRP 及 BASDAI 评分的相关性。
结果：
随着多裂肌脂肪浸润 Goutallier 分级的提高，T2 值（脂肪）及脂肪分数升高（r=0.671，r=0.715，P＜0.05），且 Goutallier 两两分级间，多裂肌 T2 值（脂肪）及脂肪分数差异有统计学意义（均 P＜0.05）；AS 患者组多裂肌 T2 值（脂肪）为 11.61±6.92ms，脂肪分数为 0.28±0.09，对照组 T2 值（脂肪）为 8.11±2.87ms，脂肪分数为 0.24±0.05，两组间多裂肌 T2 值（脂肪）与脂肪分数差异有统计学意义（均 P＜0.05），CSA 差异无统计学意义（P=0.285）；多裂肌脂肪浸润 Goutallier0 级 T2 值（脂肪）及脂肪分数差异无统计学意义（均 P＞0.05），Goutallier1 级多裂肌 T2 值（脂肪）和脂肪分数差异有统计学（均 P＜0.05），Goutallier2 级由于对照组样本量太少无法比较；AS 患者组中，T2 值（脂肪）及脂肪分数均与病程存在正相关（r=0.361，r=0.335，P＜0.05），与 ESR 同样存在正相关（r=0.433，r=0.393，P＜0.05），与 CRP 及 BASDAI 评分无明显相关性（均 P＞0.05）。

结论：
T2-mapping 和 IDEAL 技术对定量评估多裂肌脂肪浸润有一定价值，AS 患者多裂肌脂肪浸润进程较健康同龄人更显著，多裂肌脂肪浸润早于形态学改变；AS 患者多裂肌脂肪浸润与 AS 病程及 ESR 呈正相关，与 CRP 及 BASDAI 评分未见显著相关性。

## PO-142

# 抑郁症大鼠模型的 GluCEST 成像与功能改变的初步研究

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目的：抑郁症是一种复杂的严重的精神障碍，其临床症状表现为持续至少 2 周以上的情绪低落，兴趣缺失。抑郁症是世界范围内导致残疾的主要疾病，目前临床诊断抑郁症主要依靠量表和精神和心理科的医生的主观诊断，缺乏客观有力的证据进行精确诊断及疗效监测。调节谷氨酸神经递质传递异常是抑郁症治疗的重要机制。目前具有见效快，疗效强的氯胺酮就是调节谷氨酸通路来治疗抑郁症的。然而，很少有非侵入性技术能有效检测抑郁症脑中谷氨酸类神经递质的变化，且谷氨酸是否能影响抑郁症患者的静息状态功能变化也没有共识。
材料与方法：采用谷氨酸化学交换饱和转移（glutamate chemical exchange saturation transfer, GluCEST）分子成像技术检测抑郁症模型鼠海马中相比于对照组的谷氨酸含量变化。并结合高效液相色谱仪（high performance liquid chromatography，HPLC）去验证海马脑谷氨酸的这种变化。同时运用静息态功能磁共振成像（resting-state functional MRI, fMRI）技术，比较应激组（n=10）和对照组（CTRL，n=10）雄性 SD 大鼠在慢性不可预测轻度应激（chronic unpredictable mild stress，CUMS）下获得应激诱导的海马谷氨酸神经元活动的变化。谷氨酸神经元活动用静息态指标低频振幅（amplitude of low-frequency fluctuation，ALFF)和区域一致性（regional homogeneity，ReHo）来表征。最后，使用 DPABI 软件提取海马区域内的神经元异常活动信号值，通过 spearman 分析方法分析 GluCEST 检测到的谷氨酸异常值与神经元异常脑功能信号值之间的相关性。
结果：GluCEST 技术能有效检测谷氨酸水平的变化，特别是在左海马区域，实验组和对照组相比存在显著的差异，实验组的谷氨酸含量降低（3.302）± 0.345[CUMS] vs.3.850 ± 0.401[CTRL]）。HPLC 显示的谷氨酸水平变化与 GluCEST 的结果基本保持一致。在 fMRI 检测中，发现 CUMS 组大鼠的神经元活动存在明显异常，即对照组的 ALFF 和 ReHo 指标都显著低于实验组（$p < 0.01$）。此外，海马区的神经元活动异常可能与谷氨酸含量改变有关，我们发现 GluCEST 值与经过 Z 变换的 ALFF 呈正相关（$r = 0.464$，$p = 0.047$，$df = 7$），与经过平滑和 Z 变换处理的 ReHo 呈负相关（$r = -0.591$，$p = 0.013$，$df = 7$）。
结论：GluCEST 作为一种无创的分子影像技术，具有绘制抑郁症患者脑谷氨酸变化图的可行性，为临床诊断和监测谷氨酸代谢异常提供有价值的信息。CUMS 模型鼠的海马谷氨酸紊乱，引起谷氨酸神经元活动异常，因此谷氨酸神经元活动异常是组成抑郁症患者脑功能障碍的重要组成因素之一。

# PO-143
# Application value of 3D-MRI based on compressed SENSE technology in meniscal injuries

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Purpose
To investigate the feasibility of compressed SENSE in 3D-MRI of knee joint and its clinical value in meniscal injuries.
Materials and methods
Thirty healthy volunteers for right knee examinations and 26 patients with knee pain were performed on the 3.0T MRI scanner (Ingenia CX, Philips). The 30 healthy volunteers, protocol consisted of conventional 2D fat suppression(fs) PDWI scanning in 3 planes of sagittal, coronal and traverse and CS-SENSE 3D-PDWI scanning in sagittal plane. CS-SENSE 3D images were reformatted into sagittal, coronal and traverse axis with the slice thickness, gap and coverage consistent with the conventional 2D scanning. The acquired CS-SENSE 3D data was further

reconstructed with 3 denosing（DS） methods (CS-DSweak, CS-DSmedium and CS-DSstrong). Each volunteer obtained a total of 4 groups of images and the image quality in sagittal plane was evaluated through subjective and objective evaluation. Twenty-six patients were examined only by CS-SENSE 3D-PDWI, and the results assessed by two radiologists with 10 years of experience were compared with arthroscopy.
Results
The scan time of CS-SENSE 3D reduced by 54.11% when compared with conventional 2D knee PDWI. The subjective image quality evaluation results by two radiologists with 10 years of experience were highly consistent (K =0.91), and the radiologists tended to regard the images in the CS-DSmedium group as the best diagnostic images. In the objective evaluation, SNR of CS-DSstrong was the highest in the four groups of images (P <0.05), and there was no statistically significant difference in CNR between the CS-DSmedium group and the conventional group. The type of tear shown in CS-SENSE 3D images in 26 patients with meniscus tear was highly consistent with the intraoperative arthroscopy results (K =0.94).
Conclusion
In summary, CS-SENSE 3D technology can effectively accelerate the scanning speed, andprovide the same knee joint image quality in reformatted images when compared with the conventional 2D MR images. Meanwhile, CS-SENSE 3D knee joint imaging has a high consistency with arthroscopy in the observation of meniscus injury types and is worthy of clinical promotion and use.

## PO-144
# 磁共振水质分离技术 mDixon 技术在胸腺瘤、胸腺增生和胸腺囊肿之间的鉴别诊断

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目的 通过计算信号强度指数（signal intensity index，SII）探讨了 mDixon 磁共振技术（magnetic resonance imaging，MRI）在胸腺瘤、胸腺增生和胸腺囊肿之间的鉴别诊断。
材料与方法 根据术后病理学结果，将 41 例胸腺病变患者分为 3 组，胸腺瘤组 20 例，胸腺增生组 13 例，胸腺囊肿 8 例。采用 3.0T（Verio；Siemens）磁共振扫描机进行 T2fs 成像和 T1 mDixon 成像，得到正反相位，水相和脂相。对 3 组病例的 T2fs 和 T1 正反相位图像进行主观评价。测量 3 组患者胸腺病变的信号强度，计算 SII。采用 Kruskal-Wallis 检验，并做两两比较，以上均为 P＜0.05 有统计学差异。
结果 胸腺瘤、胸腺增生和胸腺囊肿 3 组病例在 T2fs 均为高信号，在 T1 正反相位图像上信号缺失不等，视觉评价很难鉴别；3 组病例的信号强度指数中值[I1]（最小值，最大值）分别为 3.15%（-17.37%,19.03%），44.48%（36.19%,56.75%）和-6.9%（-63.61%,69.57%），三组之间有统计学意义（P=0.000），胸腺瘤和胸腺增生，胸腺增生和胸腺囊肿两者之间分别都有统计学意义（P=0.000；P=0.001），胸腺瘤与胸腺囊肿两者之间无统计学意义（P=1.000）。
结论 本研究表明磁共振 mDixon 技术通过计算 SII 值可以为胸腺增生和胸腺瘤，胸腺增生和胸腺囊肿之间的鉴别诊断提供帮助。

## PO-145
# Brain gray matter volume and functional brain network in patients with lower back pain: a MRI study

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To investigate the abnormalities of brain gray matter (GM) and the functional network changes in patients with lower back pain (LBP). Methods and Methods: FMRI was performed on 20 individuals with LBP and 20 age and gender-matched healthy controls (HC). The GM volumes of the two groups were compared by voxel-based morphological (VBM) analysis. In order to reflect the network efficiency, network-based statistics were performed to explore the differences between the brain networks of patients with LBP and those with HC. Results: In comparison of HC, patients with LBP showed reduced GM volumes in several brain cortical areas. The brain networks in LBP showed a significantly longer characteristic path length as well as a lower clustering coefficient, global efficiency and local efficiency compared with HC, which led to unstable and inefficient brain networks. In addition, LBP patients showed significantly decreased functional connectivity in several brain areas. Conclusion: LBP will result in the volume reduction of GM and the damage of the topological properties of the functional brain network. Our results provide a further insight into the neural mechanisms behind LBP.

## PO-146

# 长期美沙酮维持治疗对男性海洛因成瘾者大脑三大核心网络耦合的影响:一项静息态 fMRI 研究

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背景与目的：美沙酮维持治疗（methadone maintenance treatment ,MMT）被认为是治疗海洛因依赖的一种有效的主流治疗方法。然而，长期 MMT 是否会改善三个核心大规模脑网络(凸显网络、默认网络和执行控制网络)之间的耦合及其与海洛因渴望的关系尚不清楚。本研究旨在分析海洛因依赖个体在 MMT 过程中 3 个核心网络之间的功能连接特征，并进一步探讨其与海洛因渴求的关系。
材料与方法：44 例海洛因依赖者长期 MMT、27 例海洛因依赖者短期戒断(SA)和 26 例健康对照者(HC)进行静息状态功能磁共振成像。分析三组被试大脑凸显网络、默认网络和执行控制网络的耦合差异，并研究了这些大规模网络的耦合如何与美沙酮治疗时间和药物线索暴露前后的渴求相关。
结果：与 SA 组相比，MMT 组在线索暴露前后表现出较低的渴求程度，并表现出较强的背前扣带皮层(突出性网络的关键节点)与双侧执行控制网络的关键区域(包括双侧背外侧前额叶皮层)之间的连接。后顶叶皮质和背内侧前额叶皮质。在海洛因依赖个体中，功能连接的增加与海洛因线索暴露前后的渴望呈负相关。 结论：我们的研究结果表明，长期的 MMT 可以增加显著性和双侧执行控制网络之间的耦合，这与海洛因渴望的减少密切相关。这有助于从大规模脑网络的角度进一步理解蒙脱石的神经机制。

## PO-147

# 基于弥散纤维密度成像的帕金森病合并抑郁患者脑部微观差异研究

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**目的** 本实验利用高角分辨率弥散成像（High Angular Resolution Diffusion Imaging, HARDI）进行超分辨率重建算法处理，生成纤维密度图像（Tract Density Imaging, TDI），并对帕金森病合并抑郁（Depression with Parkinson’s disease with，DPD）患者的全脑白质纤维密度的微观变化进行深入研究。结合 HARDI 技术改善弥散张量成像（Diffusion Tensor Imaging, DTI）的扩散参数在交叉纤维部位计算不准确的缺陷，且 TDI 能够准确描述全脑白质的纤维密度的优点，比较帕金森病合并抑郁患者与帕金森病非抑郁的患者（Non-depression with Parkinson's disease，NDPD）的脑白质微观结构差异，深入了解该疾病的潜在致病机制，对该疾病有进一步的研究与认识，探索该疾病患者真正的脑白质改变情况，以期待后期对该疾病的早期诊断、治疗及预后评估产生决定性意义。

**材料与方法** 使用西门子 3.0T Prisma 核磁共振收集 32 例 DPD 患者与性别、年龄相匹配的 22 例 NDPD 患者进行 HARDI 扫描，b 值=0（1 个方向），3000（64 个方向）。所有受试者均在同一状态下进行统一的帕金森病评定量表（Unified Parkinson’s Disease Rating Scale, UPDRS）与汉密尔顿抑郁测评量表（Hamilton depression scale, HAMD）汉密尔顿焦虑测评量表（Hamilton Anxiety Rating Scale, HAMA）统计。根据算法对 HARDI 数据的处理，得到 TDI 数据，选取对称图像标准化算法（Symmetric Image Normalization, SyN）将 b0 图像进行空间标准化，并将变形文件作用于 TDI 数据，完成所有 TDI 数据的标准化。使用 SPM12 对数据进行双样本 T 检验，选取年龄、性别作为协变量进行协变量回归，并用误差率判断族（Family Wise Error, FWE）矫正方法对检验结果进行多重比较矫正，团块尺寸阈值选为 150，以 FWEp < 0.05 时表示具有统计学差异。将有显著性差异的结果对应的纤维密度值与年龄、抑郁得分、病程、UPDRS-Ⅲ评分进行相关性分析，选取 SPSS22.0 中的采用 Spearman 秩相关算法进行检验，p<0.05 时表示具有统计学差异。

**结果** DPD 患者在左侧大脑脚、双侧内囊前肢、双侧内囊后肢、左侧外囊及左侧放射冠的纤维密度值均显著性小于 NDPD 组（FWEp < 0.05）。上述显著性差异区域的纤维密度值只与抑郁与焦虑评分呈负相关性（p 值均小于 0.01）。

**结论** DPD 患者相较于 NDPD 患者，在左侧大脑脚、外囊、放射冠以及双侧内囊处的纤维密度值均显著减少。这也对其他类似研究中部分脑区各向异性值(fractional anisotropy，FA)值减少有了进一步解释，很可能是由于上述脑区纤维密度改变的因素导致 FA 值的改变，且该后处理技术在纤维交叉区域的计算值与实际值非常近似，并不会出现因 DTI 无法准确计算交叉纤维处扩散参数值而导致实验结果不准确的情况发生。

# PO-148
# 脑深部电刺激术治疗帕金森病中 MR 评估的应用价值

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目的 探讨 MR 在脑深部电刺激术（deep brain stimulation, DBS）治疗帕金森病（Parkinsons disease, PD）术中评估的应用价值。
材料与方法 对 29 例 PD 患者在 DBS 术前、术后均行 3.0T 头颅磁共振扫描，扫描序列采用薄层轴位、矢状位和冠状位的 T2WI。由一位资深放射科医师和一位资深神经外科医师对患者的 DBS 术前和术后影像进行评估，评价图像对丘脑底核、苍白球等脑深部核团以及术后电极显示的清晰程度。、
结果 所有病例顺利完成检查，所得图像均不受患者手术定位架影响。所选用的常规头颅 T2WI 序列能够清晰显示 DBS 手术所需观察的丘脑底核、苍白球内侧核和丘脑中间核等靶点核团；术后电极金属伪影较少，对电极针道和电极的位置显示清晰。

结论 3.0TMR 头颅常规 T2WI 扫描能够清晰显示 DBS 手术的靶点核团以及术后的电极位置，对 DBS 术前手术方案的制定以及术后电极位置的评估有较高的应用价值。

PO-149

# An Electromagnetic Actuator for Brain Magnetic Resonance Elastography

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INTRODUCTION
Magnetic resonance elastography (MRE) is one of the few non-invasive methods that can measure the brain tissue in vivo. Different from the clinical application of MRE in liver tissue measurement, shear waves must be effectively transmitted through the skull into brain. Therefore, an effective actuator for brain MRE is desired.

Current clinically used actuator is pneumatically driven, but studies have shown that it might produce extra peaks in the frequency spectrum. Electromagnetic actuator, like the piezo-electric actuator, is convenient to control, and the actuation frequency can be accurately tuned. However, the challenge of using an electromagnetic actuator is the electromagnetic compatibility. In addition, a specific design for convenient usage in clinical settings is also crucial.

In this study, we proposed an electromagnetic actuator for brain MRE. A grappler design was used to transmit waves to the whole brain. The performances of the actuation in terms of frequency accuracy, electromagnetic compatibility, and wave generation were evaluated.

METHODS and MATERIALS
With a splint-like structure, a support frame holds the actuation coil in place on the top of the MR head coil. A transmission bar is designed to connect the actuation coil to 5 vibration plates, transmitting the vibration from the actuation coil to the plates. A curved design is adopted for all vibration plates for better fitting of the head. Soft elastic bandages were used to wrap around the vibration plates to ensure that the plates hold the whole brain firmly. The components that stand outside of the head coil have a height of 7.5 cm. Therefore, the whole actuator could fit into the MR bore easily.

We evaluated the performance of frequency actuation of the proposed actuator and compared it with that of a pneumatic actuator. Vibrations of the actuator during MRE were recorded using an accelerometer with a gradient echo (GRE) based MRE sequence and an echo planar imaging (EPI) based MRE sequence.
To estimate the magnetic field produced by the actuation coil more precisely, finite element simulations were carried out using COMSOL. In addition, to evaluate the overall influence of the metal components, we tested the electromagnetic compatibility by measuring the signal-to-noise (SNR) ratio of a spherical liquid phantom with a T1 weighted (T1W) and T2 weighted (T1W) clinical sequence, respectively.

A 1:1 human skull model was manufactured to evaluate the performance of the actuator. The brain tissue was simulated by filling the skull with glycerol gelatin and three cylindrical agar phantoms with different concentrations as inclusions. In addition, three healthy volunteers were also recruited for MRE imaging. A 2D GRE based MRE sequence was used for image acquisition. After phase unwrapping and filtering, shear modulus map was estimated using a local frequency estimation (LFE) method.

RESULTS and DISCUSSION
The frequency spectra showed the full width at half maximum (FWHM) value of each measured frequency was ~1 Hz for both actuators. Compared with the spectrum of the pneumatic actuator, we observed no significant off-center frequency component for the electromagnetic actuator. In addition, the FWHM of the vibration frequency was ~0.3 Hz with few off-central frequency peaks when without applying any imaging sequence. Compared with the GRE-based MRE sequence, the FWHM of the EPI-based MRE sequence was smaller and less background noise was also observed.

The simulated magnetic flux density showed that the ROI of the MRE imaging was outside the 3-G contour, which was less than one part in 10000 compared with the 3-T field. Therefore, the interference of the fringe field produced by the actuator was at a paltry level.

Images of the SNR test showed no observable difference in both T1W and T2W images. Analysis of the SNR values from 6 different slices from each set of images showed no significant differences. This indicated that the proposed actuator did not interfere with the imaging.

For the phantom and volunteer imaging, the real part of the first harmonic of the displacement components in three encoding directions at 30 Hz were shown. The calculated elastogram showed a clear distinguishing stiffness map between the three agar inclusions. Clear wave patterns could be observed in three directions within the brain.

CONCLUSION
In this study, we proposed an electromagnetic actuator for brain MRE. The vibration was transmitted into the brain via a grappler-shaped design. Simulation, phantom, and human experiment results showed the proposed actuator could carry out MRE measurements with multiple frequencies and high frequency accuracy. Future studies include using the actuator in a couple of clinical investigations.

# PO-150

## 图像空间均匀性对定量磁化率成像的影响

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目的:评估颅脑定量磁化率成像（quantitative susceptibility mapping, QSM)中线圈选择和空间均匀性矫正对深部核团磁化率测量值的影响。
材料与方法: 10 名健康受试者参与该项研究，每名受试者均在 3T 磁共振成像系统（西门子 Prisma）上采用 20 通道和 64 通道头颈联合线圈完成扫描。数据采集采用多回波梯度回波序列，体素大小为 0.8 mm×0.8 mm×0.8mm。扫描得到的图像数据分别施加和未施加空间均匀性矫正后，再进行 QSM 重建。在重建得到的定量磁化率图上，手动勾画出六个双侧脑深部灰质核团 ，包括红核、黑质、苍白球、壳核、尾状核和齿状核，计算核团内磁化率平均值。均匀性矫正前后的对比使用同一个感兴趣区(ROI)。采用组间相关系数(ICC)评估使用两组线圈通道数的 ROI 分割的一致性；采用配对样本 t 检验和线性相关分析比较均匀性矫正前后两组通道线圈采集获得的磁化率值的组间差异性和一致性。
结果：用于 QSM 重建的图像数据施加空间均匀性矫正后，大脑深部核团边界更加清晰，定量磁化率测量值均显著增加。20 通道线圈获得的大部分核团磁化率值较 64 通道线圈得到的磁化率值有显著的升高。
结论：线圈选择和空间均匀性矫正的使用对颅脑定量磁化率值有一定的影响，采用高空间均匀性的图像可提高 QSM 测量的准确性。

PO-151

# 腹部定量磁化率成像中的总场反演算法研究

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**目的** 通过局部场反演得到的腹部定量磁化率成像仍面临背景场分离不完全和条状伪影严重的问题，本文研究总场反演算法在腹部定量磁化率成像中的可行性。**材料与方法** 本项研究包含数值仿真实验与人体实验。数值仿真实验使用一名健康被试扫描得到的模值图与 R2*图手动勾画出腹部主要器官和组织，并参考正常人腹部常规值分别给定肝脏及以外组织的磁化率值和 R2*值以制作成数值化腹部模型。人体实验包括 3 名健康被试和 20 位输血导致的继发性铁沉积患者，所有被试均在 3.0T 磁共振成像设备上完成扫描。分别使用设置了不同预条件子的 TFI 算法与 MEDI 工具包中的传统去背景场加局部场反演方法重建出磁化率图。分析不同方法得到的磁化率图像的伪影大小，并分析不同方法得到的磁化率值的准确性及与 R2*分布的相关性。**结果** 在数值仿真实验中，去背景场加局部场反演得到的图像在肝脏内出现了明显的低信号伪影，而 TFI 则得到更准确的定量磁化率值，且采用合适的预条件子能加快 TFI 的收敛速度。在人体实验中，传统的局部场反演方法往往在靠近组织边缘处出现明显的计算错误且传播到了组织内部；而场反演算法的计算结果对于边界处脂肪的处理更加均匀准确，肝内组织对比度更加清晰，并提供更多肝脏层面组织的信息。**结论** 总场反演算法可减少腹部磁化率发生剧烈变化之处出现的计算错误，并有效提升腹部定量磁化率图像质量，而预条件子的引入可加速了总场反演的收敛。

PO-152

# 比较基于 MRI 图像的不同影像组学模型对垂体大腺瘤质地预测的价值

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目的 比较基于 MRI 图像的不同影像组学模型对垂体大腺瘤质地预测的价值。
方法 回顾性研究 2014 年 12 月至 2020 年 12 月皖南医学院弋矶山医院经手术病理证实为垂体大腺瘤患者的完整资料。根据术中记录垂体分为质软组（n=68）和质硬组（n=37）；根据肿瘤侵袭性分为有侵袭性腺瘤（n=54）和无无侵袭性腺瘤（n=59）；按照完全随机方法将患者分为训练组（n=82）和验证组（n=33）。所有患者均行垂体常规 MRI 扫描。使用 ITK-SNAP 软件勾画感兴趣区（ROI）及融合，然后导入 AK 软件提取纹理特征；利用最小冗余最大相关（mRMR）和最小绝对值收敛和选择算子（LASSO）回归分析进行特征选择和建立影像组学标签，和构建随机森林模型，绘制受试者工作特征（ROC）曲线评价模型的预测能力。
结果 在训练组中 T1、T2 和 T1 增强图像的影像组学标签诊断效能(AUC:0.859、0.874、0.857)高于随机森林模型（AUC:0.707、0.764、0.732）。在验证组中各图像的标签模型诊断效能(AUC:0.804、0.823、0.755)也均高于随机森林模型(AUC:0.715、0.793、0.6)。对于不同图像中训练组是 T2 图像的影像组学标签诊断效能（AUC:0.874）最好,在验证组中也是 T2 图像的影像组学

标签诊断效能（AUC:0.823）最好。结论 影像组学标签和随机森林模型能够鉴别垂体大腺瘤的质地。降维构建的影像组学标签诊断效能优于不降维的随机森林模型。基于 T2 图像影像组学标签和随机森林模型诊断效能最好。

# PO-153

# 基于神经网络拟合的化学交换饱和转移成像技术

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目的：
在化学交换饱和转移成像（chemical exchange saturation transfer, CEST）的临床应用中,分离酰胺质子转移效应（amide proton transfer, APT）和核奥氏增强效应
（nuclear Overhauser enhancement, NOE）的贡献很重要。本研究中，我们设计了一种基于神经网络拟合的 CEST 后处理方法，其通过对每个像素采集得到的 Z 谱特征的识别得到背景参考 Z 谱和主磁场不均匀偏移量，进而得到分离的 APT 效应和 NOE 效应。
材料与方法：
1 名缺血性卒中患者、1 名大脑低级别胶质瘤患者、2 名乳腺肿瘤患者参与研究。缺血性卒中患者的磁共振扫描在西门子 3T 磁共振成像扫描仪(MAGNETOM Prisma, 德国西门子医疗)上进行，所使用的是自主开发并改进的 CEST-GRE 序列。其他受试者的磁共振扫描均在飞利浦 3T 磁共振成像扫描系统（Ingenia CX 3.0T，飞利浦医疗, 荷兰)上完成，所使用的序列为 CEST-FSE 序列。所有序列均包含 CEST 饱和模块与数据采集模块，其中 CEST 饱和模块的射频饱和脉冲强度为 0.8μT，时长为 2s。整个扫描流程共施加 41 个范围在-10ppm 到 10ppm 之间且间隔为 0.5ppm 的射频频率偏移点，射频采集顺序由 Z 谱的两端向水峰频率靠近，此外采集一个没有施加饱和射频的参考成像。
CEST 后处理流程如下：首先，通过双池布洛赫方程仿真模拟不同组织参数下仅含直接饱和效应与半固态大分子磁化转移效应的背景参考 Z 谱,并模拟一定范围内的随机主磁场偏移；然后，将背景参考 Z 谱中避开化学交换饱和转移效应与核奥氏增强效应频率的数据点作为网络模型的训练输入，与完整的背景参考 Z 谱与主磁场偏移量作为网络模型的训练输出，从而进行训练得到模型；再者，将采集得到的每个像素的 Z 谱信息输入网络进行训练，得到主磁场偏移量信息与对应矫正后背景参考 Z 谱；最后，将矫正后的背景参考 Z 谱与采集 Z 谱做差得到对应感兴趣交换点的化学交换饱和转移效应与核奥氏增强效应信息。
结果：
缺血性卒中患者的结果显示梗死组织中的 APT 和 NOE 信号均明显低于正常组织，这可能与缺血区组织坏死有关。而低级别胶质瘤患者的肿瘤区域的 APT 对比度稍有增加，而 NOE 对比度明显降低，与 MTRasym 成像有明显的相关性，提示肿瘤区域 MTRasym 信号的升高主要是由于 NOE 效应降低导致的。乳腺癌患者的研究结果显示，相比正常侧乳腺，病变区域的 APT 信号显著升高。
结论：
基于神经网络拟合的 CEST 成像后处理方法可准确分离 APT 效应与 NOE 效应的贡献，该方法可应用于颅脑与体部器官疾病的诊断研究。

PO-154

# Silent MRA 与 3D TOF MRA 在脑动静脉畸形中的对比研究

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目的 探讨磁共振静音血管成像（Silent MRA）在脑动静脉畸形（AVM）中的应用价值。材料与方法 前瞻性收集 2020 年 7 月至 2021 年 5 月临床诊断疑似 AVM 患者 38 例,分别采用 Silent MRA 及三维时间飞越法血管成像（3D TOF MRA），以数字减影血管造影（DSA）结果为金标准，比较 Silent MRA 及 3D TOF MRA 对 AVM 显示的敏感度及特异度，评估两种技术的诊断准确率。结果 所有 38 例患者中，DSA 诊断 AVM 30 例，8 例未见异常。Silent MRA 对 AVM 敏感度、特异度、准确率分别为 96.67%（29/30）、100%(8/8)、97.37%（37/38）；3D TOF MRA 对 AVM 敏感度、特异度和准确率分别为 80.00%(24/30)、75.00%(6/8)、78.94%(30/38)。以 DSA 结果为标准，Silent MRA 对 AVM 诊断效能明显优于 3D TOF MRA。结论 相比 3D TOF MRA 技术，Silent MRA 能提供更高的诊断准确率，且与 DSA 具有更高的一致性，为 AVM 的影像学评估提供了一种安全有效的新方法。

PO-155

# 探索压缩感知技术不同加速因子对于 3D-踝关节磁共振成像显示距腓前韧带的价值

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目的 探讨压缩感知技术三维磁共振成像显示距腓前韧带的应用价值,并比较不同加速因子对成像的影响。方法 对 40 名志愿者在 3.0T MR 上行踝关节扫描，完成常规踝关节扫描和 CS-3D 踝关节扫描,根据 CS 技术采用的不同加速因子,分别设 CS-4、CS-6 和 CS-8,每例患者获得常规、CS-4、CS-6 和 CS-8 这 4 组图像，通过主、客观分析对图像质量进行评价，评估距腓前韧带的显示效果。结果 两位高年资 MR 诊断医生对图像质量的主观评价得出较高的一致性（k=0.91，p<0.001），取 2 名阅片者对 CS 组和常规组图像主观评分平均值进行 wilcoxon 符号秩和检验，结果显示：CS-6 组与常规组图像质量评分差异无统计学意义（Z1=0.38，p=0.29），CS-8 组与常规组图像质量评分差异有统计学意义（Z2=5.46，p<0.01）。客观评价中，CS-4 在四组图像中 SNR 最高（p<0.05），且 CS-6 组与常规组的 CNR 差异无统计学意义。结论 CS 技术可用于 3.0T MRI 行 3D-踝关节检查，当加速倍数为 6 时，在清晰显示距腓前韧带的同时，有效地缩短了扫描时间

PO-156

# MRI DRIVE 技术在诊断颞下颌关节腔积液中的应用价值

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**目的：**探讨 MRI DRIVE 技术在诊断颞下颌关节腔积液中的应用价值。
**资料与方法：**
一、病例资料

本研究对象为我院 2020-05-01 至 2021-05-01 颞下颌关节 612 例 MR 扫描的患者，年龄在 7 岁至 77 岁之间，研究对象条件不限。

二、颞下颌关节的 MR 检查

采用我院超导型 MR 成像系统（3.0T Ingenia Philips）对患者双侧颞下颌关节行开、闭口斜矢状面快速自旋回波质子密度加权成像 mDIXION（proton density weighted image,PDWI）扫描，即 PDWI-mDIXION-TSE 序列，在此序列中分别使用 DRIVE 和不使用 DRIVE 技术，在抑脂图像上回顾性对比分析颞下颌关节腔渗出积液的检出率和信号的显示结果。其中使用 DRIVE 技术扫描的患者有 312 例，不使用 DRIVE 技术扫描的患者有 300 例。

扫描参数：TR：2000ms TE：18ms

FOV：100mm*100mm 层厚：2.5mm 间隔：0.25mm 扫描时间：2.25min

三、MRI 评价标准

参照文献 Larheim 等的标准，在 PDWI 抑脂斜矢状面颞下颌关节连续层面内的关节腔内出现高信号影像定义为关节腔渗出积液，其评价标准为：1、无渗出积液：关节腔内无高信号影像；2、少量渗出积液：关节腔内呈点状或关节表面线样高信号影像；

3、中等量渗出积液：关节腔内呈局部小三角形或条状积聚高信号影像；4、大量渗出积液：关节腔内渗出积液量较多，范围较中等量渗出积液更大。图像由 2 名对颌面部影像诊断有经验的放射科副主任医师根据上述标准先单独盲法阅片，完成关节腔积液的评价，然后对 2 名医师结果进行一致性检验。对于 2 名医师意见不一致的病例，再次阅片，最终结果共同讨论决定。

四、统计方法

所有数据均采用 SPSS 20.0 软件进行统计分析，2 名医师对颞下颌关节腔积液评价的一致性采用 Kappa X2 检验。若理论频数 T<5，采用连续性校正 X2 检验，P<0.05 为差异有统计学意义。

612 例患者中共检出颞下颌关节腔积液

**结果：**191 例，积液占比为 31.21%，其中，使用 DRIVE 技术扫描的 312 例患者中检出关节腔积液 123 例，积液检出率为 39.42%；不使用 DRIVE 技术扫描的 300 例患者中检出关节腔积液 68 例，积液检出率为 22.67%，积液不确定 1 例。2 名医师对关节腔积液评价结果的一致性较好，Kappa 值为 0.832，少量关节腔积液的 P<0.01，有统计学意义，中等量及大量关节腔积液的 P 值分别为 0.25 和 0.31，无统计学意义。

**结论：**DRIVE 技术对颞下颌关节腔积液的检出率较高，特别是少量关节腔积液中具有重要价值，同时，因使用 DRIVE 技术，使长 T2 组织加速纵向驰豫，可以用较短的 TR 来检测其组织信号，从而可以缩短扫描时间。

# PO-157

# 磁共振 IDEAL-IQ 技术对糖尿病患者骨质疏松风险的评估价值

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目的：探讨磁共振 IDEAL-IQ 技术对糖尿病患者骨质疏松风险的评估价值，为疾病的诊断和预防提供可借鉴的参考价值。

材料和方法：在提供知情同意后，对 36 名糖尿病患者分别进行磁共振腰椎 IDEAL-IQ 序列检查和双能 X 线吸收测量法(DXA)检测，体质量指数 BMI20.21～28.08kg/m2。行双能 X 线吸收测量法（DXA）后将所有糖尿病患者分三组，A 组为骨量正常组，B 组为骨量减少组，C 组为骨质疏松组。IDEAL-IQ 序列通过一次扫描，系统可自动生成 6 幅图像，包括脂肪分数图、R2*弛豫率像、水像、脂像、同相位及反相位图像，在 GE AW4.6 后处理工作站上分别测量腰 1～腰 5 腰椎椎体脂肪分数（Fat Fraction，FF），选取 L1～L5 椎体矢状面最大层面，将感兴趣区置于椎体中心位置，最大限度包括椎体松质骨，避开骨皮质、终板和椎间盘，每个椎体测量 3 次求平均值。分析比较 A、B、C 三组腰椎椎体 FF 值，采用 SPSS 19.0 进行统计分析。

结果：A、B、C 各组间年龄差异无统计学意义(P>0.05)。A、B、C 各组间腰椎椎体平均 FF 值测量结果分别为：43.65±3.91、49.78±6.67、57.85±3.84，单因素方差分析结果显示不同组间 FF 值有显著性差异(ANOVA，F=5.515，P=0.036)。其中 A 组与 C 组间 FF 值差异有统计学意义(Post-Hoc LSD,P=0.013)；而 A 组与 B 组、B 组与 C 组间 FF 值差异均无统计学意义 (Post-Hoc LSD,P=0.084;Post-Hoc,P=0.171)，且三组间 FF 值呈逐渐递增的趋势。Pearson 相关分析结果显示 BMD 与 FF 值呈负相关。
结论：磁共振 IDEAL-IQ 可定量评估腰椎椎体脂肪含量，从而对糖尿病患者中骨质疏松风险进行无创性评估，对临床诊疗有指导价值。

## PO-158
# 体素内不相干运动磁共振扩散加权成像定量预测胃癌 HER2 及 Ki67 表达

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目的：通过体素内不相干运动扩散加权成像(intravoxel incoherent motion diffusion weighted imaging,IVIM)定量预测胃癌免疫组化因子（HER2、Ki67）的相关性价值及定量诊断阈值。
方法：本研究经过我院伦理委员会审核和批准，所有纳入研究对象检查前均签署知情同意书。从 2016 年 10 月到 2021 年 4 月共计 156 名经内镜胃活检病理证实的胃癌患者，并完成 IVIM 序列成像，最终 92 名患者进入研究对象。将 IVIM 序列数据导入软件针对肿瘤 ROI 区域进行后处理，生成参数 f 值、D 值、D*值。首先对研究对象临床特征进行分析是否影响 HER2 阴性和阳性表达及 Ki67 高低表达； 其次分析 IVIM 参数 f 值、D 值、D*值进行单因素方差分析 HER 不同评分等级的价值；对 HER2 阴、阳性表达及 Ki67 高、低表达二分类数据进行两样本 t 检验、ROC 分析。结果：1．研究对象的临床病理特征，纳入研究对象为 92 名患者，男性 58 名，女性 27 名，≤60 岁 37 名，＞60 岁 48 名；胃上、中、下部分别 25，35，25 名； 病理 T 分期中 T1 期有 10 名，T2 期有 10 名，T3 期有 10 名，T4a+b 期有 55 名；病理 N 分期中 N0 期有 20 名，N1 期有 10 名，N2 期有 14 名，N3 期有 19 名等对 HER2 阴阳性表达无统计学差别。但肿瘤体积、T 分期及 N 分期对于 Ki67 高低表达有统计学差别；2．IVIM 参数 D* 值在 HER2 不同评分等级有统计学价值，评分级别越低，D*均值越高，评分为 0、1 分、2 分、3 分的均值分别为 3.378 ×10-2mm2/s，7.056×10-2mm2/s，2.464×10-2mm2/s，1.292×10-2mm2/s；D*值检验胃癌 HER-2 是否阳性具有统计学意义，AUC 值为 0.60；HER2 阳性癌灶的 D*值更低，ROC 分析得到 D*值＜3.304×10-2mm2/s 时可以诊断 HER-2 阳性。3. IVIM 参数 D 值与 Ki67 蛋白表达率呈明显负相关；参数 D 值在胃癌 Ki67 是否高表达有统计学意义，AUC 值为 0.75，ROC 分析得到 D 值＜0.917×10-3mm2/s 时可以诊断 Ki67 高表达。
结论：IVIM 参数 D* 值可以定量预测分析胃癌 HER2 是否阳性有临床价值；参数 D 值可以预测胃癌 Ki67 是否高表达，与 Ki67 呈明显负相关；

## PO-159
# 基于改良 GRASP 的多期磁共振成像评估肺肿瘤

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目的：径向采样可以在自由呼吸状态下行磁共振检查，特别是肺部检查。但是，肺部标准的径向采样成像仍然受到呼吸运动的影响。因此，对动态径向 MRI 采取额外的运动补偿是一种有效提高自由呼吸 DCE-MRI 图像质量的手段。本研究的目的是评估一种基于改良的黄金角径向稀疏并行成像技术（M-GRASP）的自由呼吸 DCE-MRI 的有效性。
材料与方法：前瞻性收集 39 例明确有肺部占位的患者，并采用脂肪抑制 T1 加权层叠黄金角径向采样序列进行检查。根据数据分类标准，最终有 20 例患者被入组到 M-GRASP 图像重建实验。对 20 例患者的每一个径向采样数据集都采用两种方法进行图像重建，一种是采用柔性门控迭代重建算法的 M-GRASP 重建，另一种是未采取运动补偿的标准 GRASP 重建。两名有经验的放射医生分别对 M-GRASP 重建和标准 GRASP 重建的四期增强图像进行质量评分，包括图像总质量、病灶边缘、总伪影等级和诊断自信评分。在 DCE-MRI 检查之后立即行常规屏气容积内插（BH-VIBE）扫描并进行图像质量评分，对 BH-VIBE 图像和两种 GRASP 重建的延迟期图像的质量评分进行比较。另外，有 3 名患者还接受了胸部增强 CT 检查，其延迟期图像也被纳入分析。
结果：与标准 GRASP 重建相比，M-GRASP 重建在图像总质量(3.37±0.28 v.s. 3.10±0.32)、病灶边缘(3.33±0.35 v.s. 2.98±0.51)、总伪影等级(3.29±0.33 v.s. 2.96±0.49)和诊断自信(2.54±0.24 v.s. 2.31±0.31)等评分项目上均有显著提升（P 值均小于 0.05）。在延迟期，BH-VIBE 图像与 M-GRASP 重建图像的图像质量评分之间没有明显差异（P 值均大于 0.05）。总图像质量、病灶边界、总伪影等级和诊断自信评分的 Cohen’s Kappa 值分别为 0.76、0.80、0.77 和 0.94，说明两名评分者之间的图像质量评分的一致性较好。虽然屏气的 CT 图像的质量更高并且显示了更多细节，但是 M-GRASP 扫描无需屏气，避免了辐射暴露，同时提供了更好的软组织对比度与足够的诊断质量。
结论：M-GRASP 自由呼吸 MRI 技术能够有效地提升 MRI 评估肺部病变的价值和效力。与标准 GRASP 重建相比，该技术成像效能更佳，能够为 DCE-CT 扫描提供更有效的额外信息，尤其是对那些需要反复随访的病人。

PO-160

# Comparative Analysis of Amide Proton Transfer MRI, T1 mapping and Diffusion-Weighted Imaging in Diagnosing Breast mass lesions

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Objective: To investigate the feasibility of amide proton transfer MRI in assessing breast lesions and combined it with T1 mapping and conventional diffusion-weighted imaging (DWI) to explore the value in diagnosing the differential diagnosis of breast mass lesions.
Methods: APT imaging, T1 mapping and DWI were performed in 53 patients with breast mass lesions, and all lesions were confirmed by pathology. The APT signal intensity (SI) (APT SImean), T1 mapping change rate and average ADC value of benign and malignant breast lesions were measured, calculated and compared. The ROC curve was used to evaluate the diagnostic efficacy of various imaging techniques in differentiating breast lesions. Logistic regression was used to calculate the diagnostic probability of the combination of two and three methods, and the probability was used to draw the ROC curve and calculate the area under the curve. Results: A total of 53 lesions were included, including 22 benign lesions and 31 malignant lesions. Benign group: APT SImean value: 1.71±1.66, T1 mapping rate: 0.44±0.23, average ADC value: 1.42±0.37. Malignancy group: APT SImean value: 3.63±1.20, T1 mapping rate: 0.68±0.18, ADC value: 0.99±0.43. The APT SImean value

and T1Mapping change rate in malignant group were higher than those in benign group, and the average ADC value was lower than that in benign group. The areas under the ROC curve of APT SImean value, T1 mapping change rate and ADC value were (0.880, 0.790 and 0.757), respectively. The areas under the curve of APTw combined with T1mapping, APTw combined with ADC, and ADC combined with T1mapping were (0.884, 0.884, 0.787), respectively, P>0.05. The AUC of APTw combined with T1mapping and ADC was 0.94.
Conclusion: APT-weighted MRI is feasible in breast cancer. APT demonstrated a better diagnostic performance than ADC in distinguishing the differential diagnosis of breast mass lesions. APTw combined T1 mapping and ADC imaging techniques could be used in diagnosing and significantly improve the diagnostic efficiency compared with the combined of pairwise.

## PO-161

# DCE-MRI 与 DWI 诊断类风湿性关节炎活动性的价值

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目的 探讨动态增强磁共振成像（DCE-MRI）与扩散加权成像（DWI）用于类风湿性关节炎（RA）活动性的诊断价值。
方法 采用前瞻性研究方法，纳入 28 例临床确诊的 RA 患者，活动组 18 例，稳定组 10 例，所有病例均行双腕关节 MRI 常规扫描、DWI 和 DCE-MRI 检查，分析病变的表观扩散系数（ADC）、DCE-MRI 的时间-信号强度曲线（TIC）、早期强化率（EER）、平均强化率（AER）及最大强化率（MER）、达峰时间（TTP）；采用秩和检验评价两组间量化参数的差异性，运用 Spearman 相关分析评价 DWI 和 DCE-MRI 的量化参数及临床疾病活动性评分 DAS28 的相关性，用 ROC 曲线下面积评价 DWI 和 DCE-MRI 的量化参数对 RA 活动性的诊断效能。
结果 活动组及稳定组 RA 间的 DWI 和 DCE-MRI 的量化参数差异性有统计学意义（P 均＜0.05）。ADC 值和 EER、AER、MER、DAS28 呈负相关，与 TTP 呈正相关；EER、AER、MER 与 DAS28 呈正相关，TTP 与 DAS28 呈负相关。ADC 值和 EER、AER、MER 及 TTP 的 ROC 曲线下面积分别为 0.964、0.972、0.797、0.944、0.944，均有诊断效能。
结论 DCE-MRIDCE-MRI 可以从血流动力学角度间接反映 RA 活动性，而对于不能耐受钆增强对比剂的患者则可以运用 DWI 从滑膜水分子弥散受限角度间接反映其活动性，弥补了 DCE-MRI 的不足；两者同时运用保证了诊断的准确性。

## PO-162

# Evaluation of articular cartilage in knee osteoarthritis using diffusion-relaxation correlation spectrum imaging

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Purpose: To evaluate DR-CSI of knee cartilage in osteoarthritis (OA) populations for early diagnosis and characterization of OA.Materials and Methods: Thirty-six mild OA, twenty-seven moderate OA and twenty-seven healthy controls were included. The hybrid multidimensional imaging using a two-compartment model measured a slow and a fast diffusion compartment of cartilage in five compartments. We examined the relationship of Vslow values with various WORMS. ROC was used to detect the ability of Vslow, ADC and T2 relaxation time for discriminating healthy controls from early OA.Results: The intra- and inter-observer reproducibility for calculated mean Vslow values and WORMS was substantial agreement with the intraclass

correlation coefficient > 0.8 for all. Overall Vslow in all compartments significantly differed among the healthy controls (69.00 ± 7.80%), mild (58.28 ± 8.32%) and moderate OA (47.69 ± 9.29%). Mean Vslow values showed a negative correlation with the degree of OA progression (rho = -0.804, P<0.001). Mean Vslow was characterized by a higher sensitivity (0.926) and specificity (0.746), with a cut-off value of 60.2%, compared to ADC and T2 values or a combination of ADC and T2 to differentiate early OA from healthy controls.Conclusion: Volume fractions of slow and fast diffusion compartments using DR-CSI that depends on coupled values of ADC and T2 may provide incremental value for detecting cartilage degeneration at early stage of OA.

## PO-163

# APTw 联合 DCE-MRI 术前评估子宫内膜癌风险的价值

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目的：探讨 APTw 联合 DCE-MRI 术前评估子宫内膜癌（endometrial carcinoma，EC）风险的价值。
材料与方法：回顾性分析 29 例经手术病理证实为 EC 的影像资料，所有患者均行 3.0T 磁共振检查，扫描序列包括 Axial-T1WI、Sag-T2WI、Sag-APTw、Sag-DCE-MRI。高风险分组需满足以下条件：① IB 期及以上 I 型 EC；②G3 期的 I 型癌；③非子宫内膜样癌亚型。低风险组需为 IA 期（G1 和 G2 期）的 EC。最终入组高风险组（11 例）和低风险组（18 例）。由两位观察者分别测量病灶 APTw 的 APT 值、DCE-MRI 的 Ktrans、Kep、Ve 和 Vp。采用组内相关系数（intra-classcorrelation coefficients，ICC）检验两位观察者对各参数值测量结果的一致性；使用 Mann-Whitney U 检验比较两组 APT、Ktrans、Kep、 Ve 及 Vp 值的差异。使用 ROC 曲线比较两组 APTw 及 DCE-MRI 参数的诊断效能。使用 Delong 检验比较各参数诊断效能的差异。使用 Pearson 相关检测 APT 值和有差异的 DCE-MRI 参数间相关性。
结果：两位观察者测量两组病灶 APT、Ktrans、Kep、Ve 及 Vp 值的一致性很好；高风险组的 APT、Ktrans 值（2.79±0.43 %、（340.44±164.60）×10-3/min）大于低风险组（2.26±0.31 %、（276.11±144.45）×10-3/min），差异均具有统计学意义（P 值分别为 0.001、0.022）；两组间 Kep、Ve 及 Vp 值无差异；诊断高风险组 APT、Ktrans 的阈值分别为 2.775%,及 372.51×10-3/min，AUC 值分别为 0.816 及 0.848。灵敏度及特异度分别为 63.6%及 94.4%、 90.9%及 72.2%。APT 和 Ktrans 联合后 AUC 为 0.909；联合后 AUC 与 APT 和 Ktrans 单一参数的 AUC 差异无统计学意义；APT 值和 Ktrans 值间具有正相关（P=0.042，r=0.389）。
结论：APTw 联合 DCE-MRI 能够术前评估子宫内膜癌的风险，APT 值和 Ktrans 值最有价值，且两者呈正相关，当联合使用时诊断效能会增高。

## PO-164

# 囊液的 APTw 和 mDIXON-Quant 成像定量参数对卵巢囊性灶中卵巢子宫内膜异位囊肿的鉴别价值

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目的：探讨囊液的酰胺质子转移加权成像(Amide proton transfer weighted，APTw)、水脂分离定量技术（mDIXON-Quant）定量参数对卵巢囊性病灶中卵巢子宫内膜异位囊肿的鉴别价值。
材料和方法：收集 2019 年 4 月～2021 年 1 月于我院进行 3.0T MRI 盆腔扫描的卵巢囊性病变患者共 31 名合计 35 例病灶。其中卵巢子宫内膜异位囊肿（OE）18 例病灶，卵巢其他囊性病变（OC）17 例病灶。扫描序列包括 T1WI、T2WI、APTw 和 mDIXON-Quant。由两名观察者分别测量病灶囊液的 APT、R2*及脂肪分数（fat fraction，FF）值，选择囊腔最大层面及上下层面放置 3 个 ROI，计算基于 ROI 的定量参数均值。使用组内相关系数法（ICC）检验两观察者测量数据一致性。使用 Mann-Whitney U 比较两组病灶囊液的 APT、R2*及 FF 值。对于有统计学差异的参数使用受试者工作特征曲线（ROC 曲线）评估诊断效能。使用 logistic 回归计算有差异参数的联合诊断效能，使用 Delong 检验进行 ROC 曲线下面积（AUC）比较。使用 Spearman 相关分析来看 APT 与 R2*值和 FF 值的相关性。
结果：两观察者测量数据的一致性良好，ICC 值均高于 0.75。OE 组的 APT 值（1.43（0.80，1.82））%低于 OC 组（5.00（1.72，6.22））%，OE 组 R2*值（23.76（18.20，33.01））s-1 高于 OC（9.98（9.79，12.65））s-1，FF 值在 OE（1.51（1.08,2.14））%与 OC 组（1.97（1.16，2.24））%间无显著差异，p 值分别为 0.001、0.000 和 0.204。APT 值及 R2*值鉴别 OE 和 OC 的 AUC 为 0.825、0.987， APT 值及 R2*分别取阈值为 2.58%和 14.08 s-1 时，诊断灵敏度都为 100%，特异度分别为 70.6%和 94.4%。APT 与 R2*值联合后 AUC 提高到 0.990。APT 与 R2*值 AUC 无差异，p 值为 0.0507。联合后与 APT 值、R2*值间 AUC 比较，p 值分别为：0.0328、0.689。APT 值与 R2*值成负相关（r=-0.436，p=0.000），与 FF 值间无相关性（p=0.985）。
结论：卵巢子宫内膜异位囊肿（OE）与卵巢其他囊性病变（OC）囊液的 APT 和 R2 *值具有显著差异，且 APT 联合 R2*较单独使用 APT 有效地提高诊断效能，可以很好的鉴别 OE 和 OC。R2*值与 APT 值间存在负相关。

# PO-165
# 健康志愿者与肝硬化患者间门静脉 4D flow MRI 定量参数的差异性比较

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目的
验证 4D flow MRI 定量评估肝硬化患者门静脉血流定量参数的可行性，比较健康志愿者与肝硬化患者间 4D flow MRI 定量参数的差异性。
材料方法
本研究招募了 12 名健康志愿者(男性 7 名，女性 5 名，平均年龄 41.9±11.4 岁，对照组)，并回顾性收集 2019 年 9 月至 2020 年 10 月于我院就诊的 14 名肝硬化患者(男性 7 名，女性 7 名，平均年龄 42.1±10.5 岁，肝硬化组)。所有志愿者和患者都在飞利浦 Ingenia 3.0 T MRI 接受上腹部 MRI 检查，扫描序列包括常规 T1WI，T2WI，DWI，2D Q-flow 和 4D-flow 序列。其中扫描 2D Q-flow，以测量门静脉中的流速作为速度编码的参考。4D-flow 参数如下：TR/TE = 5.0/3.2 ms，FOV = 300×350 mm2，分辨率= 2.5×2.5×2.5 mm3，PC 方向= RL-AP-FH，CS=8，扫描时间= 4 分 37 秒。扫描完成后通过主机进行 4D flow 重建。将重建后的数据拷出，由临床诊断经验丰富的放射科医师（具有 5 年腹部 MRI 诊断工作经验）在 CVI 42 软件包上处理图像，以获得 3D 血管图像。首先在门静脉起始位置放置参考平面，其次在门静脉的近端、中间部和远端分别放置一个测量平面用于血流定量分析。测量的定量参数包括目标血管段的流量、流速、壁切应力(WSS)和压力梯度。采用 SPSS 22.0 统计学分析软件进行统计分析。采用 Mann-Whitney U 检验比较两组间各参数差异

性，P＜0.05 为差异具有统计学意义，选择有统计学差异参数绘制受试者工作特征曲线（receiver operator characteristic,，ROC），计算曲线下面积（area under curve，AUC），比较各参数诊断效能，计算最佳阈值的敏感性和特异性。
结果
肝硬化组门静脉远端血流量和门静脉中间部、远端流速均低于对照组(p < 0.05)。肝硬化组门静脉近端、中间部、远端压力梯度值均低于对照组(P＜0.05)。两组间其余血流定量参数均无统计学差异（P＞0.05）。根据 ROC 分析，门静脉近端的压力梯度值诊断效能最高，AUC 值为 0.985，敏感性和特异性分别为 100%和 85.7%。
结论
肝硬化患者门静脉远端的血流量和流速低于健康志愿者。压力梯度值变化显著。4D flow MRI 能够对肝硬化进行定量评估。

# PO-166
# 多对比度一站式弛豫定量技术在肝性脑病患者脑铁沉积定量方面的应用价值

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目的：探讨多对比度一站式弛豫定量技术(magnetic resonance imaging compilation , Magic) 在定量肝炎后肝硬化及肝性脑病患者脑内铁异常沉积中的应用价值。
材料与方法：连续收集 2020 年 7 月至 2021 年 5 月由宁夏医科大学总医院经临床表现及相关实验室检查确诊的乙肝后肝硬化的患者，对该类人群行数字连接实验-A（NCT-A）及数字符号实验（DST）量表筛查出肝性脑病患者，并进行分组。NCT-A 及 DST 量表均为阳性则诊断为肝性脑病。本实验共纳入 45 名受试者，其中肝性脑病患者 23（23/45）名、单纯肝硬化患者 22（22/45）名；男性患者(34)名、女性患者（11）名；年龄范围（35-55 岁），所有患者均为右利手。另收集同期年龄、性别及受教育程度与实验组相匹配的健康对照人群 21 名。所有患者均进行常规 T1WI 及 Magic 序列扫描。采用 8 个不同反转时间的 IR-TSE 序列，通过自动运算得到 T2 mapping 图，测量 ROI 的 T2 值并计算平均值。所有患者图像经后处理提取最大层面感兴趣区，ROI 包括双侧前额叶、脑深部核团（双侧尾状核头、苍白球、壳核、背侧丘脑）。所有 ROI 值由两名从事神经影像诊断的高、中年资医师分别进行测量并记录。将健康对照组 ROI 的 T2 平均值与 Hallgren 和 Sourander 对尸检结果测得铁含量结果进行线性相关，观察两者一致性。采用单因素方差分析比较三组间 ROI 的 T2 值有无差异，并将肝性脑病组的 T2 值与 NCT-A、DST 量表评分进行相关性分析。
结果：21 名健康对照组尾状核、壳核、苍白球、背侧丘脑及额叶白质平均值分别为 76.82、66.84、62.97、73.03、78.68，与 Hallgren 和 Sourander 的结果具有较高的一致性（r=-0.885,p=0.046）。苍白球的 T2 值最低。与肝硬化组相比，肝性脑病组的右侧尾状核、双侧壳核、左侧苍白球、双侧额叶的 T2 值减低（p＜0.05）；与健康对照组相比，肝性脑病组右侧尾状核、双侧壳核、左侧苍白球及双侧丘脑 T2 值减低（p＜0.05）；肝硬化组与健康对照组相比，右侧额叶 T2 值减低（p＜0.05）。左侧尾状核和右侧壳核 T2 值与 NCT-A 完成时间呈负相关，分别为（r=-0.597,p=0.011）、(r=-0.500,p=0.041)，同时左侧壳核 T2 值与 DST 分数呈正相关（r=0.490,p=0.046）。
结论：Magic T2 值对脑内铁含量进行定量测量具有可行性；肝性脑病患者右侧尾状核、双侧壳核、左侧苍白球的 T2 值均低于健康对照组及肝硬化组，肝硬化组右侧额叶 T2 值较健康对照组减低。肝性脑病患者认知功能减低可能与右侧尾状核及双侧壳核脑区铁异常沉积增加有关。

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# 磁共振同时多层（SMS）技术在肾脏扩散加权成像中的可行性研究

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目的：探讨应用磁共振同时多层（Simultaneous Multi-slice, SMS）加速技术对肾脏扩散加权成像（DWI）图像质量进行系统分析。
材料和方法：前瞻性收集接受双肾磁共振扫描的 60 名患者。采用西门子 Skyra 3.0T MRI 扫描仪。三套 DWI 扫描协议分别为：A、平面回波 DWI（EPI-DWI）：FOV 400mm×318mm、TR/TE 5700ms/93ms、层数 24、分辨率 1.1×1.1×6mm$^3$、b 值为 50s/mm$^2$ 及 1000 s/mm$^2$，扫描时间为 2min47s；B、C（SMS-DWI）：除 TR 时间外其他参数与 A 协议完全一致，B、C 协议的 TR 为 2900ms、2000ms，层数加速因子为 2（AF2）、3（AF3），扫描时间为 1min25s、54s。图像质量评估：以 A 协议为参考标准，（1）主观评价：应用 5 点量表法对三组图像质量进行分级评估；（2）客观评价包括信噪比（SNR）及 ADC 值对比。图像质量分级的差异采用秩和检验比较；采用配对 t 检验比较 A 和 B、A 和 C 图像 SNR、ADC 值的差异。
结果：与 A 协议相比，C 协议图像质量明显降低，分级差异具有统计学意义（p=0.002），B 协议表现出稳定的图像质量，组间图像质量分级差异无统计学意义（p=0.325）。B 协议与 A 协议具有相似的 SNR，差异无统计学意义（p=0.162），C（AF3）SNR 明显低于 A 标准协议，差异具有统计学意义（p＜0.05）。B、C 与 A 协议肾皮质、肾髓质 ADC 值比较，差异均无统计学意义（p=0.17 、p=0.85）。
结论：在显著减少扫描时间且不会对图像 SNR、ADC 值定量产生影响的情况下，使用 SMS-DWI（AF2）扫描协议能取得很好的临床应用效果；SMS-DWI（AF3）图像 SNR 明显下降，无法满足临床诊断需求。因此，SMS 作为一种新的磁共振加速技术，在肾脏 DWI 中具有良好的应用前景。

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# 3D Dual Flip Angle (DFA) T1 mapping for differentiating benign and malignant liver lesions at 3T: comparison with diffusion weighted imaging

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Objectives: To evaluate the diagnostic performance of T1 mapping in the differentiation of benign and malignant FLLs, and the results were also compared with that of DWI.
Methods and materials: This retrospective study enrolled 294 FLLs including 150 benign and 144 malignant lesions. Whole liver T1 values were obtained before and 2 min after the administration of Gd-DTPA to acquire native T1, enhanced T1 and ΔT1%. DWI sequence was also conducted to generate the ADC maps. The mean values of all the quantitative parameters mentioned above of benign and malignant FLLs were compared. The diagnostic accuracy for FLLs of T1 mapping and ADC were calculated using ROC analysis. Moreover, the correlations between native T1, enhanced T1, ΔT1% and ADC were performed.
Results: The benign and malignant FLLs' mean native T1, enhanced T1, ΔT1% and ADC were 2073.35ms vs 1487.29ms、268.71ms vs 486.04ms、80.5% vs 63.4%、2.133×10$^{-3}$mm$^2$/s vs 0.903×10-3mm$^2$/s, respectively（P＜0.01）. The sensitivity and the specificity of native T1 (cutoff value 1653.5 ms), enhanced T1 (cutoff value 339.2 ms), ΔT1% (cutoff value 70.8%) and ADC (cutoff value 1.21×10$^{-3}$mm$^2$/s) were 0.797/0.702, 0.911/0.976, 0.901/0.905 and 0.975/0.952,

respectively. The best cutoff value of native T1 and ADC in identifying cyst and hemangioma were 2422.9 ms （AUC 0.990，P＜0.01）and $2.077\times10^{-3}mm^2/s$（AUC 0.949，P＜0.01）, respectively, and the corresponding sensitivity and specificity were 0.963/1、0.852/0.892. Native T1 and ΔT1% showed significant positive correlation with ADC, and the enhanced T1 showed significant negative correlation with ADC.
Conclusion: Combined with the administration of Gd-DTPA, 3D VFA T1 mapping technique reveals high clinical potential in identifying benign and malignant FLLs. The enhanced T1 and ΔT1% have similar diagnostic accuracy comparing with DWI in evaluation FLLs. The native T1 shows better performance than DWI in distinguishing benign liver lesions, i.e. cyst and hemangioma.

## PO-169

# REACT 非增强磁共振下肢血管成像技术的临床应用

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【摘要】增强磁共振血管造影(CE-MRA)、增强 CT 血管造影（CTA）是成熟的评估外周血管疾病(PAD)的非侵入性成像技术，但近年来研究表明 CE-MRA 血管造影所使用的钆对比剂与慢性肾病患者的肾源性系统性纤维化关联，多次引入钆对比剂会造成钆的脑表面沉积和骨沉积，对机体产生影响，CTA 血管造影固有的电离辐射，及部分患者碘对比剂使用的过敏风险，进一步加强了临床患者对非打药增强血管造影技术（NCE-MRA）的需求。3.0T 飞利浦 IngeniaMRI 设备，其独特的非增强、非心电、呼吸门控触发的下肢血管成像技术，即 REACT 技术，采用非选择性短时反转恢复(STIR)脉冲，T2 预脉冲和双梯度回波 Dixon(mDiXONXD)的组合序列进行下肢血管的成像，在大视野(FOV)上提供较好的背景抑制，同时显示动脉与静脉为临床提供有效的影像资料。REACT 非对比剂引入的血管造影检查，可显示下肢血管全程走行，病变血管的程度、范围，结合原始冠状 mDIXON 薄层图像还可显示血管周围的骨骼，肌肉情况。主要解决临床需要打药增强的下肢血管造影，而不能使用对比剂，不能接受辐射暴露患者的问题。同时减轻患者购买对比剂的经济负担，减少放射科护士的工作量、和放射科注射造影剂的设备成本。前瞻性收集下肢血管病变的病例，进行 REACT 技术与常规 MRA 打药增强的血管图像的准确性和一致性研究，并进行参数优化设计，提升图像空间分辨率，提高末梢血管的显示能力。

## PO-170

# 前列腺癌 18F-PSMA PET/MRI 表现与病理对照研究

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**目的：**18F-前列腺特异性膜抗原（prostate-specific membrane antigen, PSMA）PET/MRI 是目前前列腺癌影像诊断前沿技术手段，受到广泛关注。本文旨在探讨前列腺癌 18F-PSMA PET/MRI 表现与病理对照关系，进一步评价 18F-PSMA PET/MRI 技术对于前列腺癌的诊断效能，提高对该病诊断水平并指导临床诊疗。**材料与方法：**前瞻性地收集 19 例临床怀疑前列腺癌患者，于本中心经肘静脉注射 18F-PSMA 显像剂后，采用一体化西门子（Biograph mMR） PET/ MRI 仪行 18F-PSMA PET/MRI 检查，收集相关 18F-PSMA PET/MRI 的影像学资料并追踪病理结果，统计分析 18F-PSMA PET/MRI 表现与 Gleason 评分对照关系。**结果：**19 例患者中确诊前列腺癌患者 15 例，前列腺增生患者 4 例，18F-PSMA PET/MRI 诊断准确率为 89.47%，灵敏度为 93.3%，特异性为 75%，阳性预测值为 93.3%，阴性预测值为 75%。18F-PSMA PEI/MRI 检查时病灶 SUVmax

值、SUVmean 值与 Gleason 评分存在显著相关性（P 值分别为 0.023、0.026）；而 T2WI 评分、DWI 信号及评分（低 B 值 800）、DWI 信号及评分（高 B 值 1400）、ADC 值×10-3mm2/s、双参数 MRI 评分等与 Gleason 评分无相关性（P=0.249~0.768）；**结论：**18F-PSMA 作为前列腺癌诊断的靶向探针，前列腺癌细胞 18F-PSMA 摄取量与其 Gleason 评分存在显著相关性，但前列腺增生也可出现 18F-PSMA 摄取，其特异性仍有待增加样本量进一步探讨。

## PO-171

# 长期饮酒恒河猴脑功能改变静息态 fMRI 研究

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目的 采用 3.0T 静息态功能磁共振成像(fMRI)，基于分数低频振荡幅度(fALFF)算法分析长期饮酒后恒河猴脑功能活动改变。方法 采用时间表程序诱导法(SIP)建立 6 只雄性健康长期饮酒恒河猴模型，年龄 6~8 岁，平均（7.0±1.0）岁，体质量 6.5～17.5kg，平均体质量（10.79±3.55）kg，实验动物于恒温（20～22℃）、恒湿（65%）的共同房间中饲养，单只猴笼安置，10 小时光照周期（上午 8:00 点亮），药物为绝对风味伏特加（每瓶 700ml，乙醇浓度为 40%），用自来水稀释，给予实验动物每日 24 小时自由口服，分别于建模前及饮酒 36 月两个时间点进行静息态 fMRI 扫描，采用 GE Discovery 750W 3.0T MR 扫描仪，头部 16 通道相控阵正交线圈，进行血氧水平依赖性(BOLD)信号采集，基于 fALFF 算法获得饮酒 36 月与建模前比较 fALFF 值差异有统计学意义的脑区。结果 与建模前比较，恒河猴酒精暴露诱导期后 fALFF 值减低的脑区包括左侧角回（簇丛≥5 个体素，P=0.002），fALFF 值增高的脑区包括左侧颞中回、右侧颞下回及右侧中央后回（簇丛≥5 个体素，P 均<0.001），见图 1。结论 恒河猴长期饮酒后脑功能改变明显，视觉功能活动减弱，听觉、记忆情感和躯体感觉区功能活动增强。

## PO-172

# Fe3O4@BiOI-Based Nanotheranostic Platform as an MR Imaging and Effective Photothermal-Enhanced Chemo-dynamic Therapy Agent for Orthotopic Brain Tumor

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**Fe3O4@BiOI-Based Nanotheranostic Platform as an MR Imaging and Effective Photothermal-Enhanced Chemo-dynamic Therapy Agent for Orthotopic Brain Tumor**

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**Background and Purpose**

Glioblastoma multiforme (GBM), a common type of malignant intracranial cancer, is characterized by a high fatality rate among patients.[1] The main methods employed to treat cancer in the clinic

are chemotherapy, radiotherapy, and surgery. Chemo-dynamic therapy (CDT), as an emerging in situ treatment strategy, has attracted many researchers' attention. CDT decomposes the high amount of hydrogen peroxide ($H_2O_2$) of tumor tissue into toxic hydroxyl radicals (•OH) via iron-mediated Fenton reaction.[2] However, the therapeutic effects of CDT are hindered by limited •OH production. Recently, synergistic treatment for cancer is an effective strategy to enhance therapeutic effects compared with monotherapy. [3,4] Photothermal therapy (PTT), which utilizes heat to kill cancer cells, has been widely explored by its advantages of minimal invasive treatment. Besides, to monitor dynamic changes of the drug in the body by image methods in real-time, such as magnetic resonance (MR), computed tomography (CT), it is important to choose the treatment plan and evaluate the therapeutic effect. Thus, it is imperious to develop multifunctional materials with both imaging and therapeutic agents for photothermal-enhanced CDT therapy. Herein, we explore a BiOI/$Fe_3O_4$ nanoparticle coated with red blood cell membrane for the targeted orthotopic brain tumor with synergistic CDT / PTT therapy.

**Materials and Methods**

First, BiOI/$Fe_3O_4$ was synthesized, and then coated with Asn-Gly-Arg (NGR) peptide modified red blood cell membrane (RBCm), which can target $CD_{13}$ receptors overexpressed in tumor neovascularization epithelial cells. Second, the RBCm-BiOI/$Fe_3O_4$ was characterized with TEM, XRD and XPS, followed by measurements of both the photothermal properties and chemo-dynamic performance in vitro. Third, the occurrence of Fenton-like reaction for RBCm-BiOI/$Fe_3O_4$ NPs was studied in the U87 cell, and in vitro cell cytotoxicity assay was also measured. Finally, subcutaneous and orthotopic tumors were used to determine the localization of RBCm-BiOI/$Fe_3O_4$ NPs in the brain tumor. U87-tumor-bearing mice were injected with RBCm-BiOI/$Fe_3O_4$ NPs and MR images of the mice were collected before and after injection at different time points.

**Results**

As shown in Figure 1A, the BiOI/$Fe_3O_4$ was successfully synthesized with high homogeneity and coated with RBCm. In addition, terephthalic acid (TA)could be selected as an indicator of •OH generation. As shown in Figure 1B, a significant increase in absorbance was observed when TA was incubated with $H_2O_2$ and BiOI/$Fe_3O_4$ NPs in pH 5.4, which indicated the release of $Fe^{2+}$ and further decompose $H_2O_2$ into ·OH. Figure 1C showed the generation of ·OH in BiOI/Fe3O4 solutions increased obviously in pH 5.4 with irradiation, indicating the excellent photothermal performance of BiOI/$Fe_3O_4$ NPs and their potential as photothermal-enhanced chemo-dynamic therapy agent. In cells, after DCFH-DA staining, DCF fluorescence in U87 cells exposed to RBCm-BiOI/$Fe_3O_4$ NPs with laser was much higher than that of control (Figure 2A), indicating that RBCm- BiOI/$Fe_3O_4$ NPs with irradiation can enhance ·OH content in cancer cells. Furthermore, cell cytotoxicity assay showed RBCm-BiOI/$Fe_3O_4$ NPs with irradiation promoted cancer cell killing (Figure 2B), which was due to the synergistic effect of chemotherapy and CDT. We used subcutaneous and orthotopic tumors to examine MRI contrast effect of RBCm-BiOI/Fe3O4 NPs in vivo. As can be seen in the $T_2$-weighted images (Figure 3A), and $T_2$ signal intensity with different times was observed (Figure 3B) .the MRI signal in the tumor site gradually darkened over time after injecting RBCm-BiOI/Fe3O4 NPs, especially in orthotopic tumors, the dark signal of the T2-weighted MR image signal obviously strengthened the contrast distinction between solid tumors and the surrounding tissue (Figure 4A), enabling us to accurately monitor the tumor location and drug accumulation in real-time. Figure 4B showed $T_2$ signal intensity with different times.

**Discussion and Conclusion**

In conclusion, RBCm-BiOI/$Fe_3O_4$ NPs with good targeting and NIR absorption were prepared successfully. RBCm- BiOI/$Fe_3O_4$ NPs exhibited good biocompatibility, photothermal properties and photothermal-enhanced ·OH generation properties. Our in vitro experiments demonstrated that the synergistic treatment effect of CDT and PTT based on RBCm-BiOI/$Fe_3O_4$ NPs. Further, under the guidance of MR imaging in vivo, the tumor location and drug accumulation were also observed, which provided an effective way to treat orthotopic tumors. Thus, this system presents a good theranostic agent for MR imaging-guided CDT and PTT synergistic therapy.

**Acknowledgements**

This research was supported by the National Key R&D Program of China (2017YFE0103600), National Natural Science Foundation of China (81720108021), Zhongyuan Thousand Talents

Plan Project(ZYQR201810117), Zhengzhou Collaborative Innovation Major Project (20XTZX05015).
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PO-173

## Large-scale functional network connectivity mediate the associations of gut microbiota with sleep quality and executive functions

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Network neuroscience has broadly conceptualized the functions of the brain as complex communication within and between large-scale neural networks. Nevertheless, whether and how the gut microbiota influence functional network connectivity that in turn impact human behaviors has yet to be determined. We collected fecal samples from 157 healthy young adults and used 16S sequencing to assess gut microbial diversity and enterotypes. Large-scale inter- and intranetwork functional connectivity was measured using a combination of resting-state functional MRI data and independent component analysis. Sleep quality and core executive functions were also evaluated. Then, we tested for potential associations between gut microbiota, functional network connectivity and behaviors. We found significant associations of gut microbial diversity with internetwork functional connectivity between the executive control, default mode and sensorimotor systems, and intranetwork connectivity of the executive control system. Moreover, some internetwork functional connectivity mediated the relations of microbial diversity with sleep quality, working memory and attention. In addition, there was a significant effect of enterotypes on intranetwork connectivity of the executive control system, which could mediate the link between enterotypes and executive function. Our findings not only may expand existing biological knowledge of the gut microbiota-brain-behavior relationships from the perspective of large-scale functional network organization, but also may ultimately inform a translational conceptualization of how to improve sleep quality and executive functions through the regulation of gut microbiota.

PO-174

## Comparative analysis of the diagnostic values of T2 mapping and diffusion-weighted imaging for sacroiliitis in ankylosing spondylitis

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Objective To investigate the diagnostic values of T2 mapping and diffusion-weighted imaging (DWI) for active sacroiliitis in ankylosing spondylitis (AS) and to evaluate the correlations of T2 and ADC values with Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and Spondyloarthritis Research Consortium of Canada (SPARCC) scores. Methods A total of 77 AS patients with sacroiliitis and 45 healthy controls were enrolled. All patients were scanned by standard magnetic resonance imaging longitudinal relaxation time (T1)-weighted imaging (T1WI), fat-saturated T2-weighted imaging (FS-T2WI)] and DWI, and T2 mapping of the sacroiliac joints. According to whether subchondral bone marrow edema was present in the FS-T2WI sequence, the 77 patients were divided into an active group (41 cases) and an inactive group (36 cases). The T2 and apparent diffusion coefficient (ADC) values of the subchondral bone marrow were measured in the active group, the inactive group, and the healthy control group. The average T2 and ADC values were compared among the three groups. Receiver operating characteristic (ROC) curves were used to analyze the diagnostic efficacy of T2 and ADC values for sacroiliitis. The correlations of T2 and ADC values with the BASDAI score and the SPARCC score were analyzed. Results The T2 and ADC values in the active group were higher than those in the inactive group, while that in the inactive group were significantly higher than those in the healthy control group ($p < 0.0001$). The T2 and ADC values of the AS patients were positively correlated with BASDAI scores, and the correlation coefficients (r) were 0.786 ($p < 0.0001$) and 0.842 ($p < 0.0001$), respectively. The areas under the ROC curves (AUCs) of T2 and ADC values between the active and inactive groups, the active group and the healthy control group, and the inactive group and the healthy control group were 0.889 (95% CI, 0.80–0.95) and 0.917 (95% CI, 0.83–0.97), 0.982 (95% CI, 0.93–1.00) and 0.984 (95% CI, 0.93–1.00), and 0.628 (95% CI, 0.51–0.73) and 0.871 (95% CI, 0.78–0.94), respectively. The T2 and ADC values of the AS patients in the active group were positively correlated with SPARCC scores, and the correlation coefficients (r) were 0.757 ($p < 0.0001$) and 0.764 ($p < 0.0001$), respectively. Conclusion T2 and ADC values can be used to quantitatively assess the activity of AS, and the efficacy of the ADC value in the diagnosis of AS was higher than that of the T2 value.

# PO-175

# 蓝斑-丘脑室旁核环路调控麻醉-觉醒意识转换的机制研究

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目的：觉醒被认为是感觉、运动、认知和意识的基础。麻醉觉醒被视为一个被动的过程，然而诸多因素会极大地影响全身麻醉药的药代动力学和药效学，因此麻醉觉醒的时机难以预测。解析麻醉–觉醒神经回路的机制，不仅有助于促进对全身麻醉觉醒机制的理解，同时推动神经科学领域对认知、意识等高级大脑功能的了解。

丘脑室旁核（paraventricular thalamic nucleus, PVT）属于丘脑中线核群，被认为是丘脑的中继站，整合大脑不同神经系统，参与调控包括觉醒、奖赏、情绪活动及摄食行为等一系列复杂的生理功能。PVT 具有多种输入–输出联系神经元，这种模式为其参与执行多种脑功能提供解剖结构基础。脑干结构中蓝斑（locus coeruleus, LC）神经核团等参与觉醒调控。PVT 接受 LC 脑区酪氨酸羟化酶（tyrosine hydroxylase, TH）神经纤维密集投射，同时 PVT 和 LC 都是参与调控睡眠–觉醒的关键性核团，因此本实验主要目的是解析 LC 和 PVT 脑区构成的功能性神经通路在调控麻醉–觉醒意识状态转换中扮演的作用。

方法：先采取病毒转染法，用光遗传病毒 AAV-DIO-ChR2-EYFP 或化学遗传病毒 AAV-DIO-hM4di-mCherry 病毒转染 LC TH 神经元，并在 PVT 脑区植入光纤用于光遗传学实验或者给药导管用于化学遗传学实验。待病毒充分表达至少 4 周于 LC TH 神经元胞体及神经末梢后，然后在 PVT 脑区用光遗传学手段激活或者化学遗传手段抑制 LC TH 神经元末梢评估其对调控 LC-PVT 环路对麻醉–觉醒行为学的影响。
结果：1.2%异氟烷麻醉状态下 10 Hz 蓝光刺激 PVT 脑区的 TH 能神经元末端，能显著缩短 ChR2-EYFP 组小鼠自异氟烷诱导的无意识状态中苏醒所需的时间（P = 0.0099），但对麻醉诱导时间无明显影响（P > 0.05）。10 Hz 光激活 TH:LC-PVT 神经环路能减少脑电爆发性抑制率（P = 0.0032），改变脑电频谱，delta 能量值百分比降低，theta 和 alpha 能量值百分比增加，增加动物的觉醒电生理指标，证实激活 TH:LC-PVT 神经环路促进麻醉觉醒意识状态的转变的作用。环路特异性化学遗传学抑制 TH:LC-PVT 神经环路。微注射 CNO 显著降低注射后延长小鼠从麻醉状态到恢复意识所需的时间（P = 0.0057），但对麻醉诱导时间及脑电无明显影响（P > 0.05）。
结论：TH:LC-PVT 神经环路参与麻醉–觉醒意识转换，不参与麻醉诱导的调控，麻醉状态的意识丧失和麻醉苏醒意识恢复可能受不同的神经环路控制。

## PO-176

# DRD4 基因型对未接受药物治疗的 ADHD 儿童和健康儿童的内在脑网络连接强度的不同影响

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目的：多巴胺 D4 受体基因 (DRD4) 一直被报道与注意力缺陷/多动障碍 (ADHD) 相关。最近的研究将 DRD4 与特定大脑区域之间的功能连接联系起来。目前的研究旨在比较 DRD4 不同基因型对健康儿童和未使用药物的 ADHD 儿童功能完整性的影响。
材料与方法：从 49 名 ADHD 儿童和 37 名健康对照 (HC) 获得静息态功能性 MRI 图像。使用度中心度 (DC) 研究 DRD4 的 2 重复等位基因对两组大脑网络连接的影响，该参数反映了整个大脑连接组的局部功能关系。
结果：在颞叶，包括左侧颞下回 (ITG) 和双侧颞中回 (MTG)，发现了与 DC 显着的基因×诊断相互作用。根据解剖距离进一步细分 DC 网络，在远距离 DC 网络中发现了额外存在交互作用的大脑区域，包括左侧顶上回 (SPG) 和右侧额中回 (MFG)。事后分析显示，与 DRD4 相关的网络中心性改变因诊断状态而不同。
结论：这项遗传成像研究表明，DRD4 基因型以不同方式调节患有和未患有 ADHD 的儿童大脑网络的功能整合。这可能对我们理解 DRD4 在改变 ADHD 受试者功能连接中的作用具有重要意义。

## PO-177

# The shallow brain: how does social media disrupt mental health and induces brain lesion

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Background
The shallow (short, modularized, various, and irrelevant) contents in social media stimulate only the visual cortex and require frequent switches of mind. However, previous researches have yet focused on this harmful impact on human brain. Consequently, we designed a

neuropsychological research to investigate the impact of social media on mental health, and we also designed a longitudinal neuroimaging research to explore especially the impact of Media Shallow Reading (MSR) on brain function, structure, and the potential mechanisms.
Methods
Totally 289 subjects were involved in this research. Neuropsychological assessments including smartphone addiction, academic achievement attribution, attentional control and self-control, emotion, and sleep. Longitudinal neuroimaging research including a short-term (2h) MSR task and a long-term (4 weeks) MSR task, as well as multimodal MRI scanning at baseline, after the short-term task, and after the long-term task.
Results
First, more daily social media usage was related to more severe smartphone addiction, worse attentional control and self-control, and more sleep medication use. Second, short-term MSR mainly resulted in increased cerebral blood flow in Visual Network (VN), and may activate the adaptive system. Third, long-term MSR impaired the integrity of white matter fibers, making the VN more limited and blocked. Fourth, we found a strong relationship between functional connectivity changes after short-term MSR and structural connectivity changes after the long-term task.
ConclusionSocial media leads to mental disorders, and the shallow content in it may be a core risk factor of brain injury, which may be mediated through the mechanism of functional maladaptation.

PO-178

# Dynamic functional connectivity changes in unilateral sudden sensorineural hearing loss patients

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Objects
Sudden sensorineural hearing loss (SSNHL) - defined as hearing loss of at least 30 dB in three sequential frequencies in the standard pure-tone audiogram (PTA) over 3 days or less common than the late onset loss (1). Previous studies have reported alterations in the functional connectivities in subjects with SSNHL(2). However, the functional connections between brain regions are increasingly understood to be dynamic (3). The dynamic functional connectivity (dFC) approaches are novel methods for investigating reoccurring patterns of interactions among intrinsic brain regions. Our object was to explore the changes of dynamic functional connectivity in patients with SSNHL.
Materials and methods
38 unilateral SSNHL and 44 sex- and age-matched normal healthy control (HC) participants were recruited in our study. The sliding window approach was carried out using the Dynamic BC Toolbox(4). Based on the processed data, dFC calculation was limited to the entire brain mask. We defined the whole brain regions of interest (ROIs) based on Automated Anatomical Labeling (AAL)(5) template. In order to calculate the dFC of each participant, 60 s was used as the medium sliding window length and 1 TR (6) was used as the step size post-processing 180 volumes per participant divided into 151 Windows. Accordingly, the windows were clustered into two states used L1 distance. Then, we computed some temporal properties including the fraction rate (FR), the mean dwell time (MDT) and the number of transitions (NT).
Results
The dFC matrices were clustered into 2 states. State 1 was characterized by a general negative correlation of connections between the whole brain regions, while the characteristics of the state

2 were tight functional connections throughout the brain except cerebellum (Fig. 1). In regard to the between-group comparisons of the FR, MDT and NT in each state, we have found that the SSNHL patients seemed to stay in State 1 for a longer time and stay in State 2 for a shorter time (Fig. 2). The result indicated that SSNHL stays longer in the state of sparse connections, which may reveal that people with SSNHL have weaker brain connections than HC.
Conclusion
We have shown that temporal properties of functional dynamics (fractional windows, dwelling time) are altered in SSNHL versus HC. Thus, we believe this approach, particularly the temporal dynamics of functional connectivity, could be a useful imaging biomarker to monitor cognitive changes in SSNHL.

## PO-179

# Metabolic changes of the reduction of manganese intake in the hepatic encephalopathy rat: NMR- and MS-based metabonomics study

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Objective: To investigate the metabolic changes in type C hepatic encephalopathy (CHE) rats after reducing manganese (Mn) intake.
Methods: A total of 80 Sprague-Dawley rats were divided into control group and CHE groups (induced by intraperitoneal injection of thioacetamide at a dose of 250 mg/kg of body weight twice a week for six weeks). CHE rats were subdivided into 1Mn group (fed a standard diet, with 10 mg Mn/kg feed), 0.5Mn group (half-Mn diet), 0.25Mn group (quarter-Mn diet) and 0Mn group (no-Mn diet) for 4 to 8 weeks. Morris water maze (MWM), Y maze and narrow beam test (NBT) were used to evaluate cognitive and motor functions. Blood ammonia, brain Mn content and glutamine synthetase (GS) activity were measured. The metabolic changes of CHE rats were investigated using hydrogen-nuclear magnetic resonance and mass spectrometry. Multivariate statistical analysis was used to analyze the results.
Results: Significantly decreased numbers of entries in target area of MWM and Y maze, longer NBT latency and total time, higher blood ammonia, brain Mn content and GS activity were found in CHE rats. After reducing Mn intake, CHE rats had better behavioral performance, significantly lower blood ammonia, brain Mn content and GS activity. The main up-regulated metabolites were Ala, GABA, Glu, Gln, Lac, Tyr, Phe in 1Mn rats. After reducing Mn intake, metabolites recovered to normal level at different degrees.
Conclusion: Reducing Mn intake could reduce brain Mn content and blood ammonia, regulate GS activity and amino acid metabolism, ultimately improve behavioral performance in CHE rats.

## PO-180

# 学龄前先天性感音神经性耳聋患儿大脑皮层功能改变的静息态 fMRI 研究

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目的：通过分析学龄前先天性感音神经性耳聋（Sensorineural hearing loss, SNHL）患儿静息状态下大脑低频波动幅度（Amplitude of low-frequency fluctuation, ALFF）和局部一致性（Regional homogeneity, ReHo）的改变，进一步揭示学龄前先天性 SNHL 患儿皮层局部功能改变的特点。
方法：
我们搜集了 2018 年 5 月至 2019 年 6 月 58 例确诊为学龄前先天性 SNHL 患者及 30 例年龄相配的健康对照组（Healthy controls, HC）静息态功能磁共振成像（Resting-state functional MRI, rs-fMRI）数据,并且随访了人工耳蜗植入术后 6 个月时的听觉行为分级标准（Categories of auditory performance, CAP）评分。首先使用 DPABI 及 SPM12 分析软件对 rs-fMRI 数据进行预处理，包括时间处理(去除前 10 个时间点、时间层校正）及空间处理（头动校正、空间标准化、空间平滑、去线性漂移及滤波)；其次计算全脑功能参数指标 mALFF 和 ReHo，最后以性别、年龄及头动参数作为协变量，将 mALFF 及 ReHo 进行两样本 T 检验，进行基于簇水平 FFDR 校正，P＜0.05 的结果具有统计学差异。对于 mALFF 及 ReHo 有统计学差异脑区，将其 mALFF 及 ReHo 值与临床评分 CAP 进行 Spearman 相关性分析，设 P＜0.05 具有统计学差异。
结果：（1）mALFF 分析发现，与 HC 组相比，SNHL 组中双侧额上回（BA9）、双侧额中回（BA10）、左侧额下回（BA47）、双侧眶额叶回（BA11）及双侧颞上回（BA38）的 mALFF 显著减低（P＜0.05，FDR 校正）；而双侧丘脑及距状回（BA17）的 mALFF 显著增加（P＜0.05，FDR 校正）；（2）ReHo 分析显示：与 HC 组相比，双侧颞上回（BA38、41）、双侧眶额叶回（BA11）、左侧额中回（BA10）、左侧额下回（BA47）及左侧岛叶（BA13）的 ReHo 降低；而双侧丘脑、右侧尾状核及右侧中央前回（BA3）的 ReHo 增高。（3）具有差异脑区的 mALFF 值与 CAP 评分的相关性分析发现：左右两侧额中回（r = -0.2826, P = 0.0248; r = -0.2521, P = 0.0463）、右侧额上回（r = -0.2728, P = 0.0305）、左侧额下回（r = -0.2507, P = 0.0475）、右侧眶额叶回（r = -0.2554, P = 0.0434）及左侧眶额叶回（r = -0.2573, P = 0.0418）的 mALFF 值与 CAP 评分呈负相关；但有差异脑区的 ReHo 值与临床 CAP 评分不存在相关性。
结论：（1）学龄前先天性 SNHL 患儿听觉剥夺后，患儿的听觉、视觉、前额叶及躯体运动等皮层的 mALFF 和 ReHo 局部发生改变，提示耳聋患儿的这些皮层局部功能发生了改变，在这过程中前额叶皮层可能具有介导作用。（2）相关性分析结果提示，耳聋患儿听觉剥夺后，听觉、视觉及感觉运动皮层等发生的功能重组或补偿可能不利于患儿 CI 术后听觉语言的恢复。

# PO-181
# 肝硬化患者门静脉 4D flow 与肝脏 IVIM 定量参数相关性分析

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目的
比较肝硬化患者门静脉 4D-flow 与肝脏 IVIM 定量参数的相关性
材料方法
回顾性分析 2019 年 9 月至 2020 年 10 月因肝硬化于我院就诊的患者。最终入组 11 名行 3.0 T 磁共振扫描仪(Ingenia CX)检查患者，并且扫描序列包括 T1WI，T2WI，IVIM(12)，2D Q-flow 和 4D-flow 序列。其中扫描 2D Q-flow(轴向，TR/TE = 4.4/2.7 ms，FOV = 200×200 mm2，分辨率= 1.5×1.5×8 mm3，扫描时间 13 秒)，以测量门静脉中的流速作为速度编码的参考(VENC)。4D-flow 参数如下：TR/TE = 5.0/3.2 ms，FOV = 300×350 mm2，分辨率= 2.5×2.5×2.5 mm3，PC 方向= RL-AP-FH，CS=8，扫描时间= 4 分 37 秒。扫描完成后通过主机进行 4D flow 重建。将重建后的数据拷出，由临床诊断经验丰富的放射科医师（具有 5 年腹部 MRI 诊断工作经验）在 CVI 42 软件包上处理图像，以获得 3D 血管图像。首先在门静脉起始位置放置参考平面，其次在门静脉的近端、中间部和远端分别放置一个测量平面用于血流定量分析。测量的定量参数包括目标血管段的流量、流速、壁切应力(WSS)和压力梯度。所测得数据分别取均值。IVIM 定量参数在 ISP 工作站上进行

测量，包括:sADC、D、D*和 F 值。采用 SPSS 22.0 统计学分析软件进行统计分析。Spearman 检验用于分析 4D flow 与 IVIM 定量参数之间的相关性。
结果
肝脏 sADC 和 D 值分别与门静脉近端流速(r=0.626)和中间流速(r=0.709)呈负相关（P＜0.05）。肝脏 D*值与门静脉中间流量和近端流量呈正相关(r=0.900，P＜0.05)。其他参数间无相关性(P>0.05)。
结论
肝硬化患者门静脉 4D flow 与肝脏 IVIM 定量参数存在一定的相关性。

# PO-182

## Nomograms of Combining Apparent Diffusion Coefficient Value and Radiomics for Preoperative Risk Evaluation in Endometrial Carcinoma

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Purpose: To evaluate the value of nomogram models combining apparent diffusion coefficient (ADC) value and radiomic features on magnetic resonance imaging (MRI) in predicting the type, grade, deep myometrial invasion (DMI), lymphovascular space invasion (LVSI), and lymph node metastasis (LNM) of endometrial carcinoma (EC) preoperatively.
Materials and Methods: This retrospective study included 210 EC patients. ADC value was calculated, and radiomic features were measured on T2-weighted images. The univariate and multivariate logistic regression and cross-validation were performed to reduce valueless features, then radiomics signatures were developed. Nomogram models using ADC combined with radiomic features were developed in the training cohort. The receiver operating characteristic (ROC) curve was performed to estimate the diagnostic efficiency of nomogram models by the area under the curve (AUC) in the training and validation cohorts, respectively.
Results: The ADC value was significantly different between each subgroup. Radiomic features were ultimately limited to 5 features for type, 6 features for grade, 6 features for DMI, 4 features for LVSI, and 8 features for LNM for the nomogram models. The AUC of the nomogram model combining ADC value and radiomic features in the training and validation cohorts was 0.905 and 0.868 for type, 0.959 and 0.880 for grade, 0.839 and 0.766 for DMI, 0.816 and 0.746 for LVSI, and 0.910 and 0.897 for LNM.
Conclusions: The nomogram models of ADC value combined with radiomic features were associated with the type, grade, DMI, LVSI, and LNM of EC, and provide an effective, non-invasive method to evaluate preoperative risk stratification for EC.

# PO-183

## The value of three-dimensional texture analysis based on dynamic contrast-enhanced MR images in the grading of breast phyllode tumors

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Abstract
Objective: To investigate whether three-dimensional (3D) texture analysis (TA) based on DCE-MR images could be helpful to evaluate breast PTs grade.
Materials and Methods: 47 patients with histologically proven PTs from November 2012 to March 2020, including 26 benign PTs (BPTs) and 21 borderline/malignant PTs (BMPTs), were enrolled in this retrospective study. 3D texture features of DCE-MR images were calculated, and imaging features were evaluated according to Breast Imaging Reporting and Data System (BI-RADS). The differences in the texture features and imaging features between the BPT and BMPT groups were compared, the variates with statistical significance were entered into logistic regression analysis, and receiver operating characteristic (ROC) curve was drawn to describe the diagnostic efficacy of different models.
Results: Regarding imaging features, only the cystic wall (P = 0.016) showed significant differences between the two groups. Regarding texture features, 3 features of histogram, 2 features of grey-level co-occurrence matrix (GLCM) and 3 features of run length matrix (RLM) showed significant differences between the two groups (all p < 0.05). The areas under ROC (AUROCs) of image-based diagnosis, texture analysis and the combination of the two approaches were 0.706 (95% CI, 0.527-885), 0.906 (95% CI, 0.820-0.993) and 0.942 (95% CI, 0.858-0.998), respectively.
Conclusion: 3D texture analysis has the potential to improve the diagnostic efficacy of DCE-MRI in the differential diagnosis of BPTs and BMPTs.

PO-184

# 年龄对成年男性盆底结构影响的 MRI 研究

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目的：使用动静态盆底 MRI 结合解剖学知识，定量研究不同年龄组男性盆底解剖及功能的 MRI 参数的差异，分析随着年龄增长男性盆底解剖结构与功能的变化。
方法：前瞻性地于我院收集健康成年男性志愿者以及老年前列腺增生患者，所有受试者均行动静态盆底 MRI 检查，共纳入 133 例。将受试者按年龄 18～39 岁、40～59 岁、60～79 岁、80 岁以上分为四组，在静动态盆底 MRI 上测量前列腺体积（PV）、肛提肌（LAM）厚度、髂骨尾骨肌角度（ICA）、静息期及力排期膀胱颈（BN）到耻骨尾骨线（PCL）的距离（BN-PCL）、H 线、M 线、肛管直肠角（ANA）、肛提肌板角度 （LPA）的大小，其中 LAM 包括耻骨尾骨肌（PCM）、耻骨直肠肌（PRM）、髂骨尾骨肌（ICM）。使用单因素方差分析或 K-W 检验比较四组间各参数的差异，如差异有统计学意义则进行成对比较。使用 Pearson 相关性分析评估上述盆底参数随年龄的变化趋势。
结果：1.四组间 PV、PCM、PRM、ICM、BN-PCL、M 线的差异均有统计学意义（P＜0.05），两两对比结果显示：PV：1 组＜2 组＜3 组≈4 组；PCM：1 组≈2＞3 组≈4 组；PRM：1 组≈2＞3 组≈4 组；ICM：1 组＞2 组≈3 组＞4 组，静息期 BN-PCL：1 组＜2 组≈3 组≈4 组；力排期 BN-PCL：1 组＜3 组≈4 组，2 组＜3 组；静息期 M 线：1 组＜4 组；力排期 M 线：1 组＜3 组≈4 组（P＜0.05）。2.PV（r=0.491）、静息期 BN-PCL（r=0.328）、力排期 BN-PCL（r=0.365）、静息期 H 线（r=0.290）、力排期 H 线（r=0.244）、静息期 M 线（r=0.323）、力排期 M 线（r=0.263）与年龄成正相关（P＜0.05）；PCM（r=-0.418）、PRM（r=-0.544）、ICM（r=-0.544）与年龄成负相关（P＜0.05）。
结论：盆底 MRI 显示随着年龄的增长，男性 PV 增大、BN 上抬、LAM 变薄、盆膈裂孔的扩大及盆膈裂孔的下降。MRI 拥有高分辨率和优越的软组织对比度，可以对盆腔解剖细节和功能数据进行量化，有助于临床医师了解老年男性盆底结构的解剖形态和功能差异，为评估老年男性排尿症状提供客观依据。

PO-185

# 磁敏感加权成像在神经梅毒诊疗中价值初探

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**目的** 总结 15 例神经梅毒的磁敏感加权成像（SWI）影像学表现，探讨 SWI 在神经梅毒诊疗过程中的应用价值。
**方法** 回顾性分析 2013 年 1 月-2021 年 1 月期间确诊的 15 例神经梅毒患者的影像学资料，总结患者治疗前后的 MRI 影像学表现，重点观察 SWI 检查的影像学变化。
**结果** 15 例患者均行 MRI 检查，其中男性 10 名，女性 5 名，年龄范围 46-60 岁，平均年龄 53±5.5 岁。15 例患者病变范围均同时累及多个脑叶，且与血管分布区不相符，灰白质受累，其中 2 例同时侵犯脊髓；MRI 平扫：15 例患者的病变均呈长 T1 长 T2 信号，Flair 呈高信号，同时 10（66.7%）例有与年龄不相符的脑萎缩；10 例行增强检查，其中 6（60%）例软脑膜强化，2（20%）例同时伴软脊膜强化，5（50%）例脑实质内结节状强化，5（50%）例无强化； 12 例患者行 DWI 检查，其中 8（66.7%）例表现为轻-中度弥散受限信号，其余患者病灶无弥散受限； 12 例患者行 SWI 检查， 其中 9（75%）例患者于深部皮层及皮层下均可见不同程度的线状低信号影（眼线征），眼线征沿脑回分布。临床抗梅毒治疗 1-2 周后复查， 6 例患者 DWI 上弥散受限程度降低，8 例患者 SWI 上皮层及皮层下线状低信号影减少。
**结论** 神经梅毒常规 MRI 影像表现复杂多样，主要表现为脑萎缩、多发脑白质病变、脑梗塞、脑水肿或脊髓病变，MRI 增强可以出现脑回样、结节状及斑片状强化，在一定程度上可判断脑组织损害情况，但缺乏一定特异性。弥散加权成像（DWI）可以反应病变细胞毒性水肿情况，神经梅毒在 DWI 上主要表现为稍高信号，可能与神经梅毒主要引起细胞外水肿相关。神经梅毒可以激活铁在小胶质细胞内的沉积，SWI 可以敏感反应铁在颅内沉积情况，因此 SWI 上“眼线征”可能是神经梅毒一个特征性影像学表现，同时 SWI 在一定程度上可以评估神经梅毒预后情况。

PO-186

# Comprehensive application of PI-RADS V2.1 and deep learning-based prostate AI in the diagnosis of CSPCa

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OBJECTIVE: To compare the efficacy of PI-RADS V2.1, prostate AI and their integration model in the diagnosis of clinically significant prostate cancer(CSPCa), and to explore the comprehensive application of these methods.
DATA AND METHODS: Cases with suspected PCa for qualitative diagnosis were screened from the mpMRI follow-up database of our hospital from February 2015 to December 2017. All enrolled cases underwent 3.0T prostate mpMRI: T2WI (three directions), DWI (0/1000/1400 s/mm2), and DCE (temporal resolution=15s). PCa prediction were performed by learning-based prostate AI, and the highest predicted value lesions were recorded directly in patients as the original AI prediction. Significant false-positive predictors were removed (extraprostatic detection, hemorrhage, abscess, etc.) as revised AI prediction. Another experienced radiologist performed retrospective PI-RADS V2.1 scoring without knowing the pathological and clinical information.

Then the PI-RADS V2.1 + AI score was obtained by the radiologist referring to the revised prediction results of prostate AI. The results of biopsy and surgical pathology and Gleason score were taken as the gold standard (the Gleason score ≥3 + 4 or ≥T3 was CSPCa). ROC curve was used to compare the diagnostic efficacy of original AI prediction, revised AI prediction, PI-RADS V2.1 score and PI-RADS V2.1 + AI score in the diagnosis of CSPCa by SPSS 23.0.
RESULTS: A total of 398 patients were enrolled in this study. There were 112 cases of CSPCa and 286 of Non-CSPCa(CISPCa and Non-PCa). The cut-off value was defined as ≥4 according to the Youden index. The AUC, sensitivity, specificity, PPV, NPV, and accuracy of original AI prediction/ revised AI prediction/ PI-RADS V2.1 score/ PI-RADS + AI score were 0.749/0.777/0.843/0.871, 91.1%/91.1%/92.0%/93.8%, 58.7%/64.3%/76.6%/80.4%, 46.4%/50%/60.6%/65.2%, 94.4%/94.9%/96.1%/97.1%, 67.8%/71.9%/80.9%/84.2%. PI-RADS V2.1 + AI score was superior to the other three, and the improvement of PI-RADS V2.1 score compared to PI-RADS V2.1 was not statistically significant (P > 0.05) , but was significantly higher than that of original AI prediction and revised AI prediction (P = 0.000) .
CONCLUSIONS: Prostate AI has high diagnostic sensitivity, but it is not specific enough. Moreover, there are a few false positive results in the original prediction. The combination of the revised prediction with the PI-RADS V2.1 score could further improve the diagnostic efficacy for CSPCa.
Clinical Relevance/Application: There is deficiency to apply the prediction result of prostate AI directly to clinic. Based on the PI-RADS V2.1, the prediction result of prostate AI is used to adjust the score, it is helpful to further improve the diagnosis of CSPCa.

PO-187

# 基于 DCE-MRI 影像组学机器学习模型预测乳腺癌淋巴血管浸润状态的研究

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目的 这项研究开发了基于 DCE-MRI 的放射组学特征机器学习模型术前预测乳腺癌患者淋巴血管浸润状态。
材料和方法 对 384 例经病理学证实为乳腺癌的患者进行回顾性研究，将其随机分为训练组（n = 198）和验证组（n = 186）。所有患者在治疗前 2 周内接受了 MR 检查。放射学家使用 LIFEx 软件从 DCE 磁共振图像中提取 390 个放射组学相关的纹理特征。然后，先后通过正态检验( Kolmogorov- Smirnov 检验)、方差齐性检验( Bartlett 检验)及 Spearman 的等级相关性分析删除低方差和弱相关性特征、最后使用单因素分析和最小绝对收缩与选择算子（LASSO）算法来选择最佳的组学特征。我们利用所提取最佳影像组学特征，经由逻辑式回归(Logistic Regression,LR)及 SVM(support vector machine,SVM)两种分类器建立淋巴血管浸润的预测模型，通过绘制受试者工作特征（ROC）曲线评估训练组与验证组预测模型的准确性。
结果 在 384 名患者中，177 名患者为 LVI 阳性，207 名患者为 LVI 阴性。经过 LASSO 两种分类器所构建的预测模型比较 ROC 曲线分析的 AUC、 准确性、敏感性及特异性。Logistic 回归分析在训练组中预测乳腺癌 LVI 状态的敏感性、特异性、准确性分别为 0.68、0.67、0.71。SVM 在训练组中预测乳腺癌 LVI 状态的敏感性、特异性、准确性分别为 0.87、0.79、0.84。无论训练组还是验证组，SVM 预测乳腺癌 LVI 状态的准确性明显优于 LR 模型，统计学存在显著差异（p<0.05）

结论　基于 DCE-MRI 放射组学特征可能是一种有前途的非侵入性技术鉴别 LVI 状态，并且 SVM 模型在预测乳腺癌的血管浸润状态的明显优于 Logistic 回归模型。

## PO-188

# Ability of ADC value and DWI-based texture features to differentiate between thymic carcinomas and primary anterior mediastinal lymphomas

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Background: Accurate preoperative differentiation between thymic carcinomas (TC) and primary anterior mediastinal lymphomas (PAML) is essential for optimizing individualized therapeutic strategies. We aimed to evaluate the ability of apparent diffusion coefficient (ADC) value and texture features based on diffusion-weighted imaging (DWI) to differentiate between TC and PAML. Materials and Methods: Clinical and MRI data for 165 patients with TC or PAML were retrospectively collected in this study. ADC value was calculated based on two different b values (0 and 1000 sec/mm2) and 75 texture features were extracted from DWI images for each patient. MRI morphologic features were also evaluated by two thoracic radiologists. Univariate and multivariate logistic regression analysis were performed to assess the relative value of these parameters in differentiating TC from PAML. The diagnostic performances were compared by receiver operating characteristic analysis and Delong test. Results: At multivariate analysis, ADC value and two DWI-based texture features (GLSZM1 and H3) were identified as independent predictors for differentiating TC from PAML, and they achieved better discriminative performances than MRI morphologic features. Integrating DWI-based texture features into a multi-layer model with age, MRI morphologic features, and ADC value had the highest discriminative ability, with a sensitivity, specificity, and area under the curve of 81.9%, 90.1%, and 0.922, respectively. Conclusion: This proof-of-concept study indicates that ADC value and DWI-based texture features could serve as noninvasive and efficient imaging biomarkers for the differentiation of TC from PAML.

## PO-189

# Contrast Dose Reduction for MR Imaging Using Deep Learning

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There are healthy concerns over the gadolinium deposition in bodies from contrast enhanced MR scanning with gadolinium-based contrast agents (GBCA). However, simply amplifying the contrast enhancement of a 1/10 low-dose CE-MRI from zero-dose MRI by a factor of ten results in poor image quality with widespread noise and ambiguous structures. This research used a deep learning method to reduce the gadolinium usage in brain MRI while keep the quality of images.

Signed informed consent, 83 patients received 3D T1-weighted inversion-recovery prepped fast-spoiled-gradient-echo (IR-FSPGR) brain MRI exams. The exams were conducted under three different conditions: pre-contrast, post-contrast with 10% low-dose (0.01mmol/kg) and 100% full-dose (0.1mmol/kg) of gadobenate dimeglumine. In practice, patients were firstly examined with MRI without any injection. Then a scanning of 0.01mmol/kg contrast enhanced MRI was carried out. In quick succession, patients injected the rest 0.09mmol/kg agent and received the last MRI scanning. The acquired images were registered and then normalized before processed using neural network. This step made acquisitions paired and directly comparable despite the different patient positions and scaling factors. To enlarge the dataset that could be used for the training process, images pairs were rotated, zoomed and mirror transformed.

A deep learning network was built to enhance image quality from zero-contrast images and low-contrast images while took the full dose images as ground truth. 30 cases were used for training and the rest 53 cases were used for testing. The deep learning network was a U-net like encoder-decoder convolution neural network shown in figure 1. Each encoder or decoder consisted of multiple convolution layers, batch normalization layers and activation layers. 2x2 max-pooling layer was used to connect each encoder and 2x2 upsampling layer was used to connect each decoder. Skip connection was used to conduct information between encoders and decoders. A combined loss of L1 and structural similarity index (SSIM) was set as cost function. Stochastic gradient descent was used to train the neural network until the model became stable. The training process was performed using Keras framework with Tensorflow backend, CUDA8 and CUDNN5.1, on a Linux server with 2 NVIDIA GTX-1080TI GPUS.

The trained network could directly applied to the co-registered and normalized zero-dose pre-contrast MRI and the 10% low-dose post-contrast CE-MRI input pair. SSIM and PSNR of input low-dose images, synthetic images and full dose ground truth images were calculated to evaluate the performance of the proposed method quantitatively. For qualitative assessment, 5-point Likert scale for general image quality, lesion visibility, SNR and the degree of the enhancement compared against pre-contrast MRI were collected from two experienced neuroradiologists independently and blindly. The consistency analysis of scores were assessed using Cohen's kappa coefficient. The difference of original images and DL-enhanced images were compared with Pearson coefficient and Fisher exact test.

As a result, DL-enhanced images achieves significantly superior performance than low-dose input ($P<0.001$) and could increase about 11% SSIM and 5.0dB PSNR. The consistency of scores from different doctors on DL-enhanced images and full-dose images was great ,which was shown in figure 2. There is no difference between DL-enhanced images and full-dose images from the qualitative assessment on overall image quality ($P=0.266$), image SNR ($P=0.130$), lesion conspicuity ($P=0.417$) and lesion enhancement ($P=0.318$).

PO-190

# Brain E/I imbalance network biomarker for drug-naive Rolandic epilepsy

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Objective
Seizure refers to transformation of normal neurons into imbalanced excitation and inhibition (E/I) of electrical activity. This study aimed to determine whether an existing E/I network biomarker matched with the accepted E/I imbalance theory in epilepsy patients.

Methods
This multicenter study comprised a discovery cohort (76 Rolandic epilepsy and 76 normal children) and a replication cohort (59 Rolandic epilepsy and 60 normal children). Spatial independent component analysis was used to identify regions of interest within seven canonical neural networks. Resting-state dynamic causal modeling-based support vector machine(rs-DCM-SVM) was used to perform individual classification, consensus feature selection and region weight ranking.

Results
Our study validated and replicated the rs-DCM-SVM to be a promising neuroimaging biomarker for Rolandic epilepsy (accuracy of 88.2% and 81.5%, AUC of 0.92 and 0.83 in discovery and replication cohorts, respectively). Consensus brain regions with the highest contributions to the classification were located within the epilepsy-related networks, which indicated the availability of this classifier. Consensus functional connection pairs with the highest contributions to the classification involved an excitation and an inhibition network loops. The excitation loop involved integration of advanced cognitive networks (subcortex, dorsal attention, default mode, executive control and salience networks), and the inhibition loop involved segregation of sensorimotor and language networks. The two loops exhibited functional segregation.

Significance
Connectome-based machine learning has potential to be served as a biomarker for individual classification in Rolandic epilepsy. This study present direct neuroimaging evidence for brain E/I imbalance, which might be an important mechanism for causing seizures and cognitive impairment.

PO-191

# Expert recommendation on data management of upper abdominal magnetic resonance image for artificial intelligent analysis in subjects with obesity

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Artificial intelligent (AI) system has been developed to segment different body composition automatically and to quantify values based on medical imaging. The hepatic proton density fat fraction (PDFF) and the amount of abdominal adipose tissue are two key points for clinical evaluation and research in patients with obesity. Upper abdominal magnetic resonance (MR) images are an appropriate method for the evaluation. Recently developed artificial intelligence (AI) assistant methods can quantify the hepatic PDFF and the amount of adipose tissue on MR image efficiently and accurately. However, the uneven quality of MR images occurs to be one of the major obstacles to AI system development. As a result, outlining the boundary of the liver and adipose tissue manually are far from precision. The key problem is the lack of a consensus about a standardized process of MR and clinical data management. This expert recommendation provides suggestions to address the problems in the field of intelligent medicine. We aims to standardize the data acquisition, utilizing and storage for AI system that target to automatic quantification of hepatic PDFF and abdominal adipose tissue. The full text will introduce the uniform standards of the whole process of data management, including patient preparation, MR parameter setting, availability of MR image for AI quantification, annotation standards, database management. We will also discuss about recently published articles and research horizons based on upper abdominal MR images in patients with obesity.

PO-192

# 基于瘤内及瘤周 DCE-MRI 的影像组学模型在鉴别乳腺 BI-RADS 4 类肿瘤良恶性中的价值

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【摘要】目的：探讨基于早期 MRI-DCE 瘤内及瘤周的影像组学模型在鉴别乳腺 BI-RADS 4 类肿瘤良恶性的价值。方法：回顾性分析蚌埠医学院第一附属医院 2016 年 1 月至 2020 年 12 月，经乳腺 MRI 检查诊断为 BI-RADS 4 类且有明确病理诊断结果的 191 例乳腺占位患者，其中良性 77 例，恶性 114 例。选取患者第二期 DCE-MRI 图像上病灶最大层面勾画感兴趣区，并自动适形外扩 5mm，提取瘤内及瘤周影像组学特征，将纳入病例按 8：2 的比例随机分为训练组和测试组，通过统计和机器学习方法降维，保留纳入模型的最优特征，采用逻辑回归作为分类器，分别建立瘤内、瘤周、瘤内联合瘤周模型，并通过单因素和多因素逻辑回归，筛选出能够预测乳腺肿瘤良恶性的独立危险因素作为临床特征，建立临床模型，联合瘤内及瘤周影像组学特征和临床特征建立联合诊断模型，绘制各模型受试者工作曲线（ROC）并计算其曲线下面积（AUC），通过 10 折交叉验证检验联合诊断模型的稳定性，并对联合诊断模型绘制列线图和校准曲线将模型可视化。结果：基于瘤内、瘤周影像组学特征及临床特征建立的联合诊断模型相比较其他模型表现出更佳的诊断性能，其训练集 AUC、灵敏度、特异度、准确度、恶性 F1-score 分别为 0.932、90.1%、86.9%、87.0%、0.89，测试集分别为 0.875、95.7%　62.5%、76.9%、0.82。通过 10 折交叉验证得到的 AUC 为 0.90（0.85-0.92），在校准曲线中预测曲线与理想曲线一致性较好。结论：基于早期 DCE-MRI 瘤内及瘤周的影像组学特征和临床特征建立的联合诊断模型在鉴别乳腺 BI-RADS 4 类肿瘤的良恶性中具有较好的性能和稳定性，能够无创为临床决策提供指导。

PO-193

# Multiparametric MR-based RadioFusionOmics Modeling for Differentiation of Glioblastoma Multiforme from Solitary Brain Metastasis

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**Background:** Glioblastoma multiforme (GBM) and solitary brain metastasis (SBM) are two common brain tumors identified in adults. They often pose a diagnostic dilemma owing to their similar appearances on conventional magnetic resonance imaging (MRI). Discrimination of these two entities is critical for selecting appropriate clinical treatment strategies.
**Purpose:** To investigate the diagnostic potential of a novel RadioFusionOmics (RFO) model in differentiating GBM and SBM through information fusion from multiple MR sequences and various classifiers based on the optimal volumetric lesion component.
**Methods:** This retrospective study collected 183 patients diagnosed and treated in two institutions between September 2007 and September 2020, including 94 GBM patients and 89

SBM patients. Three volume of interests (VOIs) were delineated on the conventional axial MR images (T1WI, T2WI, T2_FLAIR and CE_T1WI), including the volumetric non-enhanced tumor (nET), enhanced tumor (ET), and peritumoral edema (pTE). Using the RFO model, radiomics features extracted from different combinations of multiparametric MRI sequence(s) and VOI(s) were fused by a novel feature fusion method and cross-validated by 15 classification models. The best sequence and VOI (or combinations) were determined. The top predictive models were ranked and screened out on the training/validation set. Model fusion, a procedure analogous to multidisciplinary consultation, was performed on the top-3 models to generate a final model, which was validated on an independent testing set. The top features were identified and the discrimination performance of RFO was compared with three board-certified radiologists.
**Results:** Image features extracted from the volumetric ET (VOIET) showed dominant predictive performances over features from other VOIs combination. Fusion of VOIET features from the T1WI and T2_FLAIR sequences via the RFO model have achieved discrimination accuracy of AUC = 0.9249, accuracy = 0.8548, sensitivity = 0.8561, and specificity = 0.8529 on the independent testing set, which significantly outperformed three experienced radiologists (p=0.03, 0.01 and 0.02). The top-10 features included five first-order based features, four shape-based features, and one texture feature.
**Conclusion:** Fusion of multiple MRI sequences and multiple classifiers can provide multifaceted information regarding tumor characteristics. The proposed RFO model may serve as a promising tool for computer-aided diagnosis of GBM vs. SBM in the clinical settings.

# PO-194

# 多中心脑胶质瘤磁共振数据自动规定化预处理方法

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目的：
为了缓解多中心数据共享的脑胶质瘤研究中，磁共振数据由于不同采集参数、采集设备带来的数据规格、尺寸、对比度、亮度等方面存在的差异给研究结果带来偏差，本研究提出了一种磁共振数据自动规定化预处理方法，实现数据的规整和亮度的规定化，实现医学影像亮度的一致性。

材料与方法：
本来就数据来自公开数据集 Brats2017（285 例）和河南省人民医院（303 例）各级别脑胶质瘤。自动预处理包括多个步骤对于原始数据(a)，步骤(b)将所有 DICOM 数据转换为 NIfTI 格式存储，步骤(c)删除患者隐私信息，便于多中心数据共享。步骤(d)重新缩放图像到相同的尺寸。在步骤(e)中移除颅骨，以减少非脑组织对分级模型的影响。最后，步骤(f)进行直方图规范。步骤(b)-(e)实现数据的规范化存储和统一尺寸，步骤(f)使数据的亮度分布一致，增强图像的可比较性。
对步骤(f)，本文提出了一种改进的网格搜索方法来解决传统解决方案中参考图像需要指定的问题，减少人工干预带来的偏差。搜索方法是根据数据规模设置搜索坐标系并划分为相同长度的网格，为了避免遍历搜索带来的时间负担，本文提出一种基于粗分割和精细分割的联合搜索策略，实现输出最优参数的查找。网格搜索时以 AUC 值变化情况作为搜索依据，通过粗搜索大致设定参考帧选择范围，通过精细搜索对粗搜索结果进行细化，并选择最佳性能参考帧为最终参考帧。通过该方法可以避免手工搜索带来的人工偏差。
结果

原始数据中，磁共振数据的亮度分布存在明显差异，而经过规定化处理后图像的亮度和对比度具有高度一致性，如图 1。同时，为了客观验证规定化效果，本研究对 9 种分类器和 7 种 10 特征选择算法训练分级模型，规定化后图像模型对应的 AUC、准确率、灵敏度、特异度、阳性预测值和阴性预测值普遍可提高 7% ~ 15%。

结论

本文提出自动数据预处理方法可以统一数据规范，提高图像特征的可比性，实现多中心数据的有效共享。

## PO-195

# BI-RADS、影像组学和深度学习对 DCE-MRI 非肿块样强化病灶的诊断价值

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目的：评价 DCE-MRI 上非肿块样强化（Nonmass enhancement,NME）的良恶性病变的形态分布和内部强化模式，探讨放射组学和深度学习在 NME 病灶中的诊断价值。方法：本文分析了 150 例以 NME 为表现的 104 个恶性病变和 46 个良性病变。三位放射科医生使用第五版 BI-RADS 标准进行阅片。对于每个病例，使用模糊 C 均值分割病灶，生成三维肿瘤掩模。通过计算生成三个与信号流入（wash-in）、最大强化（maximum）和信号流出（wash-out）相关的 DCE 参数图，并应用放射组学进行特征提取。使用 5 种不同的机器学习算法建立放射组学模型。ResNet50 使用三个 DCE 参数图作为输入来实现。70%的病例用于训练集，30%的病例用于测试集。结果：原始 MRI 报告中的诊断性 BI-RADS 显示 104/104 恶性病变和 36/46 良性病变的 BI-RADS 评分为 4A-5。对于分类阅片，NME 形态分布的 kappa 系数为 0.83（优良），内部强化的 kappa 系数为 0.52（中等）。恶性组以节段性和区域性分布最为突出，良性组以局灶性分布最为突出。利用支持向量机（SVM）选择 8 个放射组学特征。在 5 种机器学习算法中，SVM 在训练中的准确率最高，为 80.4%，在测试数据集的准确率为 77.5%。ResNet50 具有较好的诊断性能，训练时为 91.5%，测试时为 83.3%。结论：NME 的诊断比肿块性病变更困难，BI-RADS 描述的病灶分布和内部强化模式在良性和恶性病变之间有大量重叠，无法有效鉴别良恶性病灶。放射组学和深度学习有可能提供一个临床有用的 CAD 工具，以帮助诊断。

## PO-196

# Prognostic value of late enhanced cardiac magnetic resonance imaging derived texture features in dilated cardiomyopathy patients with severely reduced ejection fractions

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Background: Late enhanced cardiac magnetic resonance (CMR) images of the left ventricular myocardium contain an enormous amount of information that could provide prognostic value beyond that of late gadolinium enhancements (LGEs). With computational post-processing and analysis, the heterogeneities and variations of myocardial signal intensities can be interpreted

and measured as texture features. This study aimed to evaluate the value of texture features extracted from late enhanced CMR images of the myocardium to predict adverse outcomes in patients with dilated cardiomyopathy (DCM) and severe systolic dysfunction.
Methods: This single-center study retrospectively enrolled DCM patients with severely reduced left ventricular ejection fractions (LVEFs<35%). Texture features were extracted from enhanced late scanning images, and the presence and extent of LGEs were also measured. Patients were followed for clinical endpoints composed of all-cause deaths and cardiac transplantation. Cox proportional hazard regression and Kaplan-Meier analyses were used to evaluate the prognostic value of texture features and conventional CMR parameters with event-free survival.
Results: A total of 114 patients (37 women, median age 47.5 years old) with severely impaired systolic function (median LVEF, 14.0%) were followed for a median of 504.5 days. Twenty-nine patients experienced endpoint events, 12 died, and 17 underwent cardiac transplantations. Three texture features from a grey-level co-occurrence matrix (GLCM) (GLCM_contrast, GLCM_difference average and GLCM_difference entropy) showed good prognostic value for adverse events when analyzed using univariable Cox hazard ratio regression (p=0.007, p=0.011, p=0.007 retrospectively). When each of the three features was analyzed using a multivariable Cox regression model that included the clinical parameter (systolic blood pressure) and LGE extent, these features were independently associated with adverse outcomes.
Conclusion: Texture features related LGE heterogeneities and variations (GLCM_contrast, GLCM_difference average and GLCM_difference entropy) are novel markers for risk stratification towards adverse events in DCM patients with severe systolic dysfunction.

PO-197

# 基于增强 MRI 的瘤周影像组学模型预测肝细胞癌 TACE 术后早期疗效的价值

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目的：
构建基于增强 MRI 的单纯瘤周、肿瘤联合瘤周的影像组学模型，用于预测肝细胞癌（hepatocellular carcinoma，HCC）患者经动脉化疗栓塞（transarterial chemoembolization，TACE）术后早期疗效。
方法：
回顾性收集进行上腹 MRI 检查且采取 TACE 治疗的 113 例 HCC 患者（治疗有效 55 例，治疗无效 58 例），按照 7：3 将患者随机分为训练集 78 例和验证集 35 例。在动脉期、门脉期和延迟期 MRI 图像上，使用 ITK-SNAP 软件沿着肿瘤边缘逐层手动勾勒感兴趣区（ROI），融合成容积感兴趣区（VOI）。使用 AK 软件分别从肿瘤边缘等距外扩 3 mm、5 mm 及 10 mm，自动生成单纯瘤周 3 mm、5 mm 及 10 mm 分割结果（VOIperi3、VOIperi5 及 VOIperi10），并提取肿瘤及 VOIperi3、VOIperi5 及 VOIperi10 的组学特征。使用观察者间和观察者内一致性检验、Spearman 相关性检验、假设检验、LASSO 算法依次进行特征选择。使用逻辑回归构建影像组学模型，计算 Radscore。构建肿瘤及 3 个单纯瘤周影像组学模型：①肿瘤组学模型；②瘤周 3 mm 模型；③瘤周 5 mm 模型；④瘤周 10 mm 模型。最后，将瘤周组学模型与肿瘤组学模型的组学特征相联合，

构建肿瘤联合瘤周影像组学模型，包括：①肿瘤+瘤周 3 mm 模型；②肿瘤+瘤周 5 mm 模型；③肿瘤+瘤周 10 mm 模型。通过单因素和多因素逻辑回归筛选临床-常规放射独立危险因素。建立临床-放射模型和联合模型（结合临床放射独立因素和最佳的影像组学评分），并将联合模型以列线图形式呈现。模型评价分别采用 ROC 分析、校准曲线及决策曲线分析。
结果：
影像组学模型显示出良好的区分能力（AUC：训练集 0.763-0.864，验证集 0.768-0.873，肿瘤+瘤周 3 mm 组学模型的效能最佳，AUC 分别为 0.864 和 0.873。联合列线图的的效能（AUC，0.900 和 0.774）优于临床放射模型（AUC，0.889 和 0.771）。
结论：
基于增强 MRI 的瘤周影像组学方法能够有效地预测 HCC 患者 TACE 术后早期疗效。

## PO-198
# 海马保护全脑放疗中的海马自动分割：一种多任务边缘感知学习

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目的：本研究旨在通过多任务边缘感知学习提高海马分割的准确性。
方法：本研究旨在开发一种用于海马自动分割的多任务深度学习框架。使用 3D U-net 作为我们的骨干模型，有两个训练目标：1)最小化目标二值掩码与模型预测之间的差异；2)优化辅助边缘预测任务，该任务旨在指导模型优化中对海马弱边界的模型检测。为了平衡多个任务目标，提出了一种改进的梯度归一化方法，通过自适应地调整不同任务损失的权重。共收集了 247 例患者的 247 个 T1 加权磁共振成像，包括 131 个非对比剂和 116 个对比剂，用于训练和验证所提出的方法。分割采用骰子系数(Dice)、Hausdorff 距离(HD)和平均 Hausdorff 距离(AVD)进行定量评价。采用 3DU-net 进行基线比较。
结果：通过 5 次交叉验证，多任务边缘知觉学习的 DICE 为 0.8483±0.0036，HD 为 7.5706±1.2330 mm，AVD 为 0.1522±0.0165 mm。反之，基线结果分别为 0.8340±0.0072、10.4631±2.3736 mm 和 0.1884±0.0286 mm。经 Wilcoxon 符号秩和检验，本研究所设计的深度学习框架与基线框架之间的差异有统计学意义($p<0.05$)。
结论：我们的结果证明了多任务边缘感知学习在海马保护全脑放疗中的有效性。该框架也可用于医学成像模式中的其他低对比度小器官分割。

## PO-199
# LSFP-Net: An Unrolled Network for Low-rank and Sparse Decomposition for Real-time Interventional MRI Reconstruction with Multi-coil Radial Sampling

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**Purpose**：Interventional MRI (i-MRI) is crucial for MR image-guided therapy. Fast data acquisition and image reconstruction play important roles in real-time i-MRI. Current fast image reconstruction methods for dynamic MR imaging are mostly retrospective and time-consuming that may not be suitable for i-MRI in real-time. Therefore, in this work, an unrolled network for

low-rank and sparse decomposition-based (dubbed LSFP-Net) was proposed for real-time i-MRI with continuously multi-coil radial sampling.

**Methods**: Firstly, a continuously golden-angle radial sampling was adopted for k-space data acquisition. Secondly, different from the conventional retrospective reconstruction scheme, a group-based scheme was exploited for satisfying the real-time demand of i-MRI. In this work, only 10 spokes per frame and 5 frames per group were used for reconstruction with a ~20 acceleration factor. Last and most importantly, an iterative Low-rank and Sparse decomposition with Framelet and Primal dual fixed point (LSFP) algorithm was unrolled (dubbed LSFP-Net) for i-MRI reconstruction.

The fully sampled brain MR images from 10 healthy subjects were collected on a 3T MRI scanner (uMR 790, United Imaging Healthcare, Shanghai, China). For each subject, 8 coronal slices were acquired with matrix size 128 x 128 and 11 channels. 4 different interventions (2 unilateral and 2 bilateral) for each slice were simulated. Dataset for network training includes 1920 groups of simulated interventional MR images from 8 volunteers. The testing dataset consists of 480 groups of simulated interventional MR images from another 2 volunteers. In addition, interventional experimental data with a gelatin phantom and cardiac cine MRI data were also used for testing the trained network.

The reconstruction results and computation time from LSFP-Net were compared with those from Non-Uniform Fast Fourier Transform (NUFFT), Low-rank plus Sparse decomposition (L+S), LSFP, and Iterative Shrinkage-Thresholding Algorithm (ISTA)-Net.

**Results**：Compared with NUFFT, LSFP, and ISTA-Net, the proposed method could provide improved reconstruction performance in terms of PSNR (29.97) and SSIM (0.9410). Moreover, the proposed method needs less computation time (~0.56s per group) compared with L+S (~5.35s per group) and LSFP (~12.6s per group). The reconstruction results from the gelatin phantom intervention and cardiac cine MRI demonstrated the effectiveness and generalizability of LSFP-net.

**Conclusion**：In this study, we proposed LSFP-Net for real-time i-MRI. The proposed method could satisfy the real-time reconstruction requirement for i-MRI and has excellent generalization capability. The improved temporal resolution demonstrates the potential of the proposed method for a variety of real-time i-MRI scenarios.

PO-200

# Parkinson’s Disease Subtype Identification Using Radiomics Based on Iron Deposition in Substantia Nigra

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**Introduction:**

Previous studies suggested that patients with Parkinson’s disease (PD) can be classified into several subtypes1-3, but their identity and pathophysiological basis remain poorly understood. In PD, iron elevation in the substantia nigra (SN) is a major pathologic feature4. The increase of iron deposition in the SN is related to disease duration and severity5. Data-driven clustering approaches provide an unbiased method to detect groups of patients with similar profiles, thus may serve as a promising way for PD subtype classification. Our goal was to identify subtypes of PD using cluster analysis based on iron deposition in the SN measured by quantitative

susceptibility mapping (QSM) and to compare the clinical assessments between different PD subtypes.

**Methods:**

A total of 104 PD patients (age range：29-81 years old) and 269 age- and sex-matched HCs (age range：31-89 years old) (cohort 1) were imaged on a 3T Philips Ingenia scanner using a 3D multi-echo gradient echo MTC sequence. The imaging parameters were as follows: TE1 = 7.5ms, ΔTE = 7.5ms, TR = 62ms, flip angle = 30˚, pixel bandwidth = 174Hz/pixel, matrix size = 384 × 384, slice thickness = 2mm, original spatial in-plane resolution = 0.67 × 1.34mm2 then interpolated to 0.67 × 0.67mm2. The second echo (TE = 15ms) was used for the QSM reconstruction to evaluate iron deposition in the SN. The susceptibility maps were created using the following steps: the brain extraction tool, BET, to isolate the brain tissue6, a 3D phase unwrapping algorithm (3DSRNCP) to unwrap the original phase data7, sophisticated harmonic artifact reduction (SHARP) to remove unwanted background fields8, and a truncated k-space division (TKD) based inverse filtering technique9 with an iterative approach to reconstruct the final QSM maps10.

For this data driven approach, we used the manual tracings of the SN from 165 QSM images to train 3D U-Net11 to perform automatic segmentation of the SN. The trained artificial neural network was tested on 19 cases. All 184 cases (Cohort 2:165 cases for training and 19 cases for testing, both from a previous unpublished work) were healthy controls and were collected using the same imaging protocol described above. This algorithm was then used to segment the 104 PD cases and 269 HCs mentioned earlier (Cohort 1). After we finished the SN segmentation, 107 radiomics features were extracted from each SN ROI. We used the radiomics features from the 269 HCs to construct a standard feature model and to eventually determine the abnormal features of the PD patients. The distance between the observed PD features and the extracted radiomics features from the HCs can be used to determine the probability of the features being abnormal. The detailed modelling steps can be summarized as: 1) To remove redundant features, the 107 radiomics features were clustered into 10 groups. In each group, features which strongly correlated with clinical scores (by Pearson correlation analysis) were selected12. 2) Radiomics features from 269 HCs were used to train a Gaussian process regressor, expected radiomics feature values can be predicted for the PD patients. The abnormal probability feature Z was defined as: , where  and  denote the observed and expected feature value of PD cases, respectively. Δ(,) and δ indicate distance function and Gaussian standard error. 3) K-Means clustering was used to obtain the final PD subtypes. We used random forest embedding to map the features to a sparse representation, and then used multidimensional scaling approach to reduce the feature dimensions. For clinical validation, a t-test was used for the comparison of MOCA and UPDRS scores between clustered subtypes. The overall framework of our approach is illustrated in Fig. 1.

**Results:**

As for SN segmentation, we achieved an average Dice-coefficient of 0.95 based on the test data. Two PD subtypes were obtained using K-Means clustering, denoted as Subtype1 and Subtype2, which included 50 and 54 PD cases respectively. The clustering result is shown in Fig. 2. Fifty-five PD cases with clinical scores available (a sub-cohort of PD cases in Cohort 1) were used for the subtype groups comparison (Table 1). Significant differences for MDS-UPDRS Ⅱ, Ⅲ and total score were found between the two subtypes (p-values < 0.05).

**Discussion and conclusion:**

In this work, two PD subtypes were identified using a data-driven approach based on iron deposition features in the SN. Significant differences of UPDRS scores were found between these two PD subtype groups. The iron deposition in SN based on QSM is a reflection of the PD pathophysiology and it could provide a strong unbiased classification biomarker for PD. In the future, the longitudinal evaluation of the iron deposition and the disease progression with a larger sample size would help validate the subtype classification of our approach.

# 应用自监督学习算法对踝关节 MRI 解剖结构小样本标注的学习及测试

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目的：基于自监督学习的像素级别解剖结构编码（Self-supervised anatomical embedding，SAM）是一种新的深度学习算法，可以在两个相同类型影像资料（如 CT 及 X 线图像）的解剖结构之间建立像素级别的对应关系。本文中我们利用踝关节 MRI 进行训练和测试，评估此算法在 MRI 中的应用价值，探讨这种高效的自监督学习算法在 MR 图像的延展性，并为后续的广泛应用奠定基础。材料与方法：本研究收集了共 63 例踝关节磁共振 T2 横断位图像，其中 60 例无标签图像作为训练组供 SAM 算法学习像素编码，另外仅 3 例进行人工标注后作为实际解剖标签；每例标注出 22 个解剖结构，包括胫骨，腓骨，距骨，跟骨，舟骨，骰骨，外侧楔骨，中间楔骨，内侧楔骨，胫前肌腱，胫后肌腱，拇长伸肌腱，趾长伸肌腱，趾长屈肌腱，拇长屈肌腱，腓骨长肌腱，腓骨短肌腱，跟腱，胫腓前韧带，胫腓后韧带，距腓后韧带，距腓前韧带。训练和测试的目标是通过 SAM 算法无监督学习 60 例后，任选 3 例新图像中某一解剖结构的任意点，测试算法正确预测出该解剖结构的正确率。将 3 例标注好的图像两两互作模板和测试，利用 SAM 算法在两个图像之间建立像素级别的对应关系。具体来说：首先在测试图像里选择一个像素 A，然后在模板图像里找到对应的像素 B，最后将 B 的解剖结构标签赋给 A。如果 B 不在任何解剖结构上，则将 B 周围 5 个像素内距离最近的解剖结构标签赋给 A。依此对测试图像中所有解剖结构的所有像素进行预测后，与实际解剖标签对比，获得正确率。结果：预测结果的整体准确率为同侧（模板和测试图像为同侧踝关节）92.26%，异侧 82.65%。22 个解剖结构的平均准确率为同侧 81.04%，异侧 66.50%。各个单一解剖结构的同侧及异侧预测准确率见表 1。较大解剖结构的预测准确率较高且同侧较异侧的预测准确率偏高。结论：利用自监督解剖结构编码（SAM）算法学习以像素为单位的解剖结构，学习组无需解剖结构标注，仅需 1 例有标注病例作为模板用于测试，将人为耗时工作降到最少，此为 SAM 的一大优势。前人已将 SAM 用在 CT 和 X 线的解剖结构关键点匹配和病灶匹配任务上，本文将 SAM 进一步应用到更复杂的磁共振图像中并得到了较好的精度。本应用可以用于多种影像类别中相同类别间解剖结构的识别与匹配，以及对应病灶的匹配与比较。未来计划进一步研究同一病人多次随诊中同一病灶的变化情况，甚至希望能够跨越不同影像类别，实现多种图像信息间的整合从而方便诊断，更加贴近人为阅读图像的能力。

PO-202

# Development of MRI-based Radiomics Model to Predict the Risk of Recurrence in Patients with Advanced High-grade Serous Ovarian Carcinoma

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Abstract
Objective: To develop a radiomics model based on preoperative MRI and clinical information for predicting the recurrence-free survival (RFS) in patients with advanced high-grade serous carcinoma (HGSOC).
Methods: This retrospective study enrolled 117 patients with HGSOC, including 90 patients with recurrence and 27 without recurrence. 1046 radiomics features were extracted from T2WI and

contrast-enhanced T1WI (T1+C) using a manual segmentation method. L1 based least absolute shrinkage and selection operator (LASSO) regression was performed to select features, and synthetic minority oversampling technique (SMOTE) was used to balance our data set. A support vector machine (SVM) classifier was utilized to build the classification model. To validate the performance of the proposed models, we applied a leave-one-out cross-validation (LOOCV) method to train and test the classifier. Cox proportional hazards regression, Harrell's concordance index (C-index) and Kaplan-Meier plots analysis were used to evaluate the associations between radiomics signatures and RFS.
Results: The fusion radiomics-based model yielded a significantly higher AUC value of 0.85 in evaluating RFS than the model using a single T1+C or T2WI features separately (AUC = 0.79 and 0.74, P<0.05). Kaplan-Meier's survival curve showed significant differences between high and low recurrence risk in patients with HGSOC by different models. The fusion model combining radiomics features and clinical information demonstrated higher performance than that of clinical model (C-index = 0.62 and 0.60, respectively).
Conclusions: The proposed MRI-based radiomics signatures may provide a potential way to develop a prediction model and can help identify the patients with high risk of recurrence in advanced HGSOC.

PO-203

# Usefulness of the texture signatures based on multiparametric MRI in predicting growth hormone pituitary adenoma subtypes

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**Objective**: The subtypes of growth hormone (GH) pituitary adenomas (PA) determine the differences in the scope or approach of tumor resection and even affect the outcome of transsphenoidal surgery. Therefore, it is essential to predict the pathological subtypes before formulating optimum treatment regimens accurately. Thus we aimed to explore the usefulness of texture signatures based on multiparametric magnetic resonance imaging (MRI) in predicting the subtypes of GH pituitary adenoma.
**Methods**: Forty-nine patients with GH-secreting PA confirmed by the pathological analysis were included in this retrospective study. Texture parameters based on T1-, T2- and contrast-enhanced T1-weighted images (T1C) were extracted and compared for differences between densely granulated (DG) and sparsely granulated (SG) somatotroph adenoma by using two segmentation methods [region of interest 1 ($ROI_1$), excluding the cystic/necrotic portion, appeared as no enhanced area on T1C images, and $ROI_2$, containing the whole tumor area]. We extracted 107 quantitative texture features, which can be divided into seven categories: (1) Shape (n = 14), (2) First Order Statistics (n = 18), (3) Gray Level Cooccurrence Matrix (n = 24), (4) Gray Level Run Length Matrix (n = 16), (5) Gray Level Size Zone Matrix (n = 16), (6) Neighbouring Gray Tone Difference Matrix (n = 5), and (7) Gray Level Dependence Matrix (n = 14). Differences in patients' demographic characteristics between DG and SG were conducted with the Pearson chi-square test or independent-samples T-test. Using pathologically proven PA subtypes as the gold standard, the area under the curve (AUC), accuracy, sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of texture signatures were calculated in differentiating the DG and SG.
Results: Among 49 included patients, 24 were DG and 25 were SG adenomas. Nine optimal texture features with significant differences between two groups were obtained from $ROI_1$. Based on the ROC analyses, T1WI signatures from $ROI_1$ achieved the highest diagnostic efficacy with an AUC of 0.918, the accuracy, sensitivity, specificity, positive predictive value (PPV), and

negative predictive value (NPV) were 85.7 %, 72.0%, 100.0%, 100.0%, and 77.4 %, respectively, for differentiating DG from SG. Comparing with the T1WI signature, the T1C signature obtained relatively high efficacy with an AUC of 0.893. When combining the texture features of T1WI and T1C, the radiomics signature also had a good performance in differentiating the two groups with an AUC of 0.908. In addition, the performance got in all the signatures from $ROI_2$ was lower than those in the corresponding signature from $ROI_1$.
**Conclusion**: The significant differences in optimal texture features were demonstrated between groups DG and SG, and good performance was obtained in differentiating two subtypes by using texture signatures from T1W, T1C, and T2W images. Therefore, texture signatures based on MR images may be useful biomarkers to differentiate subtypes of GH-secreting PA patients.

PO-204

# The value of MRI-based radiomics nomogram in the diagnosis of deep myometrial invasion of FIGO I stage endometrial carcinoma

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Objective ： To determine the predictive performance of the nomogram based on magnetic resonance(MR)radiomics and clinical imaging indicators for the presence of deep myometrial invasion（DMI） in endometrial carcinoma（EC）.
Materials and Methods ： We retrospectively collected 163 patients with stage I EC confirmed by pathology in two institutions from January 2015 to April 2021, which were divided into training group (from institution 1) and validation group (from institution 2). The clinical and routine imaging indexes were analyzed by logical regression to construct the model M1. The radiological features were extracted from the axial images of contrast-enhanced T1W(CE-T1W) and T2WI, and the least absolute shrinkage and selection operator (LASSO) was used to construct a radiological model M2. Normogram M3 was constructed by combining radiologic features with the most important clinical and imaging indicators. Calibration and determination curves are drawn to evaluate the Normogram.In the training (AUCT) and validation (AUCV) cohorts, the diagnostic performance of each indicator and model were evaluated by the area under the receiver operating characteristic curve.
Result ： The number of pregnancy and abortion in patients with endometrial cancer and the diagnosis of radiologists were statistically different between DMI- group and DMI+ group. Four most significant radiomics features were extracted from CE-T1W and T2W sequence images. In the diagnosis of DMI, the AUCT/AUCV of M1 was 0.798/0.738, the AUCT/AUCV of M2 was 0.880/0.852, and the AUCT/AUCV of M3 was 0.936/0.871. The calibration curve shows that the nomogram is in good agreement with the actual value.The decision curve analysis(DCA) suggests that Normogram has potential clinical application value.
Conclusion ： The nomogram based on MR radiomics and clinical imaging indicators has high value in the prediction of DMI of EC and can help clinicians to provide more appropriate treatment for patients.

PO-205

# Machine Learning based Structural and Diffusion MRI to Identify Suicide Risk in Depressed Patients

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## Objective

Suicide has caused great losses to public health all over the world and patients with major depressive disorder (MDD) have a considerably increased risk of suicide. It is urgent to develop more accurate and objective methods to predict the suicidal risk in depressed patients. Machine learning can identify suicidal risk at the individual level and prevent suicidal behavior in depressed patients.

## Method and Materials

A total of 96 depressed patients (43 patients without suicidality, DS- group and 53 patients with suicidality, DS+ group) were included. The structural MRI data were processed with the recon-all processing pipeline in FreeSurfer software suite version 6.0.0 (http://surfer.nmr.mgh.harvard.edu) to calculate measures included cortical surface area (CSA), cortical thickness (CT) and cortical volume (CV) of gray matter regions according to Desikan-Killiany atlas. In addition, the diffusion MRI data were analyzed using the FSL (FMRIB Software Library toolbox) to acquire the fractional anisotropy (FA), mean diffusivity (MD), radial diffusivity (RD) as well as axial diffusivity (AD) of each fiber track according to the track probability maps.

Then a total of 284 features including 204 cortical features of CSA, CT and CV for 68 gray matter regions and 80 diffusion features of FA, MD, AD and RD for 20 white matter fiber tracts were used as an input for machine learning algorithms. All classification modeling was performed with the Python language toolbox scikit-learn (http://scikit-learn.org/stable/index.html) using Python 3 language code. We probed performance with 6 modeling algorithms, including logistic regression, linear kernel support vector machine (SVM), polynomial kernel SVM (SVM_poly) and radial basis function kernel SVM (SVM_rbf), Naïve Bayes and extremely randomized trees (ExtraTrees). To alleviate the influence of bias data distribution, we used a nested cross-validation approach for model training, in which the training/test set split was performed 10 times. In each time, the data was separated into a training set (80% of data) and a test set (20% held-out sample). Held-out test 20% outcomes demonstrate the generalizability of the model to new data. For each model, we tuned the hyperparameters using 5-fold cross-validated grid search on the training set, and then evaluated the model using the selected hyperparameters on the test set.

The metrics chosen for the final evaluation were sensitivity, specificity, accuracy, the area under the curve (AUC), Kolmogorov-Smirnov score (KS), and F1 score. We selected the algorithm which has the maximum median accuracy score as the best algorithm for suicide risk prediction. To analyze the contribution of each feature for the suicide risk prediction, we used the sum of the importance scores of the features from the 10 iterations for the final importance evaluation.

## Results

Demographic and clinical characteristics are shown in Table 1. The results of 6 modeling algorithms are presented in Figure 1 and Table 2. The best performance was acquired by support vector machine (linear kernel). The linear kernel SVM showed a predicted result as followed (showed with medium value), sensitivity: 0.685; specificity: 0.780; accuracy: 0.700; AUC: 0.770; KS score: 0.525; F1 score: 0.700. The most important 10 features were shown in Figure 2, which included thickness of right paracentral lobule, right pars orbitalis, bilateral rostral middle frontal gyrus, left rostral anterior cingulate cortex and left medial orbitofrontal gyrus, volume of bilateral pars triangularis and right pars opercularis, and mean diffusivity of left anterior thalamic radiation.

## Conclusion

Our finding suggested it is possible to use machine learning algorithm with structural and diffusion MRI to reliably classify suicidal risk in depressed patients and the most important features were located in fronto-limbic circuit. We can develop a classification model using MRI data to help diagnosis and assess suicidal risk in depressed patients.

## PO-206

# Deep Learning-Enabled Identification of Autoimmune Encephalitis on 3D Multi-sequence MRI

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Purpose: Autoimmune encephalitis (AE) is a noninfectious emergency with severe clinical attacks. It is difficult for the earlier diagnosis of acute AE due to the lack of antibody detection resources. To implement and test a deep learning (DL) algorithm using multi-sequence MRI for the earlier identification of acute AE, and to evaluate its diagnostic performance with radiologists.
Materials and Methods: A total of 160 consecutive patients with clinically confirmed AE were retrospectively enrolled, and 177 patients with herpes simplex virus encephalitis (HSVE) and 184 healthy controls (HC) were enrolled for model development and internal testing. Fifty-two patients from another hospital were enrolled for external validation. Five DL models were developed from individual or combined MRI sequences (T1WI/T2WI/FLAIR/DWI) to classify the datasets as AE, HSVE or HC. The ground truth of the hippocampal areas was established by two radiologists' annotations on a consensus basis. Reader experiment was further carried out by another three radiologists. The discriminative performance of the different models was assessed and compared using the area under the receiver operating characteristic curve (AUC). Classification performance using confusion matrices was reported to evaluate the diagnostic value of the models and the radiologists' assessments.
Results: The fusion model achieved the greatest diagnostic performance in the internal test dataset with AUCs of 0.83, 0.88 and 0.90 for AE, HSVE and HC, respectively. The fusion model also exhibited an equally strong performance in the external validation dataset, with all AUCs of over 0.80. Among models using single sequence to predict each disease category, DWI sequence revealed a better discrimination ability, with the AUCs of 0.81, 0.81 and 0.86 for AE, HSVE and HC, respectively. The classification performance of the fusion model outperformed the average radiologists with satisfactory accuracies in classifying AE (83% vs. 72%), HSVE (84% vs. 62%) and HC (88% vs. 63%), and demonstrated a better agreement than radiologists (kappa: 0.65 vs. 0.23).
Conclusion: The proposed DL algorithm derived from multi-sequence MRI provided desirable identification and classification of acute AE.

## PO-207

# 基于 18F-FDG PET/MR Habitat 影像组学预测晚期宫颈癌患者无进展生存期

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目的：利用患者治疗前 18F-FDG PET/MR 影像资料，运用 Habitat 影像组学方法预测晚期宫颈癌患者的无进展生存期。
材料与方法：我们回顾性整理了 2017 年 4 月至 2019 年 5 月的 196 名晚期宫颈癌患者，将其治疗前 18F-FDG PET/MR 图像与复查随访资料进行分析，采用随机分组的方法，将晚期宫颈癌患者分成训练组（n=111）与测试组（n=48）。对一体机采集的治疗前 18F-FDG PET/MR 图像进行融合，分别提取整个肿瘤区域的组学特征和基于 Habitat 方法的组学特征。通过 PCC 等方法对特征进行降维，筛选出有意义的特征用来形成预测晚期宫颈癌患者无进展生存期的影像学指标。
结果：在整个肿瘤区域提取的组学特征模型与 Habitat 形成的组学模型相比，含 Habitat 方法的混合预测模型对于晚期宫颈癌患者的无进展生存期有着更高的预测价值（AUC0.835 vs. AUC0.718）。同时，该混合模型模型可以较好地对预后进行分层。
结论：治疗前 18F-FDG PET/MR Habitat 影像组学可以有效地指导晚期宫颈癌患者预后分层，对于宫颈癌诊疗计划具有重要意义。

PO-208

# Whole-tumor PEI-based Entropy Parameter: Correlation with Lymph Node Metastasis of Invasive Ductal Carcinoma of the Breast

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Purpose:
Invasive ductal carcinoma (IDC) of the breast, a heterogenous disease with a high morbidity and mortality, is the second leading cause of cancer-related death for women. The presence and degree of lymph node metastasis indicate the optimal curative management and prognostic situations. Sentinel lymph node (SLN) biopsy is the common method to assess lymph node status in clinical practice which has a risk of complications. Establishing a non-invasive technique for the identification of lymph node status is helpful for avoiding axillary biopsy or dissection in node-negative patients of breast cancer. To investigate whether whole-tumor quantitative parameters based on dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) can help evaluate the status of lymph node metastasis of invasive ductal carcinoma (IDC) of the breast.
Material and Methods:
Among breast tumor patients who underwent breast MRI from April 2010 to September 2019, 501 patients with pathologically confirmed breast carcinoma were searched. The inclusion criteria were: 1) Preoperative DCE-MRI accomplished; 2) Patients with histologic confirmation of IDC by biopsy or surgery; 3) Availability of pathologic status of lymph node metastasis; 4) Patients did not receive neoadjuvant chemotherapy (NAC) prior to pathological and MRI examinations. We excluded patients if: 1) Patients with other histological types (n=46); 2) Patients performed MRI after receiving NAC (n=7); 3) Tumors were diffused lesions without a well-defined and solid mass (n=21); 4) Patients with prosthesis implantation (n=2). Among the 501 patients, 326 breast cancer patients were detected by mammography and performed MRI examination after breast-conserving surgery.
A total of ninety-nine patients with one hundred lesions with histopathological diagnosis of IDC were enrolled in the study. The retrospective study analyzed one hundred IDC with preoperative DCE-MRI. A whole-tumor segmentation was extracted from the 1st postcontrast enhancement images, positive enhancement integral (PEI) maps, apparent diffusion coefficient maps, wash-in and wash-out maps with histogram parameters calculated. Univariate and multivariate regression analysis were performed to determine the status of the lymph node metastasis.
Results:

The mean age of the 40 patients with metastasis to lymph nodes was 47 ± 12 years. The mean age of the 60 patients with non-metastasis to lymph nodes was 51 ± 10 years. Only age (P = 0.018) was of statistical significance by using the Mann-Whitney U test. There were no significant difference between positive SLN group and negative SLN group in lesion location, BI-RADS and kinetics features (P = 0.519-0.874).
For Shape features, only volume values achieved in patients with positive SLN were significantly higher than those achieved in patients with negative SLN (P = 0.042), while sphericity and compacity (P = 0.673 and 0.149, respectively) did not.
For histogram features, on the PEI map, the 1st postcontrast image and wash-in map, entropy values calculated in positive-SLN group were significantly higher than in negative-SLN group (P = 0.001, 0.050 and 0.017, respectively). On the same parametric mapping, negative SLN group showed significantly higher energy values than positive SLN group (P = 0.001, 0.034 and 0.027, respectively). Skewness, kurtosis extracted on the PEI map, the 1st postcontrast image and wash-in map, and also all histogram features extracted on the wash-out map, ADC map showed no significance with lymph node metastasis (P = 0.065-0.844).
At univariate analysis, entropy and energy features obtained from PEI map demonstrated significant correlations with lymph node metastasis (P = 0.012 and 0.016; odds ratio [OR]: 2.326 and 0.368;). Volume and compacity also correlated significantly with lymph node metastasis (P = 0.025 and 0.036; OR: 1.790 and 1.567). And age was statistically correlated to lymph node metastasis (P = 0.045; OR: 0.045).
These valuable parameters were entered into multivariate analysis, entropy from PEI map (P = 0.012; OR: 2.285; 95% confidence interval [CI]: 1.199-4.354) and age (P = 0.041; OR: 0.625; 95%CI: 0.398-0.980) were independently associated with status of lymph node metastasis.
Conclusion:
Our study stood out from previous medical imaging studies because we added PEI maps for the first time to analyze SLN metastasis. PEI map provides measurable assessment and characterization of tissue perfusion. we were committed to exploring the biological information of the whole tumor on PEI map, which segmented lesion slice by slice with integrated intratumor tissue, rather than using single ROI for parametric analysis.
In our work, entropy feature extracted from PEI map in positive SLN group (0.34±0.061) was statistically higher relative to negative SLN group (-0.22±1.14), and there was statistical significance (P = 0.012). Our study confirmed that entropy feature from PEI map was correlated with the heterogeneity of the lesion. Therefore, we assumed that malignant tumor possessed a more aggressive biologic nature and relative adverse prognosis, and entropy values extracted from PEI map were significantly higher.
Besides, we revealed that younger women illustrated a trend toward more tumor cells dissemination compared with older counterparts age (47 ± 12 vs. 51 ± 10).
In conclusion, Entropy derived from the PEI map during DCE-MRI can provide an added value as a non-invasive approach for discriminating the status of lymph node metastasis in patients with invasive breast cancers.

PO-209

# Predicting Peritumoral Edema Development after Gamma Knife Radiosurgery of Meningiomas Using Radiomics: A Multicenter Study

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**Background and Aim:** Gamma Knife Radiosurgery (GKS), the most widely used method of stereotactic radiosurgery, has emerged as a valuable primary or adjuvant management strategy

for meningioma patients that attains long-term inhibition of tumor growth and prevention of new or worsened symptoms. However, peritumoral edema is a common complication of GKS that could lead to a variety of symptoms including headache, nausea, ataxia, seizure, and localized neurologic symptoms. 20-58% cases of symptomatic post-GKS edema even required resection. Risk factors of post-GKS edema were investigated, but there is so far no effective tools to predict the risks. The aim of this study is to construct radiomics-based machine learning (ML) models to predict post-GKS edema development.

**Materials and Methods:** 445 meningioma patients who underwent GKS in our institution were enrolled and partitioned into training and internal validation datasets (8:2). 150 cases from multicenter data were included as the external validation dataset. In each case, 1132 radiomic features were extracted from each pre-treatment MRI sequence (contrast-enhanced T1WI (CE-T1WI), T2WI, and ADC maps). The features were then selected step-wise using univariate Cox analysis and the variable-hunting algorithm with 10-fold cross validation on the training set. 9 clinical features and 8 semantic features were also generated. 19 ML models based on random survival forest (RSF) with different combination of the selected radiomic features, clinical features, and semantic features were developed with the training dataset, and evaluated with internal and external validation respectively. Concordance indices (C-index) were calculated to evaluate the predictive accuracy of the models. The best model achieving the highest C-index in external validation was chosen for further analysis. To evaluate whether the best model was able to stratify groups with different risks for post-GKS edema, three datasets were respectively dichotomized into high-risk and low-risk subgroups and compared using the log-rank test. A nomogram was established to better elucidate the predictive potential of the model in a more interpretable manner.

**Results:** 62 (17.4%), 14 (15.7%), and 18 (12.0%) patients in the training, internal validation, and external validation datasets respectively showed post-GKS edema development. After step-wise feature selection, 17, 24, 15 and 20 features were selected respectively among CE-T1WI, T2WI, ADC and all radiomic features. All the 19 RSF models were successfully validated on both internal and external validation datasets. The RSF model incorporating clinical, semantic and ADC radiomic features achieved the best performance with a C-index of 0.861 (95% CI: 0.748-0.975) in internal validation, and 0.780 (95% CI: 0.673-0.887) in external validation. It stratifies high-risk and low-risk cases effectively (all $P < 0.05$, C-index = 0.908, 0.892, and 0.787 for the training, internal validation and external validation datasets). The nomogram based on the predicted risks provided personalized prediction with a C-index of 0.962 (95%CI: 0.951-0.973) and satisfactory calibration.

**Conclusions:** This study is the first to create post-GKS edema prediction model using ML methods based on a large multi-institutional dataset and rich radiomic features. Given the excellent performance and convenient acquisition of conventional sequences, the RSF model integrating clinical, semantic and radiomic features derived from ADC maps represents a potential tool for post-GKS edema prediction in meningioma patients. This model with the nomogram can be used as a handy, non-invasive, and cost-effective tool to assist better counselling on the risks, making appropriate treatment decisions individually, and employ customized follow-up plans.

## PO-210

# 深度学习算法在基于磁共振图像和非图像数据的肝纤维化自动分期中的价值和应用

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目的
评估基于 MR 增强图像结合非图像信息的全自动深度学习 (automated deep learning，ADL) 算法在筛选肝纤维化患者及在肝纤维化具体分期中的价值及应用
材料与方法
对 384 例慢性肝病及 116 例对照组行腹部 MR 增强检查，术前血清学检查，慢性肝病患者以肝脏穿刺或手术病理作为肝纤维化分期金标准，对照组以肝功能正常为标准。以上述样本的 MR 增强延迟期图像作为 ADL 的输入数据建立模型 DL，结合非图像数据（血清学指标： APRI 及 FIB-4, 病毒状态：HBV 及 HCV 阳性, MR 信息：机型和场强) 建立模型 Full，采用 Delong test 对比分析模型 DL 和模型 Full 的诊断效能 (AUROCs)。
结果
在测试组中，模型 DL 诊断肝纤维化分期 F0-4, F1-4, F2-4, F3-4 and F4 的 AUROC 分别为 0.92 (0.85-0.96), 0.91 (0.85-0.95), 0.86 (0.78-0.91), 0.80 (0.71-0.86)  0.80 (0.72-0.87)，而模型 Full 的 AUROC 分别为 0.99 (0.94-1.00), 0.98 (0.93-0.99), 0.90 (0.83-0.95), 0.81 (0.73-0.88) and 0.84 (0.76-0.90),模型 Full 在肝纤维化分期 F0-4 和 F1-4 组的诊断效能显著高于模型 DL (Delong test P-value=0.003, 0.021)。
结论
基于 MR 增强图像结合非图像信息的全自动深度学习算法在筛选肝纤维化患者及在肝纤维化具体分期中具有一定的临床应用价值。

# PO-211
# 基于心脏磁共振电影的心肌放射组学特征预测经皮冠状动脉介入术后病人心肌微循环障碍的研究

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目的 基于心脏磁共振电影（cine CMR）序列的心肌放射组学特征预测经皮冠状动脉介入术后（PCI）病人心肌微循环障碍（MVO）的研究。
材料与方法 回顾性分析来自深圳市人民医院 116 例病人。所有病人均行经皮冠状动脉介入术并于术后接受心脏磁共振检查（CMR）。将来自 116 例病人按照 0.7: 0.3 随机分为训练集（n =81）和验证集（n =43）。通过在心脏磁共振电影图像上半自动绘制三维感兴趣区域（three-dimensional volumes of interest, 3D-VOI）来提取放射组学特征。使用 Pearson 相关分析剔除重复性高（r > 0.8）的特征，并使用 Mann-Whitney U 秩合检验比较 MVO 阳性和阴性组间放射组学特征的差异。在训练集中使用套索回归（Least absolute shrinkage and selection operator，LASSO ）进行特征选择和模型建立，并在验证集中进行验证。计算受试者工作特征曲线（receiver operating characteristic curve, ROC）下面积（AUC 值）评估模型的在训练集及验证集中的预测效能。P＜0.05 认为差异有统计学意义。
结果 107 个放射组学特征中，在剔除冗余特征后，单因素分析表明 9 个放射组学特征在 MVO 阳性和阴性组间差异存在统计学意义。该模型于训练集和验证集 AUC 致分别为 0.78 和 0.72。
结论 基于心脏磁共振电影（cine CMR）序列的心肌影像组学特征建立的 LASSO 回归模型预测经皮冠状动脉介入术后（PCI）病人心肌微循环障碍（MVO）可达到较高的诊断效能。
【关键词】 放射组学；机器学习；微循环障碍；磁共振成像

# 书面交流

PU-001

# 场强对 IDEAL-IQ 序列定量影响的初步研究

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目的：探讨场强对 IDEAL-IQ 序列定量的影响。方法：20 例志愿者，分别在 3.0T（A 组）和 1.5T（B 组）的 GE MR 设备上扫描上腹部 IDEAL-IQ 序列，在 FatFrac 图和 R2*图分别测定肝脏和皮下脂肪的 PDFF 及 R2*，并行 A、B 两组配对 t 检验。结果：A、B 两组配对分析，肝脏及皮下脂肪 PDFF（t=-1.672、-0.301，P=0.111、0.767）及 R2*（t=7.553、4.372，P=000、000），PDFF 的差别无统计学意义，而 R2*的差别有显著统计学意义 。结论：场强不是影响脂肪定量的关键因素，而场强是影响铁定量的关键因素；3.0T 和 1.5T 场强下 IDEAL-IQ 序列测定的肝脏 PDFF 可以相互替代，但 R2*值不能相互替代。

PU-002

# 不同扫描方式对 MR 腹部增强图像质量的影响

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目的：探讨采用不同增强扫描方式时，腹部 MR 影像质量的差异。
方法：采用西门子 1.5T(Magnetom Aera)磁共振扫描仪对 2020 年 11 月至 2021 年 5 月的我院 267 例患者行上腹部 MR 增强检查，结合四种不同的增强扫描方法。方法①：降主动脉胸段追踪法+自动语音指令；方法②：技师经验延时法+自动语音指令；方法③：技师经验延时法+技师语音指令，方法④：降主动脉胸段追踪法+技师语音指令。结合上腹部增强磁共振专家共识和诊断需求，由高年资诊断医师和影像技师对增强图像进行质量评价：动脉期、门脉期的增强时机准确性评价和动脉期、门脉期、静脉期呼吸伪影评价。
结果：1、增强时机准确性评价：动脉期准确率方法④＞方法①＞方法③＞方法②，分别为 90.38%（47/52）、87.27%（96/110）、84%（42/50）、83.64%（46/55）；门脉期准确率方法④＞方法③＞方法①＞方法②，分别为 92.31%（48/52）、0.88%（44/50）、86.36%（95/110）、81.82%（45/55）。2、呼吸伪影评价：动脉期发生率方法①＞方法②＞方法④＞方法③，分别为 27.27%（30/110）、21.82%（12/55）、17.31%（9/52）、14%（7/50）；门脉期发生率方法①＞方法②＞方法④＞方法③，分别为 22.73%（25/110）、14.55%（8/55）、13.46%（7/52）、8%（4/50）；静脉期发生率方法②＞方法①＞方法④＞方法③，分别为 14.55%（8/55）、10.91%（12/110）、9.62%（5/52）、6%（3/50）。
结论：采用降主动脉胸段追踪法时，增强时机较经验延时法更准确；采用技师语音指令时，呼吸伪影发生率较自动语音更小；其中，技师经验延时法+技师语音指令，呼吸伪影发生率最小且增强时机较准确，是腹部 MR 增强扫描的最优检查方式，值得广泛推广。

PU-003

# 探讨颌面部 MR 图像质量评价标准在颌面部规范化扫描中的应用

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目的：探讨颌面部 MR 图像质量评价标准在颌面部规范化扫描中的应用价值
方法：对 2021 年 1 月至 2021 年 5 月期间的颌面部 MR 进行抽查，每月质控例数 96 例，根据 2019 年版颌面部规范化扫描专家共识，分别从图像信噪比、对比度、分辨力、均匀度及图像伪影制定图像质量评价标准，从而在体位设计、伪影控制、图像信噪比及序列选取方面扣分，根据扣分计算其占比对颌面部 MR 扫描进行质量评价。
结果：抽查例数共 480 例，根据图像质量评价标准进行扣分，分别比较 1-5 月体位设计、伪影控制、图像信噪比及序列选取方面扣分占比的区别，分析每月在各项扣分中的具体原因并公示结果。
结论：根据制定的颌面部 MR 图像质量评价标准，对每月颌面部 MR 扫描图像进行质量评价，并将结果汇总绘制模型公示，各位技师共同发现问题，提出问题，进而避免问题，提高颌面部 MR 图像质量，为诊断医师及临床医师提供更优质的服务。

PU-004

# Gadolinium Retention in the Brains of Mother and Pup Mice: Effect of Pregnancy and Repeated Administration of Gadolinium‐Based Contrast Agents

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Abstract
Objective: We aimed to investigate the effects of pregnancy and repeated administration of gadolinium-based contrast agents (GBCAs) on Gd retention in the brains of mother and pup mice.
Methods: From gestational day 16 to 19, pregnant and non-pregnent BALB/c mice were administered four doses of saline and (2.0 mmol Gd/kg) GBCAs, including gadodiamide, gadopentetate dimeglumine, and gadoterate meglumine. T1-weighted magnetic resonance imaging (MRI) and transmission electron microscopy were performed on the mother and pup mice. The adult mice and pups were sacrificed 1 day and 28 days after birth, respectively, and the brains were extracted. Gd was determined by inductively coupled plasma mass spectrometry in the adult mice and intact GBCAs and insoluble gadolinium contents were determined in the pup mice. The deep cerebellar nuclei (DCN) of the pups were analyzed by Nissl staining.
Results: Retention of Gd in the brains of pregnant mice was lower than that of non-pregnant mice. Retention of Gd in the brains of pups whose mothers were administered gadoterate meglumine was significantly lower than that of pups whose mothers were administered gadodiamide and gadopentetate dimeglumine. The olfactory bulb and DCN showed the highest Gd retention. In mice treated with gadodiamide, most of the retained Gd in the brain tissue was insoluble. Nissl staining showed no neuronal damage in the area of the DCN in the pups.
Conclusion: We demonstrated that intrauterine Gd was retained by placenta in pups. In different brain areas of the mother and pup mice, the retention of Gd after gadoterate meglumine administration was always lower than that of gadodiamide and gadopentetate dimeglumine administration, and almost all detected Gd in pups' brains was intact soluble GBCAs. By contrast, gadodiamide yielded both soluble and insoluble Gd-containing species, although insoluble species dominated. Pregnancy affected Gd retention in the brains of mother and pup mice, although no detectable neuronal damage was observed.

PU-005

# 不同种类钆对比剂多次静脉注射后与脑内核团 T1WI 信号比值的研究

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**目的** 探讨肝肾功能正常者多次静脉注射钆对比剂后，末次脑内核团平扫 T1WI 信号比值与钆对比剂种类的关系。
**方法** 回顾性分析了 2017 年 1 月至 2020 年 12 月期间在我院行头颅 MRI 增强检查（≥6 次，且每次均注射同一种对比剂）的 68 例肝肾功能正常者的 MRI 资料，作为实验组，其中线性组 48 例（钆喷酸葡胺组 33 例，钆贝葡胺组 15 例），大环组 20 例（钆布醇组 12 例，钆特酸葡胺组 8 例）；选取无钆对比剂注射史且行头颅 MRI 平扫检查的正常人作为对照组，对照组年龄、性别及 MRI 扫描仪器需与实验组末次检查时相匹配。分别测量对照组及实验组末次检查时脑内核团平扫 T1WI 信号比值（齿状核/小脑半球、苍白球/额叶白质、丘脑/额叶白质），比较不同种类钆对比剂脑内各核团 T1WI 信号比值的差异。
**结果** 线性组脑内各核团 T1WI 信号比值明显高于对照组（*P* 均＜0.05），且 T1WI 信号比值与注射次数呈正相关（R=0. 51，*P*＜0. 05），与平均时间间隔呈负相关（R=-0. 26，*P*＜0. 05），而大环组与对照组差异均无统计学意义（*P* 均＞0.05）。线性组脑内各核团 T1WI 信号比值亦均高于大环组（*P* 均＜0.05）；钆喷酸葡胺组与钆贝葡胺组比较，苍白球/额叶白质 T1WI 信号比值差异有临界统计学意义（*P*=0.04），其余核团差异无统计学意义；钆布醇组与钆特酸葡胺组差异均无统计学意义（*P* 均＞0.05）。
**结论** 不同种类钆对比剂多次静脉注射后脑内核团 T1WI 信号比值存在差异，多次静脉注射线性对比剂会引起脑内各核团 T1WI 信号增高。

PU-006

# 心脏磁共振（CMR）扫描技术规范

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目的：心脏磁共振（CMR）成像不仅能够提供心脏结构与功能，而且其高度的组织学特征能够实现病理影像化，因此在疾病的诊断、鉴别诊断、预后等方面发挥重要指导价值。
方法和资料：心脏磁共振检查通常需要多通道线圈来进行并行采集，且需要心电门控来同步心脏节律运动。心脏磁共振（CMR）成像内容包括心脏形态学检查、心功能检查、心肌灌注、心肌活性、心肌组织定量评估和心脏大血管、冠状动脉成像等检查。心脏形态成像主要应用黑血和亮血，黑血序列利用血液流空效应，使心脏及大血管内快速流动的血液呈无信号，心肌呈等信号。称“黑血”。亮血序列通过增强血池信号的亮度使血池呈高信号，而心肌呈等信号，其中以稳态自由进动序列。心脏电影成像能获得单个层面心动周期内不同时相的一系列图像。可评价心脏收缩功能、心肌质量、心室腔容积、血流情况等心功能指标，推荐采用呼气末屏气方法。心肌灌成像主要采用对比剂首次通过法，采用时间分辨率足够高的快速成像序列对心肌进行连续多时相扫描，通过检测带有对比剂的血液首次流经心肌时引起心肌信号强度随时间的变化来反映组织的血流动力学。对缺血性心脏病诊断十分重要。钆对比剂延迟增强成像（LGE），通常是从静脉注入钆对比剂后延迟 8-15min，采用反转恢复或 PSIR 序列，通过 TI scout 设置 TI 时间，获得 T1 加权图像。心肌梗死后纤维化，细胞外间隙扩大，使钆对比剂浓集，LGE 扫描呈高信号。心肌组织定量评估，能利用质子驰豫特性显示心肌或血管的组织学特征。T1Mapping 成像应用最广，基于反转恢复脉冲技术或其于饱和恢复脉冲技术。细胞外容积（ECV）评价技术是通过钆对比剂注射前后的 T1Mapping 图

像，经过血细胞比容值校正后获得心肌弥漫纤维化信息。T2Mapping 通常使用多回波快速自旋序列,在缺血性心脏病中，心肌梗死、梗死后缺血再灌注等引起心肌水肿时可引起心肌 T2 值改变。
结果：心脏磁共振（CMR）成像多序列、多参数、一站式检查成为评估心功能的"金标准"，对心血管疾病的诊断及鉴别诊断提供重要帮助。
结论：随着心脏磁共振（CMR）技术的不断进步，规范化心脏磁共振扫描技术，获得诊断价值的图像，临床应用前景广阔。

## PU-007

# 颞下颌关节盘在磁共振常规斜矢状位的显示技术研究

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【摘要】目的：探索颞下颌关节盘按照常规斜矢状位磁共振定位扫描是否能清晰显示达到诊断标准，与脸型和面部不对称畸形是否相关。方法：对 10 名面部不对称畸形患者及 10 名圆脸、10 名方脸、10 名长脸的患者为研究对象，采用 GE 1.5T MRI 成像系统和颞下颌关节专用表面线圈对颞下颌关节进行常规 T1WI\PDWI 斜矢状位扫描。由 MRI 技师和 MRI 医师共同对颞下颌关节盘的显示情况进行打分。结果：斜矢状位常规定位扫描，PD WI 显示关节盘效果最好。斜矢状位常规定位扫描能否显示出关节盘，与脸部情况和脸型有间接关系，髁状突正常时，按照常规定位扫描方法均可显示；髁状突形态、大小异常时，则未能显示或显示不清。结论：扫描定位非常重要，检查前要对患者张闭口位关节移动有评估，定位像出来根据髁突情况和关节形态整体走行相结合进行扫描定位。而关节盘最终能否显示满意也与病情相关。

## PU-008

# 人结直肠癌裸鼠皮下瘤模型的 3.0T MRI 参数优化及功能成像评估

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【摘要】 目的 对人结直肠癌裸鼠皮下瘤模型进行 3.0T MRI 扫描参数优化及功能成像评估，以得到优质的裸鼠皮下瘤图像和探讨功能成像评估皮下瘤模型的价值。方法 裸鼠 20 只，随机分为 A、B 两组，建立人结直肠癌 SW480 细胞株裸鼠皮下瘤模型，待瘤体生长至 1～1.5 cm 时进行 MRI 扫描。设计 a、b 两种相同序列不同参数的扫描方案用于裸鼠横断位 T1WI、T2WI 及 T1WI 增强扫描，A 组裸鼠用 a 方案进行扫描，B 组裸鼠用 b 方案进行扫描(a 方案横断位 T1WI 序列矩阵：256×224；b 方案横断位矩阵：256×256。a、b 两组方案的其余参数均相同)。对所有裸鼠进行体素内不相干运动扩散加权成像（IVIM-DWI）与三维动脉自旋标记成像（3D-ASL）扫描来评估皮下瘤的水分子扩散运动（细胞密度）与微循环信息。分别测量 A 组和 B 组裸鼠皮下瘤横断位 T1WI、T2WI 及增强序列的信噪比（SNR）、对比噪声比（CNR）。测量所有裸鼠肿瘤组织及同层面肌肉组织标准表观扩散系数（ADC）、慢速表观扩散系数(D)、快速表观扩散系数(D*)、灌注分数(f）及血流量（BF）值。结果 最终入组 A 组裸鼠 10 只，B 组裸鼠 5 只，15 只(100％)裸鼠在 MRI 上均显示成瘤。 A 组横断位 T1WI 及增强序列 SNR 均大于 B 组（P<0.05)。A 组增强序列 CNR 大于 B 组（P<0.05)。肿瘤组织 ADC 值、D 值及 D*值均小于肌肉组织（P<0.05)。f 值及 BF 值均大于肌肉组

织（P<0.05)。皮下瘤病理诊断为结直肠低分化腺癌，瘤体微血管生成丰富，肿瘤组织细胞密度高。结论 通过适当缩小临床型 3.0T MRI T1WI 矩阵，可以获得优质的裸鼠 MRI 解剖图像。IVIM-DWI 与 3D-ASL 技术可以反映皮下瘤内微血管生成与细胞密集度的状况。

## PU-009

# 探讨专家共识与科室具体情况结合的胎儿 MRI 扫描规范

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目的　探讨专家共识与科室具体情况结合的胎儿 MRI 扫描规范，以提高胎儿 MRI 图像规范率。
方法　在国内最新胎儿 MRI 专家共识及相关文献指导下，结合本科室实际 MRI 使用机型、护理准备工作及诊断组相关需求制定胎儿 MRI 质量控制规范。并用卡方检验比较规范前后两个自然月内胎儿 MRI 检查序列规范占比。
结果　规范前技师间扫描序列各不相同，符合规范要求率低（10/24），规范后技师间扫描序列符合规范要求率显著提高（14/15），P=0.001<0.05,差异有统计学意义，可认为规范后的序列更具有一致性。
结论　通过制定规范，可显著提高胎儿 MRI 扫描图像序列一致性，利于诊断报告的书写。

## PU-010

# 颅脑 MR 图像质量评价标准在颅脑扫描中的价值探讨

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目的：探讨颅脑 MR 图像质量评价标准在颅脑扫描中的价值应用。方法：根据颅脑 MR 图像质量评价标准，对 2021 年 1 月-5 月，每月进行颅脑 MR 质控筛查，每月质控病例数≥50 例。与未应用颅脑 MR 图像质量评价标准的相同病例数进行质控系数、扣分占比及优片率比较。结果：应用颅脑 MR 图像质量评价标准质控病例共 243 例，未应用颅脑 MR 图像质量评价标准的病例共 240 例，应用颅脑质控标准的质控系数为 0.982，未应用颅脑质控标准的质控系数为 0.936；应用颅脑质控标准的优片率为 86%，未应用颅脑质控标准的质控系数为 81%；应用颅脑质控标准的扣分占比为 14%，未应用颅脑质控标准的扣分占比为 19%；结论：颅脑 MR 图像质量评价标准是在日常质控中总结后讨论得出的，应用颅脑 MR 图像质量评价标准每月进行质控，并将质控问题绘制表格及曲线张贴上墙，技师进行扫描时会根据评价标准及上个月的质控汇总及时注意常见问题，从而减少重复扫描，提高扫描质量。不仅使扫描图像更加的美观、标准，也能更好的为临床提供服务。

## PU-011

# 肛周脓肿磁共振扫描技术质量评价

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目的：探讨肛周脓肿磁共振扫描定位的应用标准，获取肛周脓肿磁共振精准图像，帮助临床对于肛周疾病的诊断。方法：选取就诊于本院的肛周脓肿疾病患者 50 例作为本次研究对象，所有患者均采用西门子 1.5 T 磁共振进行扫描，同一病人同时采用两种扫描定位方法，一组采用小视野扫描方法，横断面图像在矢状位定位像上使横断层面垂直于肛管解剖结构，得到 fs-T2WI ，T1WI 横断面图像；在矢状面定位像上扫描层面平行于肛管，得到 fs-T2WI 冠状面图像，使肛管位于图像中心，肛周组织左右对称。另一组采用大范围全盆腔轴位 fs-T2WI 和 T1WI 扫描。将所得到的两组图像，让同一位影像诊断医生进行观察对比判断。结果：将 50 组图像进行对比分析。第一组小视野扫描方法，50 例图像能够清晰显示病灶范围，脓肿与肛管的解剖位置关系显示准确，其中 11 例存在瘘管患者能明确瘘道有无形成及其位置；第二组大视野全盆腔扫描方法，50 例图像能够清晰显示病灶范围，但脓肿与肛管解剖位置关系显示不准确 18 例（测量脓肿距离肛管最短的距离），11 例存在瘘管患者中能够明确 9 例，其中 2 例不能明确有无瘘道形成。结论：肛周脓肿磁共振扫描定位应根据肛管解剖结构进行精准定位，能够更为准确的得到肛周脓肿病变图像，明确脓肿与肛管距离及有无瘘道的形成，帮助临床更为直观的观察与治疗肛周疾病。

## PU-012

# 定量磁共振成像技术在孤独症儿童早期诊断中的应用价值

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目的：探讨定量磁共振成像技术在孤独症儿童早期诊断中的应用可行性。
方法：共有 60 名 2-4 岁孤独症儿童和 60 名年龄、性别相匹配健康儿童参与研究；所有儿童均行头部 MRI 常规序列、3D-T1 序列、DKI 序列、ESWAN 序列、3D-ASL 序列扫描，通过软件对 DKI 序列、ESWAN 序列、3D-ASL 序列原始数据进行处理，获得 DKI 定量图、QSM 定量图、CBF 定量图；采用基于体素的形态学分析（voxel-based morphometry，VBM）法,我们在 MATLAB 2018a 平台上，使用 SPM12 软件，将 3D-T1 序列结构图分别与 CBF 定量图、DKI 定量图、QSM 定量图进行配准，在 SPM12 软件中利用 CAT12 工具包将配准后的 CBF、DKI、QSM 结构定量图进行分割，提取各个脑区体积参数值和 CBF、DKI、QSM 等参数值。最后对获取的 DKI 定量图、磁敏感定量图、CBF 定量图、3D-T1 脑结构图参数值进行全脑分析，比较两组儿童各脑区体积、铁含量、脑血流量、脑微结构等，并分析其相关性。
结果：
研究组儿童脑部额叶、颞叶、海马、尾状核、黑质、红核等处铁含量、脑血流量低于对照组儿童相对应脑区（$p<0.05$）；研究组儿童脑部额叶、颞叶、壳核、海马、尾状核、黑质、红核等脑区 MK 值、RK 值、AK 值均低于对照组儿童相对应脑区（$p<0.05$）。采用 Pearson 相关系数描述孤独症儿童额叶、颞叶、海马等脑区铁含量与脑血流量、脑微结构 DKI 值的关系，发现：脑区 CBF 值、FA 值、MK 值、AK 值、RK 值与 QSM 值呈正相关( $P<0.01$)，脑区 MD 值、FAK 值与 QSM 值呈负相关( $P<0.01$) 。
结论：
孤独症儿童脑部额叶、颞叶、海马、尾状核、黑质、红核等处铁含量、脑血流量低于正常儿童，脑微结构也发生改变。孤独症儿童额叶、颞叶、海马等脑区可能最先发生微结构改变，可以将这三个脑区作为诊断孤独症儿童脑影像的重点区域。

## PU-013

# Quantitative susceptibility mapping shows lower brain iron content in children with autism

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Objective: To explore the application of quantitative susceptibility mapping (QSM) of brain iron content in children with autism.
Methods: For the control group, 40 normal children aged 2-3, 3-4, 4-5, and 5-6 years were prospectively selected from June 2018 to December 2018, with equal numbers of males and females in each age group. For the study group, 40 children with autism aged 2-3, 3-4, 4-5, and 5-6 years were prospectively selected from January 2019 to October 2019; once again, there were equal numbers of males and females in each age group. All children received routine head MRI scans and enhanced T2*-weighted angiography (ESWAN) sequence scans, and the ESWAN sequence images were processed by software to obtain magnetic susceptibility maps. The regions of interest (ROI) of the frontal white matter, frontal gray matter, thalamus, red nucleus, substantia nigra, dentate nucleus, globus pallidus, putamen nucleus, caudate nucleus, pons, and splenium of corpus callosum were selected, and the magnetic susceptibility values were measured. The differences in magnetic susceptibility between the two groups were compared in children at the same age.
Results: For the children aged 2-3 years, the magnetic susceptibility values in the caudate nucleus, dentate nucleus and splenium of the corpus callosum in the study group were lower than those in the control group (P<0.05). For the children aged 3-4, 4-5, and 5-6 years, the magnetic susceptibility values in the frontal white matter, caudate nucleus, red nucleus, substantia nigra, dentate nucleus, and splenium of the corpus callosum in the study group were lower than those in the control group (P<0.05).
Conclusion: The brain iron content of children with autism is lower than that of normal children.

## PU-014

# 三维动脉自旋标记灌注成像显示学龄前孤独症儿童部分脑区血流下降

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目的：探讨三维动脉自旋标记(3D-arterial spin labeling, 3D- ASL)灌注成像在学龄前孤独症儿童脑部的应用可行性。 方法：选取 2-3、3-4、4-5、5-6 岁孤独症儿童各 40 名为研究组，选取 2-3、3-4、4-5、5-6 岁健康儿童各 40 名为对照组，所有儿童均行磁共振常规序列、3D-T1、3D-ASL 序列扫描。通过软件后处理获得脑部各区脑血流灌注 CBF 值，比较分析相同年龄段孤独症儿童和健康儿童脑部各区血流灌注 CBF 值，找出各年龄段孤独症儿童脑部各区脑血流灌注 CBF 值特点。 结果：2-3 岁组，孤独症儿童颞叶、海马、壳核等脑区 CBF 值低于健康儿童（P＜0.05）；3-4 岁组，孤独症儿童额叶、颞叶、顶叶、海马、壳核等脑区 CBF 值低于健康儿童（P＜0.05）；4-5 岁组，孤独症儿童颞叶、额叶、顶叶、枕叶、海马、壳核、尾状核等脑区 CBF 值低于健康儿童（P＜0.05）；5-6 岁组，孤独症儿童颞叶、顶叶、枕叶、海马、壳核、尾状核等脑区 CBF 值低于健康儿童（P＜0.05）。结论：3D-ASL 技术可以反映脑血流灌注情况，与 MR 平扫序列相结合，可以更加全面地反映孤独症儿童病理过程。

## PU-015

# 3D-ASL 在早产儿和足月新生儿脑血流灌注定量分析中的应用

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目的：通过 3D-ASL 磁共振灌注成像技术，探讨不同校正胎龄期早产儿与正常同龄期足月儿脑血流量（CBF）的差异性，了解早产儿脑部脑血流量的变化。
方法：将 42 例早产儿及 56 例正常足月儿分成三组：校正胎龄＜37 周组早产儿 22 例、校正胎龄＞37 周组早产儿 32 例、足月儿组 44 例。三组新生儿均进行头颅常规 MRI 及 3D-ASL 检查，获得脑部灌注图像。分别测得双侧额叶、颞叶、枕叶、顶叶的灰质和白质、尾状核、壳核、苍白球、丘脑的 CBF 值。在 T1WI 像与 CBF 图的融合图上分别于额、顶、颞、枕灰质及白质，尾状核、壳核、苍白球、丘脑选取感兴趣（ROI），记录各 ROI 的 CBF 值。采用
单因素方差分析、配对样本 t 检验、独立样本 t 检验、Pearson 线性相关进行统计学
分析。

结果：校正胎龄＜37 周的早产儿和足月儿各部位脑组织的 CBF 均小于校正胎龄≥37 周早产儿，差异有统计学意义（P＜0.05）；校正胎龄＜37 周早产儿各部位脑组织的 CBF 小于正常足月儿，差异有统计学意义（P＜0.05）；各个校正胎龄期及足月新生儿的额叶灰质 CBF 大于其它脑区，差异有统计学意义（P＜0.05）；各个校正胎龄期及足月新生儿的脑组织深部核团中，苍白球的 CBF 最低，差异有统计学意义（P＜0.05）；性别对各个校正胎龄期及足月新生儿的各脑区 CBF 无明显影响，CBF 值比较并无统计学差异。

结论：3D-ASL 可以无创、定量测定脑组织 CBF，可用于评价新生儿脑血流变化，具有重要价值。

# PU-016
# 3D-ASL 技术在双胞胎新生儿脑血流灌注定量分析中的的应用

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目的 通过 3D-ASL 磁共振灌注成像技术，分析双胞胎新生儿脑血流量的影响因素。
方法 收集 2019.7-2021.3 在我院出生的健康双胞胎新生儿共 32 对，其中男性 37 例，女性 27 例。在 36 周<矫正胎龄≤37 周时，行常规磁共振及 3D-ASL 灌注成像检查。根据每对双胞胎出生体重不同，分为 A 组（出生体重较轻）和 B 组（出生体重较重）。两组分别测定尾状核、苍白球、丘脑、脑灰质、脑白质区域的脑血流量（CBF）。其中脑灰质分别测量额叶、颞叶、枕叶脑灰质；脑白质测量双侧侧脑室旁及半卵圆中心区域，取平均值。不同部位 CBF 值采用均数和标准差表示，比较采用 t 检验或单因素方差分析，以 p<0.05 为检验水准。
结果 1.双胞胎新生儿围生期合并症、性别、胎龄、分娩方式无统计学差异（p>0.05）；A 组平均出生体重低于 B 组（p<0.01），A 组平均出生头围低于 B 组（p<0.01）。2.男性各脑区 CBF 值稍高于女性，但是无统计学差异（p>0.05）。3.A 组与 B 组在额、颞叶灰质区域、尾状核、丘脑的 CBF 值有统计学差异（p<0.05），在枕叶灰质区域、脑白质区域、苍白球的 CBF 值无统计学差异（p>0.05）。
结论 双胞胎新生儿，体重是影响不同脑区 CBF 值的主要因素。性别对各脑区 CBF 值无显著影响。额叶灰质区域 CBF 值高于其它脑区。

# PU-017

# 射血分数保留的 2 型糖尿病患者亚临床收缩功能障碍与细胞外容积的心脏磁共振研究

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目的 基于心脏磁共振 T1mapping 和 tissue-tracking 技术定量评价射血分数保留的 2 型糖尿病患者左室 native T1 值，细胞外容积分数和心肌应变。材料与方法 收集我院 2020 年 6 月至 2021 年 4 月 46 名患者，其中 13 例单纯 2 型糖尿病患者（G1），13 例 T2DM 伴高血压患者（G2）及 20 例单纯高血压患者（G3），同时收集 32 例性别、年龄、BMI 匹配患者作为健康对照组（HCs）。所有受试者均接受心脏磁共振检查(1.5T, MAGNETOM Amira, Siemens, Best, Netherlands)，扫描改良 Look-Locker 反转恢复序列，根据 AHA17 节段分别测量左室心肌基底部、中部和心尖部 1-16 节段的 native T1、post T1 和 ECV 值。CMR 检查前收集相关临床和生化指标。结果 所有糖尿病患者的心肌 native T1 值、ECV 值、心肌质量及心肌质量指数均显著高于健康对照组，(native T1: 1078.73±13.28 ms vs. 1034.35±12.34 ms; ECV: 29.4 ± 3.8% vs. 25.5 ± 2.3%; Myo-Mass: 64.24 ± 4.62g vs. 52.41 ± 4.54g; Myo-Mass index: 53.43 ± 1.82g/m2 vs. 40.56 ± 2.33 g/m2; $p < 0.05$ for all). G2 组患者 ECV 值较 G1 和 G3 组患者显著升高(31.7 ± 2.3% vs. 27.6 ± 2.5%, [G1] $p < 0.05$; 31.7 ± 2.3% vs. 27.5 ± 2.4%, [G3] $p < 0.05$)。G2 组患者的心肌质量和心肌质量指数明显增高(Myo-Mass: 69.52±5.29g vs. 54.64±4.47g; Myo-Mass index: 54.03±4.92g/m2 vs. 42.26±2.37g/m2; [G1] $p < 0.05$ for all)。G1 组患者 GLS 较 HCs 组显著减低(-18.6 ± 3.2% vs -20.7 ± 2.4%, $p < 0.05$)。G2 组患者 GLS 较 G1 组增高(-20.6 ± 3.8% vs -18.6 ± 3.2%, $p < 0.05$)。然而，糖尿病患者左心室容积、射血分数、GRS、GCS 等与健康对照组无统计学差异。单纯 T2DM 组患者的 ECV 值与 GLS 具有相关性(standardized $\beta = 0.389$, $p < 0.05$)。结论 射血分数保留的 2 型糖尿病患者心肌细胞外基质扩张、心肌应变受损，且二者具有相关性。

PU-018

# 基于弥散张量成像的影像组学可重复性分析及其在高低级别胶质瘤术前分级中的诊断效能

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目的：
探讨基于术前弥散张量成像的影像组学的可重复性及其对高低级别胶质瘤的鉴别诊断价值。

方法：
收集术前行常规 MRI 检查及弥散张量检查，且经手术病理证实的胶质瘤 46 例（低级别 18 例，高级别 28 例），在肿瘤最大层面由观察者 1 和观察者 2 结合常规 MRI 图像应用 MaZda 软件分别在 b0 图像上勾画肿瘤 ROI，并将 ROI 拷贝到同层面 MD 和 FA 图上，1 月后由观察者 1 再次勾画肿瘤 ROI，获取肿瘤 MD 及 FA 的组学特征（包括灰度直方图、游程矩阵、梯度模型、自回归模型、小波变换频带系数能量 5 大类共 51 个特征），对组间和组内一致性良好（ICC>0.75）影像组学特征采用独立样本 t 检验、Mann-Whitney U 检验统计高低级别胶质瘤有统计学差异的影像组学特征，应用 ROC 评价其诊断效能；应用 Spearman 相关性分析进行特征去冗余（$|r|>0.8$），纳入剩余特征行 logistic 回归分析建立多变量诊断模型，评估模型诊断效能。

结果：
影像特征提取获得 102 个影像组学特征，对观察者 1 和 2 进行观察者内内和观察者间组学特征进行一致性分析（ICC>0.75）后组间比较，MD 和 FA 分别有 15 个和 10 个特征在高低级别胶质瘤存在差异性（P<0.05），其中 MD 的 WavEnLL_s-3 曲线下面积最大，为 0.929，敏感度和特异度为 92.9%和 72.2%。经去冗余及 logistic 回归分析，MD 的 GrVariance、WavEnLL_s-3、WavEnLH_s-3 共 3 个参数进入模型，模型的 Hosmer-Lemeshow 拟合优度 X2 值为 0.456，P>0.05，ROC 曲线下面积 0.996，敏感度和特异度为 96.4%和 94.4%。

结论：
基于弥散张量成像的影像组学具有良好的稳定性及可重复性，其所建立模型具有很好的可靠性，可在术前准确鉴别高低级别胶质瘤。

## PU-019

# The appropriateness criteria of abdominal fat measurement at the level of the L1-L2 intervertebral disc in patients with obesity

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**Background.** We aimed to evaluate the appropriateness of quantification of total abdominal fat at the L1-L2 (lumbar) intervertebral disc level in patients with obesity.
**Methods.** All patients in the IRB-approved database of our institution who underwent bariatric surgery between November 2017 and November 2019 were recruited. We retrospectively reviewed upper abdominal magnetic resonance (MR) data acquired before surgery. We analyzed the correlation and consistency of the amount of abdominal subcutaneous adipose tissue (ASAT) and visceral adipose tissue (VAT) measured at the L1-L2 and at L2-L3 levels on MR images. We randomly split the cases into linear regression model establishment and verification sets at a ratio of 7:3.
**Results.** Two hundred and forty-five subjects were included. The ASAT and VAT values measured at the L1-L2 and L2-L3 levels were highly correlated ($male^{ASAT}$: r=0.97, $female^{ASAT}$: r=0.93; $male^{VAT}$: r=0.93, $female^{VAT}$: r=0.89). There was no substantial systematic deviation among the results at the two levels. The ICCs were 0.96 and 0.93 for $male^{ASAT}$ and $female^{ASAT}$ and 0.93 and 0.89 for $male^{VAT}$ and $female^{VAT}$, respectively. The amount of fat at the L2-L3 level was well predicted. The coefficient β of linear regression that predicted L2-L3 ASAT from L1-L2 ASAT was 1.11 for males and 0.99 for females. The R-squares were 0.97 and 0.91, respectively. For VAT prediction, the coefficient β was 1.02 for males and 0.96 for females. The R-squares were 0.82 and 0.77, respectively.
**Conclusion.** For patients with obesity, the L1-L2 intervertebral disc level was appropriate for abdominal fat measurement.

## PU-020

# 生物学定义的阿尔茨海默病受试者在不同认知状态下自发性脑活动的改变：一项基于表面的功能性脑成像研究

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目的：在认知能力明显下降之前，阿尔茨海默病（AD）病程中的受试者会出现显著的自发性脑活动的改变，这或许可用于早期诊断。既往对于局部大脑活动的研究大多是基于体积的分析方法，这一分析过程中可能会遭受皮质信号混叠的影响，我们的目的是使用基于表面的分析方法研究 AD 连续体中皮质功能的改变。
材料与方法：基于 “A/T” 生物标志物，从 ADNI 数据库中纳入 11 名健康对照（HC，A-T-），22 名临床前期 AD（CU，A+T+），33 名前驱期 AD（MCI，A+T+）和 20 名 AD 伴痴呆患者（d-AD，A+T+)。分别在经典频段（0.01-0.08Hz）、slow-4 频段（0.027-0.073 Hz）和 slow-5 频段（0.01-0.027 Hz）下使用低频振幅（ALFF）评估自发性脑活动的改变。
结果：在经典频段和 slow-4 频段下，协方差分析显示四组间左侧后扣带回（PCC）皮层的标准化 ALFF（zALFF）值存在显著差异。事后分析表明，在经典频段下，AD 组 zALFF 值较其他三组显著降低，与 HC 组相比，CU 组 zALFF 值显著降低。slow-4 频段下检测到了更多的组间差异（HC>CU/MCI>d-AD）。在 slow-4 频段下，通过左侧 PCC 脑活动对 HC 中的 CU、MCI 和 AD 进行分类的准确率分别为 0.774、0.744 和 0.920。此外，左侧 PCC 的 zALFF 值与脑脊液生物标志物以及神经心理学测试有显著相关性。
结论：在临床前期阿尔茨海默病患者中，当认知功能相对正常时，左侧 PCC 的自发性脑活动可能已经开始减少。将基于表面的方法和特定频段分析结合在一定程度上可以提高识别临床前期 AD 受试者的敏感性。

PU-021

# T2 MRI at 3T of Cartilage and Menisci in Patients with Hyperuricemia: Initial Findings

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Objective: To compare and evaluate T2 values of compartmental femorotibial cartilage and subregional menisci in patients with hyperuricemia at 3T.
Materials and methods: 32 subjects were included in this study and subdivided into two subgroups: 15 healthy controls (3 females, 12 males; mean age = 45.3 ± 10.9 years), 17 patients with hyperuricemia (2 females, 15 males; mean age = 44.4 ± 12.7 years). All subjects were assessed on a 3T MR scanner using an 8-channel phased-array knee coil (transmit-receive). Wilcoxon rank sum test and analysis of covariance (ANCOVA) were performed to determine whether there were any statistically significant differences in T2 values of compartmental femorotibial cartilage and subregional menisci between the two subgroups.
Results: Lateral tibial cartilage (48.6±3.5 ms) in healthy subgroup had significantly lower ($p < 0.05$) T2 values than all subcompartments of femorotibial cartilage in hyperuricemia subgroup. Medial tibial cartilage (56.5±4.3 ms) in hyperuricemia subgroup had significantly higher ($p < 0.05$) T2 values than all subcompartments of femorotibial cartilage except medial tibial cartilage in healthy subgroup. Medial anterior horn of meniscus (39.4±2.9 ms) in healthy subgroup had significantly lower ($p < 0.05$) T2 values than all subregional menisci except both medial anterior horn and medial body segment of meniscus in hyperuricemia subgroup.
Conclusion: T2 values in certain compartmental femorotibial cartilage and subregional menisci in patients with hyperuricemia are evidently and abnormally heightened compared with those in

healthy subjects, to which special attention should be paid when diagnosing and treating the patients with hyperuricemia in the clinical setting.

## PU-022

# 基于弥散张量成像的直方图分析在高低级别胶质瘤术前分级中的价值

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目的：
探讨基于术前弥散张量成像的直方图分析对高低级别胶质瘤的诊断价值。
方法：
收集术前行常规 MRI 检查及弥散张量检查，且经手术病理证实的胶质瘤 46 例（低级别 18 例，高级别 28 例），在肿瘤最大层面由观察者 1 和观察者 2 结合常规 MRI 图像应用 ImageJ 软件分别在 b0 图像上勾画肿瘤 ROI，并将 ROI 拷贝到 MD 和 FA 图上，2 周后由观察者 1 再次勾画肿瘤 ROI，获取肿瘤 MD 及 FA 的直方图参数（平均值、标准差、最小值、最大值、偏度值及峰度值）。计算观察者间及观察者内各参数的组间和组内一致性，对组间和组内一致性良好（ICC>0.75）直方图参数采用独立样本 t 检验、Mann-Whitney U 检验比较其在高级别与低级别胶质瘤的差异性，并对有统计学意义参数绘制 ROC 曲线，分析其在高低级别胶质瘤术前分级的诊断效能，并用 Logistic 回归分析进行多参数联合分析。
结果：
MD 的平均值、标准差、最小值、偏度值及 FA 的平均值、标准差、最小值、最大值具有良好的组间及组内一致性（组内及组间 ICC 均>0.75，P<0.05）。高低级别胶质瘤 MD 平均值、标准差、最小值、偏度值及 FA 平均值、标准差、最大值组间比较具有显著性差异（P<0.05），其 ROC 曲线下面积分别为 0.936、0.725、0.968、0.855、0.806、0.861、0.825。MD 平均值、MD 最小值分别以 1.24×10-3mm2/s 和 0.755×10-3mm2/s 为临界值时，诊断高低级别胶质瘤的敏感性及特异性分别为 88.3%、89.3%和 94.4%、85.7%。当联合 MD 最小值和 MD 偏度值联合诊断高低级别胶质瘤时，其曲线下面积、敏感性及特异性为 0.992、96.4%和 94.4%，模型的 Hosmer-Lemeshow 拟合优度 X2 值为 5.24，P=0.63。
结论：
基于弥散张量成像的直方图分析具有良好的稳定性及可重复性，可提供更多的量化信息，可在术前较准确鉴别高低级别胶质瘤，联合 MD 最小值和 MD 偏度值可提高诊断效能。

## PU-023

# MRI 提高色素沉着绒毛结节性滑膜炎的诊断

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**摘要**；**目的**；提高对色素沉着绒毛结节性滑膜炎的认识**方法**；膝关节常规 DR 正侧位片、膝关节常规 MR;矢状位-T1WI、T2WI；矢状位 PD-T2WI，冠状位 STIR 及轴位 STIR 扫描； **结果**；影像所见，DR 正侧位片膝关节骨质结构未见明显异常；MRI 示左膝关节髌下脂体内可见椭圆形稍长 T2

稍长 T2 信号，约 1.9X2.67cm，PDWT2 呈不均质高信号，边界清晰，边缘光滑。MR 提示诊断；1.色素沉着绒毛结节性滑膜炎；2.结节性滑膜炎；3.局限型腱鞘巨细胞瘤。患者住院后，考虑为局限型绒毛结节性滑膜炎，为其行关节镜治疗，镜下可见滑膜增厚呈绒毛状，切除增厚滑膜及滑膜结节；清理关节腔，冲洗后注入糜蛋白酶及抗炎药物。**结论**：色素沉着绒毛结节性滑膜炎（PVNS）又称滑膜黄色素瘤、黄色瘤、黄素肉芽肿、绒毛结节性滑膜炎、出血性绒毛滑膜炎，关节黄色样肿瘤，巨细胞纤维瘤，是一种发生于滑膜囊腱鞘关节和滑膜的慢性增生性疾病，恶性者罕见。 本病分局限型和弥漫型两类，以弥漫型常见，局限型仅有单个或数个黄色或棕色类息肉状团块附着于滑膜上，关节内可有浆液或血性渗出物，绒毛膜近节大小不等，明显增殖可使关节腔闭塞，增生滑膜绒毛近节亦可突破关节囊而长入关节周围软组织或脱落钙化形成关节游离体，至病变晚期，关节间隙变窄，并继发退行性骨关节病改变。

PU-024

# 基于弥散加权成像的直方图分析的可重复性分析及其在高低级别胶质瘤术前分级中的价值研究

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目的：
探讨基于弥散加权成像（DWI）的直方图分析在不同观察者及不同处理软件间的结果的可重复性及在高级级别胶质瘤术前分级的诊断价值。
方法：
收集术前行常规 MRI 检查及 DWI 检查，且经手术病理证实的胶质瘤 23 例（低级别 12 例，高级别 11 例），将肿瘤最大层面 ADC 图的 DICOM 数据分别导入 ImageJ 及 MaZda 软件，由两名有经验放射科诊断医师（观察者 1 和观察者 2）结合常规 MRI 图像勾画肿瘤 ROI，两周后由观察者 1 再次勾画肿瘤 ROI，获取肿瘤的直方图参数。ImageJ 软件获得参数包括平均值（Mean_ImageJ）、标准差（StdDev_ImageJ）、最小值（Min）、最大值（Max）、中位数（Median）、偏度（Skewness_ImageJ）及峰度（Kurtosis_ImageJ），MaZda 软件参数包括平均值（Mean_MaZda）、方差（Variance）、偏度（Skewness_MaZda）、峰度（Kurtosis_MaZda）、百分位数（Perc.01%、Perc.10%、Perc.50%、Perc.90%、Perc.99%）。计算 Variance 的算术平方根获得标准差（StdDev_MaZda）。计算两软件各参数的观察者间及观察者内的组间及组内一致性，同时计算两软件的 Mean、StdDev、Skewness、Kurtosis 及 Min 与 Perc.01%、Median 与 Perc.50%、Max 与 Perc.99%的结果一致性。采用独立样本 t 检验、Mann-Whitney U 检验比较各参数在高低级别胶质瘤的差异性，并对有统计学意义参数绘制 ROC 曲线，分析其在高低级别胶质瘤术前分级的诊断效能。

结果：
各参数（除 Kurtosis 及 Perc.99%外）均具有良好的组间及组内一致性（组内及组间 ICC 均>0.75，P<0.05），两软件参数（除 Kurtosis 外）均具有良好的一致性（ICC 均>0.75，P<0.05），尤其是平均值、中位数（50 百分位数）（组间、组内及软件间 ICC 均>0.90）。高低级别胶质瘤各参数（除 StdDev、Kurtosis_ImageJ、Variance、Perc.90%）组间比较具有显著差异性（P<0.05），ROC 分析显示 Mean_ImageJ、Min、Median、Skewness_MaZda、Perc.01%、Perc.10%、Perc.50%具有较高诊断效能（AUC>0.90，P<0.05），以最大 Youden 指数确定诊断阈值，Min、Perc.01%、Perc.10%均具有较大敏感度与特异度（Se、Sp 均>90.0%）。

结论：
基于 DWI 的直方图分析在不同观察者及不同处理软件间具有良好的稳定性及可重复性，可在术前准确鉴别高低级别胶质瘤。

## PU-025

# 青少年膝关节损伤的 MRI 诊断分析

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【摘要】目的：通过采用超导 Philips Achieva 1.5T MRI 成像仪检查，对青少年膝关节的关节软骨损伤、骨损伤及半月板损伤、韧带损伤情况进行分析研究，以期提高对青少年膝关节损伤的磁共振检查及诊断水平。材料和方法：我们回顾性地对过去三年多时间内所检查的 200 余例因外伤而进行膝关节 MRI 检查的病例进行复习，对其中发现有膝关节关节软骨损伤、半月板损伤及韧带损伤的 89 例青少年的 MRI 图像进行了分析研究，这些患者均采用超导 Philips Achieva 1.5T MRI 成像仪进行扫描 T1W、T2W、PDW 及脂肪抑制像，包括矢状位、冠状位及轴位，分析上述图像结果，从而得到骨骺已愈合和骨骺未愈合这些患者膝关节不同损伤的发生率，使用卡方分析。结果：发现骨骺未愈合患者，软骨损伤较骨骺已愈合患者多；骨骺已愈合患者半月板损伤及韧带损伤较骨骺未愈合患者多。结论：骨骺未愈合患者，膝关节损伤以关节软骨损伤为主；骨骺已愈合患者，膝关节损伤以半月板、韧带及骨损伤为主。

## PU-026

# 基于弥散张量成像的影像组学在高低级别胶质瘤 术前分级中的诊断价值

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目的：
探讨基于术前弥散张量成像的影像组学可重复性及其对高低级别胶质瘤的鉴别诊断价值。

方法：
收集术前行常规 MRI 检查及弥散张量检查，且经手术病理证实的胶质瘤 46 例（低级别 18 例，高级别 28 例），在肿瘤最大层面由观察者 1 和观察者 2 结合常规 MRI 图像应用 MaZda 软件分别在 b0 图像上勾画肿瘤 ROI，并将 ROI 拷贝到同层面 MD 和 FA 图上，1 月后由观察者 1 再次勾画肿瘤 ROI，获取肿瘤 MD 及 FA 的组学特征（包括灰度直方图、游程矩阵、梯度模型、自回归模型、小波变换频带系数能量 5 大类共 51 个特征），对组间和组内一致性良好（ICC>0.75）影像组学特征采用独立样本 t 检验、Mann-Whitney U 检验统计高低级别胶质瘤有统计学差异的影像组学特征，应用 Spearman 相关性分析进行特征去冗余及（|r|>0.8），纳入剩余特征行 LASSO 分析进行进一步特征选择并计算影像组学得分(Rag_score)，对 Rag_score 进行 logistic 回归分析建立诊断模型，评估模型诊断效能。

结果：

影像特征提取获得 102 个影像组学特征，对观察者 1 和 2 进行观察者内内和观察者间组学特征进行一致性分析（ICC>0.75）后组间比较，发现 MD 和 FA 分别有 15 个和 10 个特征在高低级别胶质瘤存在差异性（P<0.05），进一步行相关分析及 LASSO 分析进行数据降维，最终筛选出 3 个非零特征，包括 MD 的 GrVariance、WavEnLL_s-3、WavEnLH_s-3，根据 Lasso 结果计算 Rag_score，根据 Rag_score 构建 logistics 回归分析，ROC 曲线下面积 0.9742 (95%CI:0.9348-1)，敏感度和特异度为 89.3%和 100%。

结论：
基于弥散张量成像的影像组学具有良好的稳定性及可重复性，其所建立模型具有很好的可靠性，可在术前准确鉴别高低级别胶质瘤。

## PU-027

# 52 例胎儿期诊断胼胝体发育异常的生后随访结果分析

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【摘要】 目的 探讨胎儿期诊断为胼胝体发育异常的预后情况资料和方法回顾性随访自 2011 年至 2021 年, 52 例胎儿期诊断为胼胝体异常并顺利出生，根据产前磁共振表现、产前或生后染色体或基因结果、生后的临床表现及神经功能发育商评估，分析胎儿胼胝体发育异常的预后。结果单胎 47 例，双胎妊娠其一为胼胝体发育异常 5 例；男 32 例，女 20 例；年龄 4 月~10 岁，平均年龄 24.9 月；完全型 32 例，部分型 14 例，发育不全或不良 6 例；35 例产前或生后有染色体或基因检测；产后提示染色体大范围缺失 2 例，Y 染色体长臂异色质长度减少 1 例，基因异常 2 例。生后发现面容异常 4 例，手异常 8 例，脚畸形 4 例，其它问题 10 处，1 例合并大脑皮层发育异常。生后共发现 7 例患儿合并多发畸形。50 例行神经认知发育商评估，平均分为 82.3 分，神经认知发育商正常 32 例（≥85 分），轻度落后 9 例（75~85 分）；中重度落后 9 例（≤75 分），2 例因合并多发畸形，出生后家人选择放弃而未检测。结论单纯型胎儿胼胝体发育异常总体预后良好，若合并多发畸形或双胎妊娠时，患儿预后及临床表现相对较差，产前超声或核磁准确评估、染色及基因完善检查，对于围产期咨询具有较高的指导意义。

## PU-028

# 基于弥散加权成像的纹理分析在胶质瘤肿瘤异质性评估及术前分级中的应用研究

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目的：
探讨基于弥散加权成像纹理分析评估肿胶质瘤异质性可行性及其在胶质瘤术前分级的价值。

方法：
收集术前行常规 MRI 检查及 DWI 检查，且经手术病理证实的胶质瘤 39 例（低级别 8 例，高级别 21 例），根据常规 MR（MR 平扫+增强）扫描在 DWI b0 图像是逐层勾画 ROI 获得全肿瘤感兴趣体积（VOI），并将 VOI 拷贝到 ADC 图上获得肿瘤 ADC 的纹理参数，包括均值、偏度、峰度、熵

及 5%、50%和 95%百分位数。同时获取肿瘤的 Ki-67 指数用以评估肿瘤的异质性。采用双样本 t 检验比较比较高低级别胶质瘤组间各参数的差异，对具有组间差异参数与 Ki-67 指数进行相关分析，并进行 ROC 分析评价其在高低级别胶质瘤分级中的价值。

结果：
组间比较发现，高低级别胶质瘤 ADC 的偏度(0.082±0.176 vs. 0.677±0.718，P = 0.002)、熵（6.26±0.41 vs. 6.87±0.56，P = 0.009）和 5%百分位数（(1.03±0.18)×10-3mm2/s vs. (0.81±0.24) ×10-3mm2/s，P = 0.024）存在显著性差异。相关分析发现偏度(r = 0.53，P = 0.003)、熵(r = 0.43，P = 0.021)及 5%百分位数(r = - 0.52，P = 0.004)与 Ki-67 指数显著相关。ROC 分析示偏度、熵和 5%百分位数鉴别高低级别胶质瘤的 AUC 分别为 0.810、0.842 和 0.792。联合 3 个参数联合诊断，AUC 为 0.905，敏感度为 80.95%，特异度为 100%。

结论：
基于 DWI 的纹理分析可评估胶质瘤的异质性，并可以用于胶质瘤术前分级评估。

# PU-029

# Application of Functional Magnetic Resonance Imaging in the Diagnosis of Parkinson’s disease: A Radiomics Analysis

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Objective
To investigate the value of amplitude of low-frequency fluctuation (ALFF)-based histogram analysis in the diagnosis of Parkinson’s disease (PD) and to investigate the regions of the most important discriminative features and their contribution to classification discrimination.

Methods
Patients with PD (n = 59) and healthy controls (HCs; n = 41) were identified and divided into a primary set (80 cases, including 48 patients with PD and 32 HCs) and a validation set (20 cases, including 11 patients with PD and nine HCs). The Automated Anatomical Labeling (AAL) 116 atlas was used to extract the histogram features of the regions of interest in the brain. Machine learning methods were used in the primary set for data dimensionality reduction, feature selection, model construction, and model performance evaluation. Specifically, we used the two-sample t-tests, correlation analysis(|r|>0.9) and least absolute shrinkage and selection operator (LASSO) logistic regression based on 10-fold cross-validation was used for further feature selection and data dimensionality reduction. The radiomic signature score (Rag-score) of each subject was calculated by the formula generated by the LASSO logistic regression algorithm. Receiver operating characteristic (ROC) curve analysis based on the Rag-score was performed, and we calculated the area under the curve (AUC), sensitivity, specificity, and accuracy to evaluate the diagnostic efficacy of the model. The model performance was further validated in the validation set. To evaluate the robustness and generalization of the model performance, we performed the LASSO logistic algorithm with 5-fold cross-validation and leave-one-out cross-validation (LOOCV) for feature selection.

Results
After feature data dimension reduction and feature selection, 23 of a total of 1,276 features were entered in the model. The brain regions of the selected features included the frontal, temporal,

parietal, occipital, and limbic lobes, as well as the cerebellum and the thalamus. In the primary set, the AUC of the model was 0.974, the sensitivity was 93.8%, the specificity was 90.6%, and the accuracy was 93.8%. In the validation set, the AUC, sensitivity, specificity, and accuracy were 0.980, 90.9%, 88.9%, and 90.0%, respectively. We found that our models achieved high classification performances with the 5-fold cross-validation and LOOCV in both the primary and validation sets.

Conclusion
ALFF-based histogram analysis can be used to classify patients with PD and HCs and to effectively identify abnormal brain function regions in PD patients. It can assist in the early diagnosis of PD and provide a means for PD mechanism research and clinical therapeutic efficacy evaluation.

# PU-030

## 3.0T 磁共振成像增强扫描在睾丸生殖细胞肿瘤诊断中的应用

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目的：探讨 3.0T 高场磁共振成像增强扫描在睾丸生殖细胞肿瘤诊断中的应用价值，提高对该病的认识。材料与方法：回顾性分析我院 2019 年 7 月-2021 年 5 月经手术病理证实为睾丸生殖细胞肿瘤的 12 例患者 MRI 资料。所有患者均行 MRI 增强扫描。以手术结果为标准，分析 MRI 检查显示睾丸生殖细胞肿瘤的准确性。结果：所有患者顺利完成 MRI 增强扫描，并进行手术治疗。12 例患者病灶为单发，右侧 10 例，左侧 2 例。所有病灶边界清晰，实性 11 例，囊实性 1 例，轻度推压周围组织，多数肿瘤在 T1WI、T2WI 呈混杂信号，T2WI 多以稍高信号为主多，液化坏死呈低信号，增强后多呈不均匀强化,1 例呈渐进性不均匀边缘状强化，12 例病变中,同侧的精索静脉曲张 3 例。磁共振增强扫描检查在病变位置、大小、形态的显示上与手术结果一致。结论：睾丸生殖细胞肿瘤的 MRI 增强表现具有相对典型特征。磁共振增强扫描在肾上腺节细胞神经瘤睾丸生殖细胞肿瘤的诊断中有重要价值，可用于临床手术计划的制定。
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# PU-031

## Machine Learning of Schizophrenia Detecting with Structural and Functional Neuroimaging

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Objective
To explore the value of multi-modal imaging and multi-level characterization with multi-classifier(M3) method in distinguishing Schizophrenia（SZ）patients and healthy controls(HCs) and investigate the influence of global signal regression(GSR) and brain segmentation on SZ classification.

Methods
A total of 109 subjects (64 HCs and 45 SZs) who underwent resting-state fMRI (rs-fMRI) and structural MRI (sMRI) were included in this study. We calculated the following fMRI and sMRI

measurements by standardized preprocessing step(without GSR),including amplitude of low frequency fluctuations (ALFF), regional homogeneity (ReHo), degree centrality (DC), and voxel-mirrored homotopic connectivity (VMHC) and grey matter density (GMD). We got 246 features for each fMRI and sMRI map and a total of 1230 features for each individual by using the Brainnetome (BN) 246 atlas. We used M3 method to construct the model, which mainly includes: feature selection, maximum uncertainty linear discriminate analysis -based classification and multi-classifier. Leave-one-out cross-validation (LOOCV) was conducted to estimate the performance of our classifier. We performed grid search (from 0.001 to 0.05 with a 0.001 interval) to select the optimal P threshold for feature selection. A permutation test was applied to test the significance of the prediction performance. To evaluate the influence of GSR and brain parcellation to our classifier, we did an additional analysis: (1) We did regress out global signal in the regressing out nuisance covariates step; (2) We use Power-264 atlas (without the ROIs of the cerebellum) to segment brain ROIs. And then we performed the same M3 method and evaluated the classification performance.

Results
We found the optimal P threshold was 0.027, and the corresponding classifier obtained a classification accuracy of 83.49%, with a sensitivity of 68.69%, a specificity of 93.75%, and an AUC of 0.8491, respectively. The most discriminative regions that contributed to single subject classification included left superior parietal lobule, inferior parietal lobule, inferior temporal gyrus, middle frontal gyrus, lateral occipital cortex, fusiform Gyrus, right basal ganglia, Cingulate Gyrus, superior frontal gyrus, posterior superior temporal sulcus, bilateral medio-ventral occipital cortex, parahippocampal gyrus. We obtained a high classification performance with Power-264 atlas. We found that the accuracy and specificity of the classifiers without GSR were higher than of the classifiers with GSR both with BN 246 atlas and Power-264 atlas.

Conclusion
Our findings indicated that M3 method is a great tool to distinguish SZs from HCs effectively with high classification accuracy; it can be generalized in different brain parcellation schemes. Global signal may contain important neuronal information; it can improve the accuracy and specificity to detect SZ patients. The M3 method without GSR is helpful to identify patient accuracy and early intervention, and it can identify discriminative regions to detect SZ to explore the neural mechanisms underlying SZ.

PU-032

# PVL 合并痉挛型脑瘫患儿脑灰质体积与运动功能相关性的 VBM 研究

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目的：运用基于体素形态测量学（VBM）方法，探讨脑室周围白质软化症（PVL）合并痉挛型脑瘫患儿的灰质体积改变及其与运动功能的相关性。方法：对 30 例 PVL 合并痉挛型脑瘫儿童、24 例健康儿童进行 3DT1 结构像全脑扫描，并行粗大运动功能分级系统（GMFCS）及手功能分级系统（MACS）评估。采用 VBM 方法，比较两组之间灰质体积差异，提取差异脑区灰质体积与 GMFCS、MACS 进行偏相关分析，以年龄作为协变量。结果：与对照组儿童相比，患儿组双侧（顶叶、丘脑、小脑）、右侧（额叶、壳核）灰质体积下降（P<0.05, FDR 校正）；双侧丘脑、右侧小脑半球第 6 区及左内侧和旁扣带回灰质体积与 GMFCS 分级呈负相关（r 分别为-0.668、-

0.397 及-0.414，P 值分别为<0.001、0.033 及 0.025）；双侧丘脑、右侧壳核灰质体积与 MACS 分级呈负相关（r 分别为-0.557、-0.630，P 值分别为 0.002、<0.001）。结论：PVL 患儿双侧丘脑、右侧壳核、小脑及左侧扣带回灰质体积变化与运动功能相关，磁共振 VBM 技术可用于 PVL 患儿脑灰质体积变化的评估。

## PU-033

# 症状性颅内动脉粥样硬化斑块特征与卒中类型及卒中复发风险相关性研究

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**目的**：探讨症状性颅内动脉粥样硬化斑块特征与卒中类型以及卒中复发风险的关联。
**方法**：前瞻性纳入症状性颅内动脉粥样硬化狭窄的患者，所有患者均行高分辨率磁共振成像，评估责任血管狭窄程度、责任斑块形态、斑块厚度、斑块负荷及强化程度，并行统计学分析。
**结果**：本研究共纳入 206 例患者【平均年龄（64±12）岁；男性 141 例】，AIS 患者 154 例，TIA 患者 52 例，前循环缺血症状患者 124 例，后循环缺血症状患者 82 例。AIS 组患者舒张压(t=-2.605; *p*=0.011)、总胆固醇(t=-2.470; *p*=0.014)、载脂蛋白 b(z=-2.411; *p*=0.016)、载脂蛋白 a/b (t=-2.865; *p*=0.006)、LDL(t=-2.424; *p*=0.016)水平及动脉硬化指数(z=-2.256; p=0.024)高于 TIA 组，AIS 组斑块处剩余管腔面积较 TIA 组小（t=2.539; p=0.013），狭窄程度更大(t=-3.317; *p*<0.001)；共有 24 例（13.6%）患者半年内出现了卒中复发，复发组 T1 高信号的发生率高于未复发组(RR=2.592 (1.091, 6.58)；$\chi^2$=4.892；*p*=0.034)。后循环责任斑块有更大的斑块厚度(t=-4.205; *p*<0.001)及剩余管腔面积(z=-4.127; *p*<0.001)，后循环责任斑块显著强化（$\chi^2$=9.681;*p*=0.003）、正性重构（$\chi^2$=5.661;*p*=0.015）及 T1 高信号（$\chi^2$=16.472;*p*<0.001）的发生率高于前循环；后循环缺血症状患者糖尿病患病率明显高于前循环缺血症状患者($\chi^2$=9.038, *p*=0.004)。
**结论**：症状性颅内动脉粥样硬化斑块处狭窄程度、剩余管腔面积与卒中类型相关，且斑块 T1 高信号患者半年内卒中复发风险增加。后循环责任斑块易损性更高，可能与糖尿病继发的代谢因素有关。

## PU-034

# 中度重症、重症急性胰腺炎腹膜腔、腹壁 MRI 成像及解剖学扩散机制

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目的：利用磁共振成像技术对急性胰腺炎入院病人的腹壁影像学特征进行观测，分析 MRI 上腹壁水肿的扩散通路和尸体大体标本与局部断面的解剖学机制。方法：收集 2017 年 9 月 20 日至 2019 年 6 月 30 日我院诊治的急性胰腺炎住院病人的临床资料，共纳入 211 例急性胰腺炎患者进入研究，针对首次 MRI 检查，沿着腹白线中点和腰椎棘突中线勾画一条前后方向走行的直线（AP 线）、沿 AP 线的中点作一条左右方向走行的水平直线（LR 线）将腹壁划分为四个区。采用腹壁水肿评分（0~4 分）。对 3 具男尸用尸体专用切断器制作横断面断层标本，对感兴趣区观测。结

果：共 211 例急性胰腺炎病人，男性 119 例（56.4%）、女性 92 例（43.6%），年龄为 52.9±16.5 岁。包括轻度急性胰腺炎（MAP）72 例（34.1%）、中度重症急性胰腺炎（MSAP）99 例（46.9%）、重症急性胰腺炎（SAP）40 例（19%）。总共 211 例急性胰腺炎病人首次 MR 图像上出现腹壁水肿的占 56.9%（120/211）；轻度组、中度重症组、重症组腹壁水肿发生率为 16.7%（12/72）、68.7%（68/99）、100%（40/40），三组间腹壁水肿发生率存在统计学差异（P＜0.0001）。120 例腹壁水肿的急性胰腺炎病人腹壁水肿评分：轻度组（n=12）积分为 1.3±0.5 分、中度重症组（n=68）积分为 2.5±0.9 分、重症组（n=40）积分为 3.3±0.7 分；腹壁水肿评分在轻度、中度重症和重症三组之间差异存在统计学意义（F=32.3，P＜0.0001）。腹壁水肿评分与急性胰腺炎严重性存在较好的正相关（R2 =0.35，P＜0.0001）。腹壁水肿评分预测新亚特兰大分类下重症急性胰腺炎的诊断能力为：AUC=0.786（95% CI：0.704，0.868），P＜0.001。当腹壁水肿评分≥3 分，腹壁水肿评分诊断新亚特兰大分类下重症急性胰腺炎的敏感度为 85%、特异度为 65%。MRI 上，120 例出现腹壁水肿的急性胰腺炎病人腹壁水肿累及范围排序：累及左后腹壁者占 95.8%（115/120），累及右后腹壁者占 84.2%（101/120），累及左前腹壁者占 48.3%（58/120），累及右前腹壁者占 33.3%（40/120）。累及左后腹壁者 115 例的解剖扩散通路 MRI 为五条通道。左前腹壁水肿扩散通路有两条。右后腹壁水肿形成通路分为五条。右前腹壁水肿的扩散通路有两条。腰骶后正中皮下水肿通路为跨越肾旁后间隙和腰方肌外侧缘旁的狭窄通道，经过网状纤维束和浅筋膜结缔组织纤维束最终到达浅筋膜结缔组织纤维束和深筋膜胸腰筋膜后层之间。结论：急性胰腺炎 MR 图像上出现腹壁水肿是一种常见影像学征象；腹壁水肿评分与急性胰腺炎严重性存在较好的正相关性。腹壁水肿评分具有较佳的诊断新亚特兰大分类下重症急性胰腺炎的能力。急性胰腺炎病人腹壁水肿累及左后腹壁者最多，存在五条解剖学通路；累及左前腹壁者和右前腹壁者较少，且上述各通路均存在“扩散解剖学薄弱区”。

# PU-035
# MRI 高分辨率平扫序列及多期增强序列在初诊肛瘘检测中的价值

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**目的** 探究 MRI 高分辨率平扫序列和多期增强序列在肛瘘的内口、瘘管及脓肿检测中的诊断价值。
**方法** 回顾性搜集 2020 年 4 月至 2021 年 3 月于我院就诊并进行手术治疗的肛瘘患者，共 42 例，均有 MRI 平扫序列（包括高分辨率 T2WI、DWI 序列[b=1000 s/mm2]和 T1WI），部分包含增强序列。由一名高年资放射医生（有超过 7 年的直肠和肛管 MRI 诊断经验）采用盲法评估所有 MRI 图像。手术结果(瘘管数、内口数、脓肿数)由一位有 15 年肛瘘诊治经验的外科医生在不知道 MRI 结果的情况下记录，以手术结果为金标准，使用 SPSS 20.0 软件进行统计分析，采用配对 χ2 检验比较 MRI 不同序列诊断内口、瘘管及脓肿的准确率。
**结果** 42 例病例中，有 26 (61.90%)例只有 MRI 平扫，16 (38.10%)例同时进行了平扫+增强检查。手术共发现了 59 个内口、85 个瘘管和 22 个脓腔。根据 Parks 分型，括约肌间型和经括约肌型占绝大多数，分别为 24 (53.33%) 、18 (40.00%)。高分辨率 T2WI 序列检测内口 45 个(76.27%)，DWI 序列检测内口 36 个(61.02%)，高分辨率 T2WI 与 DWI 序列检测内口的差异有统计学意义，P 值为 0.004；与高分辨率 T2WI 相比，DWI 序列显示瘘管较少(分别为 69、81.18% vs 58、68.24%)，差异有统计学意义(P=0.001)。多期增强序列显示瘘管 33 个(97.06%)，而高分辨率 T2WI 平扫序列仅显示瘘管 27 个(79.41%)(P=0.031)。对于肛瘘内口，多期增强序列与高分辨率 T2WI 序列比较无显著性差异。对于脓腔的检测，各序列比较均无显著性差异。
**结论** 对于肛瘘内口的判断，高分辨率 T2WI 序列检出率优于 DWI 序列。在肛瘘瘘管检测中，多期增强序列检测效果优于 T2WI 序列。T2WI 序列、DWI 序列及多期增强序列对脓腔的检测准确率均较高。

PU-036

# Altered Dynamic Amplitude of Low-frequency Fluctuations in Patients with Postpartum Depression

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Abstract
Background: Postpartum depression (PPD) is a common mood disorder, and its incidence is increasing year by year. However, the mechanism of the dynamic changes in local neural activity of patients with PPD remains unclear. In this study, the variance values of dynamic amplitude of low-frequency (dALFF) were used to investigate the abnormal temporal variability of local neural activity in PPD and its potential correlation with clinical severity.
Methods: Twenty-four patients with PPD and nineteen healthy controls (HCs) were examined by resting-state functional magnetic resonance imaging (rs-fMRI). The variance values of dALFF were calculated using the sliding window method through the DPABI toolkit. K-means clustering method was used to estimate the status of variance values in the dALFF. Two-sample t-test was used to compare the differences of variance values of dALFF between the two groups. Pearson correlation analysis was used to analyze the correlation between dALFF states and clinical severity.
Results: (1) Patients with PPD had lower variance values of dALFF than HCs in the cognitive control network, cerebellar network, and sensorimotor network. (2) Four dALFF states were identified, and patients with PPD spent more time in state 2 than the other three states. The number of transitions between the four dALFF states increased compared with that in HCs. (3) Multiple dALFF states were found to be correlated with the severity of depression. The variance value of dALFF in the right middle frontal gyrus was negatively correlated with the Edinburgh postnatal depression scale score.
Conclusion: This study provides new insights into the brain dysfunction of PPD from the perspective of dynamic local brain activity. Abnormal dALFF variability is associated with symptoms of PPD, and this finding helps distinguish between patients with PPD and HCs.

PU-037

# CMR 组织特征追踪技术对射血分数保留的肥厚性心肌病患者左心室功能的初步研究

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目的：探讨 CMR 组织特征追踪技术对射血分数保留肥厚性心肌病患者（HCMpEF）左室应变的价值。材料与方法：对 70 例 HCMpEF 患者及 42 例正常者（对照组）行 3.0TCMR 稳态自由进动序列扫描后，将图像导入 CVI42 后处理软件，测量左心基本功能参数及左室整体 3D 应变参数，包括：径向（radial）、周向（circumferential）及纵向（longitudinal）的峰值应变（Peak strain，PS）、收缩期峰值应变率（Peak systolic strain rate，PSSR）及舒张期峰值应变率（Peak diastolic strain rate，PDSR），采用 SPSS26.0 软件对两组参数进行统计学分析。结果：HCMpEF 组的各个方向的峰值应变均低于对照组（径向：26.00（14.63）vs32.39（10.55），周

向：-17.30±4.55vs-19.67±3.73，纵向：-8.14±3.25vs-10.74±3.26，HCMpEF 组 vs 对照组，单位：%），差异具有统计学意义（P＜0.005）；HCMpEF 组的各个方向的收缩期及舒张期峰值应变率均低于对照组（收缩期峰值应变率径向：1.55(0.94)vs1.85(0.61),周向：-0.99(0.39)vs-1.13(0.29),纵向：-0.49(0.38)vs-0.67(0.28)，单位：1/s，P＜0.05；舒张期峰值应变率径向：-1.37(-0.86)vs-2.17(1.35),周向：0.87(2.44)vs1.16(0.53),纵向：0.46(0.24)vs0.68(0.33),单位：1/s），差异具有统计学意义（P＜0.001）。结论：HCMpEF 患者尽管射血分数保留，但是心脏收缩及舒张功能已经受损，CMR-FT 定量分析技术可以为评价心脏功能提供新的依据。

## PU-038

# 基于放射组学的影像标志物预测胶质瘤缺氧生物学行为及预后临床研究

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目的：本研究旨在通过构建放射组学特征识别肿瘤微环境中的缺氧程度，进而评估胶质母细胞瘤预后。
材料和方法：共有 180 例胶质母细胞瘤纳入本次研究. 采用生物信息技术构建与预后密切相关的缺氧标志物风险评分，将患者分为缺氧高风险组和缺氧低风险组。基于 FLAIR 和 T1 增强序列，肿瘤分为 3 个区域包括瘤周水肿、肿瘤坏死和肿瘤实质.两名在神经放射学领域拥有超过 5 年经验的专家手动提取 3D 肿瘤的组学特征，采用差异分析方法提取与缺氧风险评分最相关的放射组学特征。单因素和多因素 Cox 回归来评估组学特征是否是影像 GBM 预后的独立危险因素，进而预测组学特征能否有效将 GBM 患者进行危险分层。GSEA 对高风险患者进行通路富集分析。
结果：5 个缺氧相关基因（VEGFA、HK2、JUN、LDHA 和 GAPDH）风险模型与患者的总生存期显着相关，生存分析结果显示，高危组的死亡率明显高于低危组。我们发现增强区和水肿区 8 个最相关组学特征与缺氧风险评分相关，单因素分析表明，放射组学评分与预后显着相关（p<0.001））。多因素 Cox 回归显示高缺氧风险评分与胶质瘤患者的 OS 显着较差独立相关。GSEA 对比高和低风险组，主要相关通路包括缺氧、DNA 修复、PI3K-AKT-MTOR 信号传导和血管生成刺。
结论：增强区和水肿区的放射组学特征似乎可以预测缺氧的程度，还发现放射组学特征可以对 GBM 进行风险分层。

## PU-039

# 不同性别中老年人腰椎脂肪含量、R2*与骨密度的相关性研究

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目的 探讨不同性别中老年人各腰椎体脂肪含量（FF）、R2*与骨密度（BMD）的相关性。方法 通过 MRI 脂肪定量技术（mDIXON-Quant）测量 40 例中老年人（男女各 20 例）共 200 个腰椎体 FF、R2*值，通过定量 CT（QCT）测量腰椎各椎体 BMD，采用 SNK 检验比较不同性别腰椎各椎体 BMD、FF 和 R2*值，两独立样本 t 检验比较不同性别间腰椎 BMD、FF 和 R2*值。Spearman 相关分析不同性别腰椎各椎体 FF、R2*值与 BMD 的相关性。结果 不同性别中老年人 L1-L5 各椎体间 BMD、R2*比较，差异均无明显统计学意义（P＞0.05），各椎体间 FF 比较，差异均有统计学意义（P＜0.05），其中男、女性中老年人 L4FF、L5FF 均大于 L1FF，男性 L4FF 大于 L2FF。男、女两组腰椎体 BMD、FF 比较，差异无明显统计学意义（P＞0.05），R2*比较，差异具有统

计学意义（P＜0.05），且男性腰椎体 R2*大于女性。不同性别中老年人腰椎 BMD 与 FF 值均呈负相关（rs 男=-0.76，rs 女=-0.77，P 均＜0.05），与 R2*值均呈正相关，（rs 男=0.56，rs 女=0.45，P 均＜0.05）。
结论 中老年人腰椎体 BMD 与 FF、R2*值有一定相关性，且中老年女性 R2*小于男性，同时中老年人下腰椎 FF 值较上腰椎高。

## PU-040

# 儿童脑性瘫痪的磁共振成像新技术研究进展

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**摘要 目的** 总结新兴磁共振技术在儿童脑性瘫痪（cerebral palsy）中的研究进展。**方法** 查阅国内外相关文献，综述各项新兴磁共振技术的技术特点，总结其在儿童脑瘫诊断中的现状、进展及其存在的问题。**结果** 新兴磁共振成像技术包括基于体素的形态测量学（voxel based morphometry, VBM），弥散张量成像（diffusion tensor imaging, DTI）、扩散峰度成像（diffusion kurtosis imaging, DKI）、神经突离散度和密度成像（neurite orientation dispersion and density imaging，NODDI），脑功能成像（functional MRI, fMRI），动脉自旋标记（arterial spin labeling，ASL），磁共振波谱（MR spectroscopy, MRS）等，这些技术已经开始应用于儿童脑瘫研究并表现出一定的诊断价值，尤其是弥散成像技术已进入临床用于患者白质纤维束的评价，为疾病的早期诊断、治疗后随访提供重要参考。VBM 可精细测定脑组织各组分密度和体积，NODDI 等可计算细胞完整性和组织微结构等信息，fMRI 可反映各区域大脑皮层活动及脑网络连接情况，ASL 可评价脑血流灌注情况，MRS 可测定活体组织代谢物的化学成分和含量等。**结论** 磁共振成像是无创性评价脑瘫的重要方法，目前常用的是 DTI、DKI 为主的弥散成像技术，其余如 VBM、NODDI、fMRI、ASL、MRS 等技术尚未大规模应用于临床。未来亟需从微观结构、功能区乃至生物分子层面对脑瘫进行综合研究，探究康复治疗后运动、认知功能恢复差异的原因，理解儿童脑瘫潜在损伤机制及神经重塑过程，真正实现精准医学时代儿童脑瘫的早期诊断和精细评价。

## PU-041

# 3D-CUBE T1 和 SWI 对急性缺血性脑卒中的动脉血栓诊断价值

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目的 探讨多模态磁共振的液体衰减反转恢复成像序列(FLAIR)、磁敏感加权成像（SWI）与 3D-CUBE T1 对急性缺血性脑卒中（AIS）的责任动脉血栓对比研究价值。方法 35 例 AIS（<72h）检查患者均行常规 MRI、MRA、SWI 和 3D-CUBE T1，将 T2FLAIR、SWI 和 3D-CUBE T1 联合应用对 AIS 的 T2FLAIR 的高信号血管（FLAIR vascular hyperintensity, FVH）、磁敏感征(SVS）和 3D CUBE T1 的高信号血管征（CUBE vascular hyperintensity, CVH)行责任动脉血栓相关性分析。结果 35 例 AIS 患者中总计有 38 根责任血管，其中 FVH、SVS 与 CVH 责任动脉血栓阳性的血管分别为 24 根、22 根和 36 根，分别占总数的 63.2%、57.9%和 94.7%。其中， CVH 与 SVS 责任动脉血栓的相关性分析，显示差异有统计学意义（X2=14.268，p<0.001)； SVS 与 HVS 责任动脉血栓相关性分析，显示两者具有高度一致性（X2=0.220, p=0.639).结论 FVH、SVS 与 CVH 对 AIS 的责任动脉血栓显示具有明显一致性，高分辨 3D CUBE T1 序列诊断敏感性和准确率均高于 T2-FLAIR 和 SWI。此研究对危重患者优化检查流程、为临床制定正确的治疗方案和预后判断具有重要临床意义。

PU-042

# 磁敏感征和不对称静脉征对急性大脑中动脉闭塞患者诊断价值

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目的探讨磁共振磁敏感加权成像( susceptibility weightedimaging，SWI)的动脉磁敏感征(susceptibility vessel sign,SVS）和不对称脉静脉血管征（asymmetrically veinssign,AVS)对急性大脑中动脉闭塞(acute middle cerebral artery occlusion,AMCAO)引起急性缺血性卒中（AIS）体积程度的预测研究和临床价值。材料与方法 45 例 AMCAO 的患者，根据阿尔伯塔卒中计划早期 CT 评分的为基础的改良 SWI-ASPECTS 评分梗死病灶侧显著组和稀疏组以及无 SVS 组、SVS≤20mmm 组、＞21mm 组进行 SWI-ASPECTS 评分量化，比较患者脑梗死体积程度是否差异。结果 45 例 AMCAO 的患者中，无 SVS 为 11 例、占 24.4%，有 34 例 SVS 征（SVS≤20mm 为 19 例、SVS>20mm 为 15 例）、占 75.6%。无 SVS 组、SVS≤20mm 组、SVS>20mm 组，其脑梗死体积分别（5.11±5.913）、（22.71± 33.568）和（111.51± 87.352）mm3，三组梗死体积差异有显著统计学意义（P＜0.001），三组梗死 SWI-ASPECTS 评分差异有显著统计学意义（P＜0.01）。随着 SVS 长度增加，SWI-ASPECTS 评分呈减小趋势(经 Spearman 检验，r=-0.538，P<0.001)；AVS 稀疏组 19 例、占 42.2%，AVS 显著组 26 例、占 57.8%，其体积分别（103.555±80.684）和（7.413±8.224）mm3，经 Mann-Whitney U 检验，稀疏组的梗死体积大于显著组，差异有显著统计学意义。(Z=-5.102，P<0.001)。结论 SVS 是颅内动脉严重狭窄或闭塞的标志，代表了血栓的存在及血管内新鲜凝血块形成、预测栓子成分。AVS 代表急性颅脑大血管闭塞的脑缺血区周围软脑膜侧支循环的形成，AVS 越广泛，SVS 长度越小，梗死面积越小，SWI-ASPECTS 评分越高患者的侧支循环分级越高。这对于患者最终梗死体积及临床预后的评估都具有重要意义。

PU-043

# Polygenic hazard score associated multimodal brain networks along the Alzheimer's disease continuum

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Background: Late-onset Alzheimer's disease (AD) is a polygenic neurodegenerative disease. Identifying the neuroimaging phenotypes behind the genetic predisposition of AD is critical to the understanding of AD pathogenesis. Two major questions which previous studies have led to are: 1) should the general 'polygenic hazard score' (PHS) be a better choice to identify the individual genetic risk for AD instead of any single genetic variant; and 2) should researchers also include inter-modality relationships in the analyses considering these may provide complementary information about the AD etiology.
Methods: We collected 88 healthy controls, 77 patients with mild cognitive impairment (MCI), and 22 AD patients to simulate the AD continuum. PHS-guided multimodal fusion was used to investigate the impact of PHS on multimodal brain networks in AD-continuum by maximizing both inter-modality association and reference-modality correlation. Fractional amplitude of low frequency fluctuations, gray matter volume, and amyloid standard uptake value ratios were included as neuroimaging features. Eventually, the changes in neuroimaging features along AD

continuum were investigated, and relationships between cognitive performance and identified PHS associated multimodal components were established.
Results: We found that PHS was associated with multimodal brain networks, which showed different functional and structural impairments under increased amyloid deposits. Notably, along with AD progression, functional impairment occurred before neurodegeneration, amyloid deposition started from the MCI stage and progressively increased throughout the disease continuum.
Conclusions: PHS is associated with multi-facets of brain impairments along the AD continuum, including cognitive dysfunction, pathological deposition, and neurodegeneration, which might underpin the AD pathogenesis.

## PU-044

# 3D pCASL 对鼻咽癌放化疗疗效评估价值

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【摘要】目的：探讨三维准连续式动脉自旋标记（3D pCASL）成像评估鼻咽癌放化疗疗效的价值。材料与方法：分析 64 例经病理确诊的鼻咽癌首诊并接受标准放化疗治疗患者资料，所有患者均于治疗前行鼻咽部 MRI 平扫、3D pCASL 扫描及增强扫描，用后处理软件得到治疗前肿瘤血流量（tumor blood flow，TBF)值，同步放疗加诱导化疗后 4 周行 MRI 复查，根据实体瘤疗效评价标准（RECIST）将所有病例分为敏感组（46 例）和不敏感组（18 例），并计算肿瘤最大径消退率、轴位最大表面积消退率和体积消退率。鼻咽癌治疗前敏感组与不敏感组 TBF 值、最大径、最大表面积及体积差异采用独立样本 t 检验；治疗前 TBF 值与肿瘤消退率间行 pearson 相关分析；治疗前 TBF 值对预测鼻咽癌放化疗敏感性诊断效能行 ROC 曲线分析。结果 鼻咽癌敏感组与不敏感组治疗前 TBF 值、肿瘤体积间差异具有统计学意义（P＜0.05）；治疗前 TBF 值与肿瘤消退率间具有显著相关性；治疗前 TBF 值对预测放化疗疗效具有很好的诊断效能。结论：3D pCASL 可无创预测鼻咽癌放化疗疗效，治疗前高 TBF 值预示肿瘤对放化疗敏感，治疗前 TBF 值与肿瘤消退率间具有很好的相关性，对临床治疗具有较高的指导价值。

## PU-045

# 基于钆塞酸二钠增强 MRI T1mapping、R2*与乙肝肝硬化 MeId 评分、血清指标的相关性研究

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目的 探索乙肝肝硬化患者钆塞酸二钠增强 MRI T1mapping、R2*定量参数与 MeId 评分、血清的相关性。方法 回顾性分析 52 例乙肝肝硬化患者的临床及影像学资料，其中男 38 例，女 14 例，年龄 27-80 岁，平均 51.15±10.03 岁。记录所有患者血清指标，包括 TBIL、DBIL、ALT、AST、TBA、ALP，并进行 MELD 评分。所有患者均行钆塞酸二钠增强 MRI 及 mDxion-quant 扫描，并于增强前（pre）、增强后 5min（mid）、增强后 20min（HBP）通过 Look-Locker 序列获得 T1mapping 图像（获取近肝门处层面）。测量计算肝脏相关 T1 弛豫时间定量值（包括 T1pre、T1mid、T1HBP），T1 弛豫时间减低率（ΔT1mid、ΔT1HBP）、脂肪分数（FF）及 R2*。比较 MELD 评分≤10 分和＞10 分两组间各 MRI 参数、血清指标的差异性。Spearman 相关分析具有统计学差异的 MR 定量参数与 MELD 评分、血清指标的相关性。Logistic 二分类回归分析各具有统计学差异的

MR 参数评价 MELD 评分＞10 分的危险因素，ROC 曲线评价危险因素的参数对区 MELD 评分＞10 分的诊断效能。结果 两组间 T1mid、T1HBP、ΔT1mid、ΔT1HBP 、R2*比较差异具有统计学意义（P＜0.05），T1pre、FF 比较差异无明显统计学意义（P＞0.05）。T1mid、T1HBP、R2*与 MELD 评分均呈正相关，rs 分别为 0.409、0.525、0.597（P 均＜0.05）；ΔT1mid、ΔT1HBP 与 MELD 评分均呈负相关，rs 分别为-0.614、-0.646（P 均＜0.05）；T1pre、FF 与 MELD 评分均无明显相关性（P＞0.05）。Logistic 二分类回归分析显示 ΔT1HBP 和 R2*是 MELD 评分＞10 分的危险因素。ROC 曲线显示 ΔT1HBP 、R2*区分 MELD 评分＞10 分的 AUC 分别约 0.854、0.811（P 均＜0.05）。结论 基于钆塞酸二钠增强 MRI 纵向弛豫时间及 R2*定量参数有助于评估乙肝肝硬化的肝功能状况。

## PU-046

# Is PC-MR ideal for predicting the outcome of shunt surgery in patients with idiopathic normal pressure hydrocephalus?

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OBJECTIVE: Phase-contrast magnetic resonance (PC-MR) is widely-used in patients with idiopathic normal pressure hydrocephalus (iNPH), but its role in predicting prognosis remains controversial. We sought to evaluate the effectiveness of PC-MR in predicting the clinical response to shunt surgery in patients with iNPH.
METHODS: Thirty-three patients with iNPH were included between December 2017 and January 2020. PC-MR was used to evaluate CSF peak velocity (PV), average velocity, aqueductal stroke volume (ASV), net ASV, and net flow. The modified Rankin Scale (mRS), iNPH grading scale (iNPHGS), mini-mental state examination (MMSE), and timed 3-meter up and go test (TUG) were used for clinical assessment. The primary endpoint was improvement in the mRS score at 1 year after surgery, and the secondary endpoints were the iNPHGS, MMSE, and TUG scores at 1 year. Differences between shunt responders and non-responders, based on the clinical outcomes, were compared using the Mann-Whitney U test. Correlations between CSF flow and clinical outcomes were assessed using Spearman’s correlation coefficient.
RESULTS: No any CSF parameters significantly differed between shunt responders and non-responders based on mRS and secondary outcomes. And all CSF parameters showed significant overlap in both shunt responders and non-responders based on mRS and secondary outcomes. Significant correlations between the mRS and iNPHGS scores, and PV, ASV, and net ASV were observed.
CONCLUSIONS: While PC-MR CSF flow parameters reflected the symptom severity of iNPH to a certain extent, they alone might not be ideal markers of shunt responsiveness.

## PU-047

# 应用 4D-Flow MRI 定量评价颅内动脉瘤血流动力学与破裂风险的相关性

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【摘要】目的 应用 4D-Flow MRI（Four dimensional-Flow MRI, 4D-Flow MRI)定量评价颅内动脉瘤血流动力学与破裂风险的相关性。材料与方法 回顾性分析 44 例未破裂颅内动脉瘤患者。3D-DSA 获得动脉瘤大小、位置、形态。4D-Flow MRI 获得动脉瘤血流动力学参数：最大壁面切应力（Max wall shear stress, WSSmax），平均壁面切应力(Average wall shear stress, WSSavg)，总速度(Total velocity)，峰值速度(Peak velocity), 最大压力(Max pressure, Pmax)及平均压力(Average pressure, Pavg)。PHASES 评分评估动脉瘤 5 年破裂风险。研究以上指标的相关性。结果 动脉瘤直径、位置（颈内动脉/大脑中动脉）、不规则形态、WSSmax、WSSavg、流出道总速度在不同破裂风险组之间有统计学差异。Spearman's 秩相关分析示 WSSmax、WSSavg 与动脉瘤直径呈显著负相关（r=－0.40 和－0.42, P 均＜0.001），WSSmax、WSSavg 与动脉瘤 5 年破裂风险也呈显著负相关（r=－0.55 和－0.56, P 均＜0.001）。结论 基于 4D-Flow MRI 定量评价血流动力学显示颅内动脉瘤直径越大，壁面切应力越小则破裂风险越高。

## PU-048

# 原发性纵隔（胸腺）大 B 细胞淋巴瘤的临床及 MRI 特征分析

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目的：探讨原发性纵隔（胸腺）大 B 细胞淋巴瘤（PMLBCL）的临床及 MRI 特征，以提高对该病的认识。材料与方法：回顾性分析经病理证实的 31 例 PMLBCL 的临床及 MRI 资料，包括肿瘤大小、形态、信号均匀性、瘤旁囊肿等形态学参数及表观扩散系数（ADC）值，并通过独立样本 t 检验及 Fisher 精确概率法评估 MRI 特征与 PMLBCL 分子分型及 Ann Arbor 临床分期的相关性。结果：PMLBCL 肿瘤大小 7.1~19.0cm，平均 12.3cm。26 例（83.9%）肿瘤形态不规则；27 例（87.1%）信号不均匀，出现 T1WI 低信号、STIR 高信号坏死区，部分坏死区边缘清楚；11 例（35.5%）伴发瘤旁囊肿。肿瘤侵犯肺组织 21 例（67.7%）、心包 18 例（58.1%）、血管 17 例（54.8%）、胸壁 7 例（22.6%）、膈神经 6 例（19.4%）。肿瘤 ADC 值为（0.495~0.889）×10-3mm2/s，平均 0.715×10-3mm2/s。非生发中心型 PMLBCL 的 ADC 值显著低于生发中心型（P＜0.001），晚期 PMLBCL 肿瘤大小明显大于早期（P=0.027）。结论：PMLBCL 的 MRI 表现具有一定特征性，其 ADC 值与分子分型、肿瘤大小与临床分期之间存在相关性。

## PU-049

# Improved diagnostic performance for HCC ≤3.0 cm on gadoxetate disodium‐enhanced MRI using classification and regression tree analysis

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**Objectives:** To build a new algorithm for diagnosing HCC ≤ 3.0cm on gadoxetate disodium‐enhanced MRI using classification and regression tree (CART) analysis, and to compare the diagnostic performance of the new algorithm with conventional LI-RADS (cLI-RADS) and modified LI-RADS (mLI-RADS).
**Materials and Methods:** In 236 patients at risk of HCC who underwent gadoxetate disodium‐enhanced MRI in 2018, a total of 253 hepatic lesions ≤ 3.0cm were included retrospectively. Two

board-certified abdominal radiologists independently reviewed all the images and evaluated the presence or absence of imaging features according to LI-RADS version 2018. Univariate and multivariate regression analyses were performed to identify independently significant features for diagnosing HCC ≤ 3.0cm. The CART analysis was carried out using these independently significant features. Additionally, LI-RADS categorization was done four times. The first categorization based on cLI-RADS, and the subsequent three mLI-RADS criteria were applied as follows: (a) mLI-RADS-1: transition phase (TP) hypointensity as an additional washout; (b) mLI-RADS-2: hepatobiliary phase (HBP) hypointensity as an additional washout; (c) mLI-RADS-3: TP and/or HBP hypointensity as an additional washout. The final diagnosis was determined histopathologically or clinically. Per-lesion sensitivity and specificity of each criterion were compared using generalized estimating equations. Bonferroni correction was used to adjust the effect of multiple comparisons. Receivers operating characteristic curves (ROCs) analyses were constructed to calculate the area under the curves (AUCs), and AUCs were compared by Delong test.

**Results:** The new algorithm was obtained by multivariate CART analysis and presented as a decision tree, which was consisted of four independently significant features with their best application sequence (HBP hypointensity, nonrim-arterial hyperintensity (APHE), and TP hypointensity plus mild-moderate T2 hyperintensity). In the first step, the feature of HBP hypointensity was used to identify lesions suggestive of HCC (219/86.6%). In the second step, the feature of nonrim-APHE was evaluated in a group of HBP hypointensity lesions, further classifying lesions as suspicious for HCC (190/75.1%). For the remaining 29 HBP hypointense lesions without APHE, the last CART analysis was carried out using TP hypointensity plus mild-moderate T2 hyperintensity, selecting 18 lesions as suspicious for HCC. Among all criteria, the new algorithm yielded the highest sensitivity (94.0%, all $p<0.05$), while LI-RADS yielded the lowest sensitivity (66.9%). Conversely, LI-RADS and mLI-RADS-1 showed the highest diagnostic specificity (both 94.6%, all $p\geq0.05$), but there were no significant differences in specificity. Moreover, the new algorithm also achieved the highest AUC, but statistically significant difference was only found between the new algorithm vs. LI-RADS (0.91 vs. 0.62; $p=0.002$) and the new algorithm vs. mLI-RADS-3 (0.91 vs. 0.89; $p<0.001$).

**Conclusions:** Compared with cLI-RADS, both the new algorithm and mLI-RADS criteria were able to improve diagnostic sensitivity for HCC ≤ 3.0cm on gadoxetate disodium‐enhanced MRI without significant loss of specificity. Among all criteria, the new algorithm using CART analysis exhibited the best diagnostic performance, particularly for small (<2 cm) HCC.

# PU-050

# MRI 对鼻咽癌调强放疗患者腮腺脂质含量时间演变的初步研究

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【摘要】目的：利用磁共振成像（MRI）定量评价鼻咽癌（NPC）患者调强放疗（IMRT）后腮腺脂肪含量的变化趋势及其与放射性口干的相关性。方法：NPC 患者 22 例（男 16 例，女 6 例，年龄范围 11-65 岁，中位年龄 48.5 岁）。患者放疗前（t0 期）、放疗后 0~3 个月（t1 期）、3~12 个月（t2 期）及 12 个月以上（t3 期）进行常规磁共振检查。测量各期双侧腮腺脂质相对信号值的平均值，并记录各期对应口干严重程度。比较腮腺各期 T1WI、T2WI 信号强度，并分析各期信号强度与同期口干程度的相关性。结果：t2 期腮腺 T1WI 相对信号值均明显高于 t0、t1、t3 期，差异具有显著性（x2=-5.61、-3.27、5.14，均 P<0.01）；t1 期腮腺抑脂 T2WI 相对信号值均明显低于 t0、t3 期，差异具有显著性（x2=3.50、-3.91，均 P<0.01）；t2 期腮腺抑脂 T2WI 相对信号值均明显低于 t0、t3 期，差异具有显著性（x2=6.01、-6.42，均 P<0.01）；t1、t2 期腮腺 T1WI 相对信号值、t2 期腮腺抑脂 T2WI 相对信号值与同期口干程度具有显著相关性（r=0.55、0.51、0.65，

P=0.01、0.02、<0.01）。结论：MRI 能定量显示 IMRT 治疗后 NPC 患者腮腺脂质含量动态变化，腮腺脂质含量与放射性口干有显著相关性。

## PU-051

# Clinical and CMR imaging features of apical hypertrophic cardiomyopathy

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Objective To investigate the clinical and Cardiac magnetic resonance imaging (CMR) features of patients with apical hypertrophic cardiomyopathy(ApHCH). Methods Clinical and CMR imaging data of 26 ApHCM patients (21 males and 5 females) diagnosed by Department of Cardiology in our hospital were collected and analyzed. Results 26 ApHCM patients with hypertension and arrhythmia were 6 cases (23.1%), 8 cases (30.7%), including 6 cases of atrial fibrillation (23.1%), 1 case of sinus syndrome (3.8%), 1 case of bradycardia (3.8%). The patients with chest tightness, chest pain and palpitation were 16 cases (61.5%), 12 cases (46.2%) and 8 cases (30.8%), In addition, 20 patients (76.9%) had inverted T wave and 2 patients (26.9%) had left ventricular hypertrophy. There were 23 cases (88.5%) with “black peach heart”, 2 cases (7.7%) with ventricular aneurysm and 4 cases (15.4%) with apical occlusion in CMR, Left ventricular end systolic volume (LVESV), left ventricular end diastolic volume (LVEDV), left ventricular output per beat (LVSV) and left ventricular ejection fraction (LVEF) were 34.72 ± 2.00ml, 122.12 ± 4.65ml, 87.40 ± 3.49ml, 71.89 ± 1.39%, The left ventricular mass, interventricular septal thickness (IVST) and apical thickness were 118.09 ± 6.29g,14.83 ± 0.50mm,20.18 ± 0.97mm. The results of T1mapping analysis in 5 patients showed that native T1 values of apical segment, middle segment, basal segment and the whole were 1036.66 ± 14.93ms, 1059.66 ± 11.28ms, 1070.33 ± 10.10ms, 1056.00 ± 9.98ms, The Post1 values of apical segment, middle segment, basal segment and whole segment were 432.83 ± 8.97ms, 443.66 ± 7.30ms, 450.50 ± 8.54ms, 439.83 ± 6.37, The ECV of apical, middle, basal and whole segments were 29.71 ± 0.99%, 27.51 ± 0.35%, 26.32 ± 0.72%, 28.40 ± 0.64%. Conclusion The clinical manifestations of ApHCM patients are not specific. The typical inverted T wave of ECG has certain diagnostic value, but it needs to be differentiated from coronary heart disease. CMR has high diagnostic value and can clearly show cardiac structure and myocardial tissue characteristics.

## PU-052

# 心尖肥厚型心肌病临床及磁共振表现特点分析

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目的 总结分析心尖肥厚型心肌病（ApHCM）患者临床及心脏磁共振表现特点。方法 收集我院 2016 年 7 月-2021 年 4 月于我院行 CMR 检查并诊断或怀疑 ApHCM 患者的临床及 CMR 资料。结果 共收集 ApHCM 患者 26 例，男性 21 例（80.8%），女性 5 例（19.2%）；平均年龄 54±3 岁，最小 26 岁，最大 85 岁。伴发高血压、心律失常的患者分别为：6 例（23.1%），8 例（30.7%），其中房颤 6 例（23.1%），窦房结综合征 1 例（3.8%），心动过缓 1 例（3.8%）；

出现胸闷、胸痛、心悸患者分别为：16 例（61.5%），12 例（46.2%），8 例（30.8%）；ECG 出现倒置 T 波、左室肥厚的患者分别为：20 例（76.9%），2 例（26.9%）。CMR 出现桃尖征、室壁瘤、心尖闭塞的患者分别为 23 例（88.5%），2 例（7.7%），4 例（15.4%）；左室收缩末期容积（LVESV）、左室舒张末期容积（LVEDV）、左室每博输出量（LVSV）、左室射血分数（LVEF）分别为：34.72±2.00ml，122.12±4.65ml，87.40±3.49ml，71.89±1.39%；左心室质量、间隔壁厚度（IVST）、心尖最厚处厚度分别为：118.09±6.29g，14.83±0.50mm，20.18±0.97mm；其中 5 例患者接受 T1mapping 扫描，结果显示其心尖段、中段、基底段及整体 NativeT1 值分别为：1036.66±14.93ms，1059.66±11.28ms，1070.33±10.10ms，1056.00±9.98ms；心尖段、中段、基底段及整体 PostT1 值分别为：432.83±8.97ms，443.66±7.30ms，450.50±8.54ms，439.83±6.37；心尖段、中段、基底段及整体 ECV 分别为：29.71±0.99%，27.51±0.35%，26.32±0.72%，28.40±0.64%。结论 心尖型肥厚型心肌病患者临床表现无特异性，心电图典型倒置 T 波有一定诊断价值，但需与冠心病鉴别，心脏磁共振诊断效能更高，可清晰显示 ApHCM 患者心脏结构及心肌组织特征改变。

## PU-053

# The value of MRI in identifying pancreatic neuroendocrine tumor G3 and carcinoma G3

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**Background:** Pancreatic neuroendocrine neoplasm grade 3 (pNEN-G3) has recently been reclassified as pancreatic neuroendocrine tumor-G3 (pNET-G3) and pancreatic neuroendocrine carcinoma-G3 (pNEC-G3).
**Aim:** We aimed to explore the differences between the two diseases on MRI.
**Methods:** Between 2009 and 2019, 31 patients underwent pNEN-G3 resection with preoperative MR imaging in Dezhou People's Hospital and Yucheng People's Hospital. Based on the 2017 WHO classification, they were subclassified as pNET-G3 or pNEC-G3. MRI features included lesion size, T1W and T2W signal intensity, apparent dispersion coefficient (ADC) and enhancement pattern. The positive enhancement integral (PEI) and the signal enhancement ratio of each phase were measured.
**Results:** The 31 patients were assigned to a pNET-G3 group (n = 13, 41.9%) or a pNEC-G3 group (n = 18, 58.1%). There was no statistically significant difference between the two groups in lesion size, clinical characteristics or laboratory indexes. The lesions of the two groups showed high or slightly higher signal on DWI, and decreased ADC values which differed between the two groups（p=0.013）. The difference between the groups in PEI, arterial phase and portal phase signal enhancement ratio were statistically significant; however, the delayed phase signal enhancement ratio was not significantly different. In terms of TNM staging, there was no statistical difference between the two groups, although the pNEC-G3 group was generally at a later stage.
**Conclusions:** pNET-G3 and pNEC-G3 showed different characteristics on MRI. In particular, the ADC value and dynamic enhanced scanning could have an important role in distinguishing between the two.

## PU-054

# DWI、DKI 联合 DCE-MRI 在鉴别孤立性肺结节良恶性中的应用

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目的：探讨弥散峰度成像（DKI）联合 DWI、DCE-MRI 在鉴别孤立肺结节(SPN)良恶性中的诊断价值。

材料与方法：选取本院 47 名 SPN 患者，男:30 例，女:17 例，年龄：29～86 岁，平均年龄：61 岁。行常规 DWI 与 DKI（b 值从 0 到 2000 sec/mm2）和 DCE-MRI 扫描。比较良性组与恶性组 ADC、Kapp、Dapp、Ktrans、Kep、Ve 和 iAUC 值。构建受试者 ROC 曲线以评估诊断效能。

结果：恶性组 SPN 的 Kapp、Ktrans、Ve 和 iAUC 值显著高于良性组 SPN（P < 0.035）， 而 ADC 值良性组显著高于恶性组（P = 0.001）。两组之间 Dapp 和 Kep 值无差异性统计学意义（P = 0.06）。 Kapp 值的灵敏度（81.8%）和准确度（75.7%）最高，ADC 值的特异性最高（80.0%）。ADC 和 iAUC 值的结合将灵敏度提高到 81.8%，特异性提高到 86.7%，准确度提高到 83.8%。

结论：对于孤立肺结节(SPN)的良恶性鉴别，DKI 比传统的 DWI 和定量 DCE-MRI 更加敏感与准确，而常规 DWI 与定量 DCE-MRI 的结合可以提高 SPN 的诊断效能。

## PU-055

# 3D 酰胺质子转移加权成像联合动态增强扫描诊断乳腺肿块样病变的价值

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**目的** 探讨 3D 酰胺质子转移加权成像（APTWI）及其联合动态增强扫描（DCE-MRI）对乳腺肿块样病变的鉴别诊断价值。**方法** 回顾性分析 2020 年 7 月至 2020 年 12 月 DCE-MRI 表现为肿块样病变且接受 APTWI 检查的 140 名患者，共 140 个肿块，所有肿块均经病理证实。用以下三种诊断方法区分病变的良恶性：基于乳腺影像报告和数据系统（BI-RADS）的 DCE-MRI；APTWI 计算的 MTRasym（3.5 ppm）定量评估值；DCE-MRI+APTWI 联合诊断。Mann-Whitney U 检验比较良恶性肿块间 APTWI 参数的差异，采用受试者工作特性曲线（ROC）比较三种方法的诊断效能。**结果** DCE-MRI 和 APTWI 均能用于区分乳腺良恶性肿块，其中 DCE-MRI 诊断的敏感度、特异度和准确度分别为 100.0%、41.5%、72.9%，APTWI 以 MTRasym（3.5 ppm）等于 2.8%为最佳临界值，诊断的敏感度、特异度和准确度分别为 76.0%、70.8%、73.6%。DCE-MRI+APTWI 鉴别乳腺肿块样病变的 AUC（0.877）大于 DCE-MRI（0.813，P<0.05）和 APTWI（0.796，P<0.05），诊断的敏感度、特异度和准确度分别达 89.3%、86.1%、87.9%。DCE-MRI+APTWI 对 BI-RADS 4 类肿块诊断的 AUC 显著大于 DCE-MRI（0.90vs0.55，P<0.05）。**结论** APTWI 与 DCE-MRI 结合，提高了对乳腺肿块样病变的诊断价值，尤其是对 4 类肿块的诊断准确性。

## PU-056

# 扩散峰度成像（DKI） 在脑胶质瘤复发与假性进展鉴别中的应用价值

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**目的** 探讨扩散峰度成像（DKI）在鉴别胶质瘤患者术后复发（PD）与假性进展（PsP）中的临床应用价值。
**材料与方法** 经患者知情同意后，回顾性收集宁夏医科大学总医院 2018 年 10 月-2020 年 12 月间经手术治疗并术后接受放、化疗治疗的脑胶质瘤患者共 40 例。通过二次病理或经 MRI 增强扫描随访>6 个月分为 PD 组（24 例）与 PsP 组（16 例）。测量 PD 组与 PsP 组患者增强病灶和瘤周水肿中参数值相对平均峰度（rMK）、相对轴向峰度（rAK）、相对径向峰度（rRK）、相对平均扩散系数（rMD）、相对部分各向异性（rFA）。统计分析胶质瘤 PD 和 PsP 之间各参数值的组间差异，绘制受试者工作特征曲线（ROC），计算不同参数值的曲线下面积（AUC）、最佳诊断阈值、灵敏度和特异度。
**结果**
1. 胶质瘤 PD 组患者的增强病灶中，rMK、rRK 显著高于 PsP 组患者（P < 0.001，P < 0.001），rMD 显著低于 PsP 组患者(P = 0.025)。相比较 rRK 值、rMD 值的曲线下面积（AUC=0.828，AUC=0.701），rMK 值的曲线下面积最大（AUC=0.935），以 0.801 作为最佳诊断阈值时，诊断的灵敏度和特异度分别为 87.50%和 99.37%。
2. 胶质瘤 PD 组患者的病灶瘤周水肿中，rMK 显著高于 PsP 组患者（P < 0.001），rMD 显著低于 PsP 组患者(P = 0.012)。相比较 rMD 值的曲线下面积（AUC=0.734），rMK 值的曲线下面积最大（AUC=0.816），以 0.817 作为最佳诊断阈值时，诊断的灵敏度和特异度分别为 79.20%和 78.70%。
**结论**
1. 胶质瘤 PD 与 PsP 患者的增强病灶中，参数值 MK、RK 和 MD 具有鉴别诊断价值，较 PsP 患者，胶质瘤 PD 患者增强病灶的 MK 值、RK 值升高，MD 值降低。
2. 胶质瘤 PD 与 PsP 患者的瘤周水肿中，参数值 MK 和 参数值 MD 具有鉴别诊断价值，较 PsP 患者，胶质瘤 PD 患者瘤周水肿的 MK 值升高，MD 值降低。
3. DKI 技术在鉴别胶质瘤 PD 与 PsP 方面的敏感性及特异性较好，其中 DKI 的参数值 MK 的诊断效能最高，今后有可能作为较好的影像学标记。

PU-057

# T2-FLAIR 高信号血管征在 AIS 患者侧支循环评估以及早期神经功能恶化预测中的应用价值

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目的：探讨 FLAIR 高信号血管征（FHV)评估急性缺血性脑卒中（AIS）患者侧支循环的可行性，以及对 AIS 患者早期神经功能恶化（END）的预测价值。
材料和方法：回顾性分析我院连续收治的未行血管再通治疗且发病至 MRI 检查 24-72h 的前循环 AIS 患者。记录患者入院时和入院后 72h 美国国立卫生研究院卒中量表（ NIHSS）评分。END 定义为患者入院后 72h 内 NIHSS 较入院 NIHSS 评分增加≥2 分。MR 检查序列包括：动态磁敏感增强（DSC-PWI），液体衰减反转恢复序列（T2-FLAIR），弥散加权成像（DWI）。采用 DSC-PWI 源图像重建 DSC-PWI 动态脑血流图对 AIS 患者进行侧支循环分级评价。梗死部位和梗死体积采用 F-stroke 软件进行自动测量分析。FHV-ASPECTS 评分采用改良 Alberta 卒中早期 CT 评分（ ASPECTS）进行。FHV 分级标准：0 级，未见 FHV 征象；1 级：FHV 仅见于 M3-M2 段动脉走行区；2 级，FHV 可见于 M3 段-M1 段动脉走行区。血管狭窄/闭塞采用 TOF-MRA 进行观察，血管

狭窄/闭塞定义为 TOF-MRA 上颈内动脉或大脑中动脉闭塞或狭窄程度≥50%。采用 Kappa 检验分析 FHV-ASPECTS、FHV 分级、DSC-PWI 动态脑血流图侧支循环评估观察者之间的一致性。Spearman 相关检验用于分析 FHV-ASPECTS、FHV 分级与 DSC-PWI 动态血流图侧支循环的相关性。受试者工作特征曲线下面积（AUC）用于评估 FHV 预测 END 的诊断效能。
结果：本组病例最终入组 183 名患者，其中大血管狭窄组 87 例，非大血管狭窄组 96 例。血管狭窄/闭塞组采用 DSC-PWI 动态脑血流图评估的侧支循环分级观察者之间具有高度一致性（kappa=0.764，p<0.001），且观察者间评估结果之间具有高度相关性（ρ=0.893，p<0.001）。血管狭窄/闭塞组，FHV 侧支循环评估分级观察者之间一致性较好（kappa=0.738，p<0.001）。血管狭窄/闭塞组， FHV-ASPECTS 评分医师 A 和医师 B 之间一致性较好（kappa=0.746，p<0.001）。血管狭窄/闭塞组中，FHV 分级与动态血流图侧支评估呈中等程度正相关（ρ=0.603，p<0.001）；FHV-ASPECTS 评分与动态血流图侧支评估呈中等程度负相关（ρ=-0.547，p<0.001）。本组病例中 END 的发生率为 27.9%（51/183），其中 END 组入院 NIHSS 评分较高，两组存在显著差异（z=-3.921，p<0.001）；END 组梗死体积较 NEND 组高（t=4.734，p<0.001）。血管狭窄、闭塞组中 END 发生率为 44.83%（39/87），以是否发生 END 作为标准，DSC-PWI 诊断 END 的曲线下面积 AUC 为 0.840（95% CI，0.758-0.922）；FHV 分级诊断 END 的曲线下面积 AUC 为 0.692（ 95% CI，0.582-0.803）；FHV-ASPECTS 评分诊断 END 的曲线下面积 AUC 为 0.762 （95% CI，0.661-0.863）。
结论：
FHV-ASPECTS 评价的侧支循环与 DSC-PWI 动态血流图侧支循环分级具有良好的相关性，对于未采取血管再通治疗的大血管狭窄/闭塞的前循环 AIS 患者，较高的 FHV-ASPECTS 评分代表软脑膜侧支循环不良，对预测 END 具有较高的诊断效能，但尚不能替代 DSC-PWI 检查；对于一些无法行 PWI 成像的患者，FHV-ASPECTS 评分可能作为脑卒中后侧支循环评估的一种简易替代方法。

PU-058

# 基于血流动力学改变的影像特征在 AIS 患者早期神经功能恶化和临床预后评估中的应用价值

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目的：探讨基于血流动力学改变的影像征象联合临床实验室指标对 AIS 患者 END 及临床预后评估的应用价值。
材料和方法：收集我院连续收治的发病至 MRI 检查时间在 24-72h 未采取血管再通治疗的大动脉狭窄或闭塞的 AIS 患者。记录患者入院以及入院 72h 美国国立卫生研究院卒中量表（ NIHSS）评分，入院 72h-NIHSS 较入院 NIHSS 评分≥2 分，定义存在 END。良好预后组定义为 90d-mRS( mRS）评分为 0-2 分，预后不良定义为 90d-mRs 评分为 3-6 分。多发低信号血管征（MHV）定义为 SWI 最小密度投影（min IP）图像上梗死侧出现较健侧大脑半球增多或增粗的低信号血管影。DMV 定义为 SWI 图像上出现位于较健侧大脑半球明显增多或增粗的，发生在侧脑室周围脑白质内细长的血管；SVS 定义为 SWI 序列上大脑中动脉走行区出现的低信号血管影，观察 SVS 是否出现双层磁敏感血管征（TL-SVS）；FHV 定义为走行于蛛网膜下腔的局灶性、蛇形或管状弯曲的高信号。MHV、FHV 评分采用改良 ASPECTS 评分进行评价。将 FHV-ASPECTS 评分（0~6 分）定义为 FHV 阳性组，FHV-ASPECTS 评分（7 分）定义为 FHV 阴性组。梗死部位和梗死体积采用 F-STROKE 软件进行自动评估和测量。以 SVS 征象为基础，将上述征象进行联合，构建 5 种预测模型。以是否发生 END 为应变量，以单因素筛选出的阳性指标，建立二元 Logistic 回归方程。采用 Hosmer 和 Lemeshow 检验判断模型的拟合优度；采用受试者工作特征曲线下面积（AUC）判断模型的区分度。Pearson’s chi-squared test 用于比较两组患者 90d 预后情况。

结果：（1）本组患者中共 39 例患者发生了 END，占 44.8%，END 组与 NEND 组两组发病部位 M3 区（z=-2.832，p=0.005）、M5 区（z=-2.498，p=0.012）、尾状核（C）（z=-2.236，p=0.025）组间存在差异。（2）END 组 FHV-ASPECTS 较 NEND 组发生低（χ2=14.386，p=0.045）；MHV-ASPECTS 较 NEND 低（χ2=25.896，p=0.001），两组之间存在统计学差异。（3）END 组 DMV 发生率较 NEND 组高（χ2=5.124，p=0.024），END 组 SVS 发生率较 NEND 组高（χ2=24.925，p<0.001），END 组 TL-SVS 的发生率较 NEND 组高（χ2=19.869，p<0.001）。（4）以是否发生 END 为应变量，以单因素筛选出的指标进行二元 Logistic 回归分析，其中（FHV+MHV+SVS）阳性为 END 的独立预测因子，OR 值为 11.984，预测 END 的 AUC 为 0.863，95%CI（0.784~0.943）；（FHV+MHV+SVS+TL-SVS）阳性为 END 的独立预测因子，OR 值为 14.970，预测 END 的 AUC 值为 0.843，95%CI（0.761~0.926）。（5）END 组 90d-mRS 连续评分较 NEND 组明显增高，组间存在差异（χ2=10.832，p=0.001）。
结论：FHV、MHV、SVS，TL-SVS 能够较为全面反映 AIS 患者脑血流动力学变化；联合 FHV、MHV、SVS、TL-SVS 对未采取血管再通治疗的 AIS 患者 END 的发生具有较高的诊断效能，当存在 TL-SVS 时 END 发生的风险增加。END 组 AIS 患者 90d-mRS 连续评分较 NEND 组明显增高，患者神经功能缺损严重，预后不良。

## PU-059

# 液体衰减反转恢复序列及磁敏感加权成像相关血管征象在 急性缺血性脑卒中患者临床评估中的价值

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目的 回顾性分析液体衰减反转恢复序列（T2-FLAIR）及磁敏感加权成像（SWI）血管相关征象在急性缺血性脑卒中（AIS）临床疗效评估中的价值。
材料和方法 回顾性分析 131 例发病 24-72h 以内颈内动脉（ICA）或大脑中动脉（MCA）狭窄/闭塞的 AIS 患者。扫描序列包括 SWI、T2-FLAIR 序列；根据 SWI 上多发低信号血管征（MHVs）和 T2-FLAIR 序列上血管高信号征（FVHs）的显示程度进行分级。记录患者入院时、入院后 3d 美国国立卫生研究院卒中量表（NIHSS）评分，将患者分为早期神经功能减退（END）组（NIHSS 增加≥2）和 NEND 组（NIHSS 增加＜2）；记录患者 90 d 改良 Rankin 量表评分(mRS)，将患者分为预后良好组（mRS 0-2 分），预后不良组（mRS＞2 分）。采用 Mann-Whitney U 检验比较两组 MHVs 分级、FVHs 分级之间的差异；采用 Spearman 秩相关系数分析 MHVs 分级与 FVHs 分级的相互关系。
结果 FVHs 分级与 MHVs 分级呈轻度正相关（r=0.390，p＜0.001）；END 组 FVHs 分级较 NEND 组高（z=-3.499，p＜0.001），MHVs 分级较 NEND 组高（z=-4.663，p＜0.001）；预后不良组 MHVs 分级较预后良好组高（z=-3.993，p＜0.001），FVHs 分级在两组之间无显著差异（z=-1.472，p=0.141）。
结论 MHVs 联合 FVHs 能够反映 AIS 患者脑血流动力学改变，对缺乏再灌注治疗的超时间窗 AIS 患者 END 发生和 90-d 预后有较好的预测价值。

## PU-060

# 多模态磁共振成像在前置胎盘及前置胎盘伴植入疾病诊断中的临床应用价值

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[摘要]目的 探讨多模态磁共振成像在前置胎盘及前置胎盘伴植入疾病诊断中的临床应用价值。方法 对 248 例术前确诊为前置胎盘及前置胎盘伴植入疾病患者进行多模态磁共振影像组学进行扫描并对照手术及病理， 分析多模态磁共振成像在前置胎盘及前置胎盘伴植入性疾病的诊断准确性、敏感度、特异度，同时进行多模态 MRI 序列的优化组合。结果 对 248 例前置胎盘及前置胎盘伴植入性疾病患者术前进行多模态 MRI 扫描，分析诊断准确性、敏感度、特异度的差异进行统计学分析，并根据不同序列间的 SAR 值来进行多模态的优化组合，有统计学意义(P<0.05)。结论 多模态磁共振成像能满足大多数前置胎盘伴植入性疾病的临床诊断需求，提高了诊断准确率及临床治疗效果，又保护了患者及胎儿的安全利益，值得临床推广应用(具有很大临床价值)。

PU-061

# 不合并高血压的 2 型糖尿病相关性认知功能障碍 3D-ASL 脑灌注成像研究

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【目 的】本研究通过对 2 型糖尿病（Type 2 diabetes mellitus, T2DM）患者进行磁共振三维动脉自旋标记（3 Direction-Arterial spin labeling,3D-ASL）检查，并联合多个领域认知量表。分析脑灌注血流量与各认知功能量表评分的相关性，评估多模态 MRI 检测能否早期明确 T2DM 患者糖尿病相关认知功能障碍(Diabetes-Associated Cognitive Dysfunction, DACD)的发生及病程进展。
【方 法】纳入 15 例无高血压 T2DM 轻度认知障碍阳性组（Mild Cognitive Impairment +, MCI+）MCI+患者、17 例无高血压 T2DM 轻度认知障碍阴性组（MCI-）患者和 19 例年龄、性别、受教育程度、血脂与 T2DM 患者匹配的正常对照(Normal control, NC)受试者。所有受试者均进行各领域认知测试、3D-T1WI、3D-ASL 序列扫描。比较三组局部脑血流灌注（Region CBF, rCBF）及认知评分，分析 MCI+、MCI-组有差异脑区的 rCBF 值与认知评分的相关性。
【结 果】与 MCI-组比较，MCI+组双侧颞上回及岛叶区域 CBF(rCBF)明显减低（P < 0.05）；与 NC 组比较，MCI-组左扣带回 rCBF 减低(P < 0.0001)。MCI+组蒙特利尔认知评估量表（Montreal Cognitive Assessment, MoCA）得分与左颞上回(r = 0.563, P = 0.000)、左岛叶(r = 0.502, , P = 0.002) 、右岛叶、颞上回 rCBF(r = 0.826, P = 0.000)均呈正相关；韦氏智力量表-数字广度测验(Wechsler Intelligence Scale - Digit Span Test, WMS-DST)倒背得分与左颞上回(r = 0.383, P = 0.023)、右岛叶、颞上回 rCBF(r = 0.705, P = 0.000) 均呈正相关；WMS-DST-总分与左颞上回(r = 0.515, P = 0.002)、左岛叶(r = 0.488, P = 0.003)、右岛叶、颞上回 rCBF(r = 0.707, P = 0.000)均呈正相关；语义流畅性(Semantic Verbal Fluency, SVF)得分与左颞上回(r = 0.403, P = 0.016)、右岛叶及颞上回 rCBF(r = 0.622，P =0.000)均呈正相关。在单变量 Logistic 回归模型中，WMS-DST 倒背得分、WMS-DST 总分、SVF 得分、左侧颞上回 rCBF 和左侧岛叶 rCBF 均与轻度认知障碍(MCI)的发生有关。在多变量 Logistic 回归模型中，左侧岛叶 rCBF (OR = 0.605，95％CI 0.454-0.805，P = 0.001)，提示较高的左侧岛叶 rCBF 与较低的 MCI 发生风险有关。
【结 论】磁共振 3D-ASL 技术能够早期、敏感发现 T2DM 患者脑灌注异常，越低的左侧岛叶 rCBF 与越高的 MCI 发生风险相关。左扣带回 rCBF 减低可能在糖尿病尚未出现认知功能受损症状即病程早期就出现。3D-ASL 技术在 T2DM 认知神经科学方面具有重要临床应用前景。

PU-062

# 小视野 DWI 对肝外胆管癌的应用价值

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【摘要】 目的：探讨小视野 DWI 在肝外胆管癌中的应用价值。方法：回顾性分析经手术病理证实的 26 例肝外胆管癌患者的 MRI 图像，所有患者均行常规 DWI 及小视野 DWI 扫描。由 2 位影像诊断医师通过 4 分法分别对两组 DWI 图像质量进行主观评分，并测量两组图像 SNR、CNR 及病灶处 ADC 值。分析比较两组图像主观评分、SNR、CNR 以及病灶 ADC 值。结果：小视野 DWI 图像主观评分 (4.35±0.56)高于常规 DWI 图像(3.42±0.58)，差异有统计学意义(Z=-5.12，p＜0.05)。常规组与小视野组 DWI 图像 SNR、CNR 进行比较，差异均无统计学意义（t 值分别约 0.74、1.49，p 均＞0.05）。常规组与小视野组 ADC 值比较，差异有统计学意义(p＜0.05)，且常规组（1.06±0.23 mm2/s）大于小视野组（0.98±0.15mm2/s）。26 例肝外胆管癌中，中分化 17 例，低分化 9 例；常规组和小视野 ADC 值对区分中、低分化的肝外胆管癌时 ROC 曲线下面积分别为 0.86、0.91。结论：对于显示肝外胆管癌方面，小视野 DWI 较常规 DWI 图像具有更好的清晰度和显示效果，且对肝外胆管癌的分化程度具有较高的诊断效能。

PU-063

# 基于 3.0T 磁共振 T2*-mapping 监测猕猴膝关节 骨关节炎软骨损伤的定量研究

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**目的** 探讨 3.0T 磁共振 T2*-mapping 定量评估猕猴膝关节骨性关节炎软骨损伤的临床价值，旨在为 KOA 临床诊治提供更好的评估及指导。
**材料与方法** 选取中科院昆明动物研究所提供的健康猕猴 9 只，雌雄不限，平均年龄为 13.4±0.23 岁，体重 4.8-9.0Kg，平均 6.9±1.25Kg，由经验丰富的骨关节外科医生采用改良 Hulth 法构建单侧骨性关节炎模型，9 只猕猴 18 只膝关节均行造模。分别于造模前、造模后 3 个月、造模后 6 个月行 MRI 检查，采用自身对照，造模前关节软骨为 A 组（n=9），作为正常对照组，造模后 3 月为 B 组（n=9），造模后 6 月为 C 组（n=9），对比分析造模前、后 T2*-mapping 伪彩图变化情况，并测量造模前、后各组关节软骨的 T2*值。
**结果**（1）常规抑脂 PDWI 序列：A 组猕猴膝关节软骨表现为软骨下骨表面条带状稍高信号影，信号均匀，表面光滑、连续 ；B 组猕猴膝关节软骨表现为软骨下骨表面的条带状混杂信号影，信号欠均匀，内见细条状、点状高信号影，软骨表面欠光整，C 组猕猴膝关节并可见手术造模区全层软骨缺损；（2） 3D-FS-SPGR 序列：A 组猕猴膝关节软骨呈信号均匀、边缘光整的高信号带，信号强度高于关节积液、软骨下骨；B 组、C 组猕猴膝关节软骨于手术造模区全层软骨缺损，其余各区软骨连续、光整，信号未见明确异常；（3）T2*-Mapping 序列：A 组猕猴膝关节软骨连续厚度均匀，呈均匀一致的蓝绿色色阶，信号一致，B 组猕猴膝关节软骨蓝色色阶内见斑点状绿色色阶，C 组猕猴膝关节软骨蓝色色阶内见斑点状黄色、红色色阶。造模后猕猴膝关节软骨的 T2*-mapping 伪彩图较造模前变薄，表面粗糙且不连续，软骨色阶信号不均匀，造模前、造模后 3 个月、造模后 6 个月各组软骨 T2*值随时间呈上升趋势，各组间差异有统计学意义（P＜0.05）。

**结论** 猕猴膝关节骨性关节炎软骨各亚区软骨厚度较造模前降低，T2*值较前升高，T2*-mapping 能够通过伪彩图观察关节软骨损伤的早期病理变化，且能够用 T2*值定量评估软骨损伤程度，为 KOA 临床诊治提供更好的评估及指导。

## PU-064

# 多序列 MRI 在油漆高压注射伤中的应用

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**目的：**探讨多序列 MRI 在油漆高压注射伤中的应用价值。
**方法：**选用 8 只 8 周龄体重为 300 g 左右的 SD 大鼠，用 4%水和氯醛（1ml/100g）麻醉,五分钟后用灭菌的 5 ml 注射器在每只 SD 大鼠大腿部注射 0.5 ml 油漆。所有皮下注射过油漆的 SD 大鼠均立即进行 3.0T 磁共振成像，成像序列包括 T1 加权成像(T1WI)、T2 加权成像(T2WI)、弥散加权成像(DWI)和磁敏感加权成像(SWI)。此外，对皮下注射过油漆的 SD 大鼠还进行了随访研究，包括在第 1 天至第 5 周期间内进行的重复多序列 MRI 检查。
**结果：**皮下油漆高压注射损伤急性期在 T1WI 上呈稍高信号(低于脂肪信号)，在 T2WI 上呈高信号，在脂肪抑制的 T2WI 上变现为中心等信号和周边高信号，在 DWI 和 SWI 上都呈低信号。在随访期间，皮下油漆沿着筋膜、神经血管束和肌腱鞘等进行了迅速的扩散，并对周围邻近的组织造成了严重的感染。SWI 不仅能够敏感地显示散乱分布的油漆，而且可以敏感的显示出少量油漆。皮下油漆高压注射损伤晚期在 DWI 可见明显的周边高信号，经外科手术证实为化脓性积液所导致的。
**结论：**由于油漆具有高的毒性和腐蚀性，所以油漆高压注射伤容易并发感染。多序列 MRI 可用于鉴别高压注射损伤后的皮下油漆，并可对油漆高压损伤的发展起到很好的监测作用，为临床的彻底清创和预后疗效的评估提供了有效的辅助工具。SWI 对油漆显示敏感，特别是对少量的油漆和非急性期的显示。DWI 在显示油漆周围脓液的形成方面起着重要作用。

## PU-065

# Evaluation of Diffusion-Weighted Imaging of kidney at 3.0T with Different Breathing Schemes

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Purpose: To compare the clinical utility of single-shot echo-planar imaging (SS-EPI) using different breathing schemes, readout-segmented EPI (RS-EPI) and Zoomit DWI (Z-DWI) in the repeatability of apparent diffusion coefficient (ADC) measurements, contrast-to-noise ratio (CNR) and image quality.
Methods: In this prospective study, coronal kidneys DWIs (b=50,400,800 sec/mm$^2$) were performed in 23 volunteers on 3.0T MRI using SS-EPI with free-breathing diffusion-weighted imaging (FB-DWI), breath-hold (BH-DWI), respiratory-triggered (RT-DWI) and navigator-triggered (NT-DWI), readout-segmented EPI (RS-DWI), and Zoomit DWI (Z-DWI). ADC and CNR were measured in three anatomic cortex and medulla locations (upper, middle and inferior) in each

kindney (12 measurement points for both kindney), and image quality was assessed on all FB-DWI, BH-DWI, RT-DWI, NT-DWI, RS-DWI and Z-DWI sequences. The sequence with the optimal clinical utility was decided by systematically comparing the ADC repeatability, CNR and image quality of the above DWIs.
Results: In all six sequences, RT-DWI has reliable intra-observer agreement (intra-class correlation coefficients (ICCs): 0.807-0.853) and good inter-observer agreement (ICCs: 0.846-0.881), which was better than RS-DWI (intra-class ICCs: 0.696-0872; inter-class ICCs: 0.743-0.837), NT-DWI (intra-class ICCs: 0.685-0.811; inter-class ICCs: 0.728-0.874), FB-DWI (intra-class ICCs: 0.556 -0.782; inter-class ICCs: 0.574-0.700), BH-DWI (intra-class ICCs: 0.707-0.817; inter-class ICCs: 0.450-0.736) and Z-DWI (intra-class ICCs: 0.847-0.873; inter-class ICCs: 0.798 -0.808). RT-DWI has the best ADC repeatability at most of 12 positions (mean ADC absolute difference: 38.47-56.38×$10^{-6}$$mm^2$/s, limit of agreement (LOA): 17.33-22.52×$10^{-6}$$mm^2$/s). Among the six DWIs, the CNR were 19.42 ± 18.93 (cortex) and 12.90 ± 10.21 (medulla) with RT-DWI, which was better than them with FB-DWI (cortex: 14.78±8.56, medulla: 9.69±5.10, $p<0.05$), BH-DWI (cortex: 16.83±12.43, medulla: 8.56±7.26, $p<0.05$) and Z-DWI (cortex: 0.50±0.22, medulla: 0.30±0.16, $p<0.05$). For image quality, the two readers have excellent agreement on the image quality evaluation (Kappa value 0.950-1.000). RS-DWI and SS-EPI-based breathing schemes have significant differences in kidney clarity (K1), artifact severity (K2), image quality (K4), and overall image quality (K5) ($P<0.05$). RT-DWI has a higher score (5 points) than other DWIs in terms of imaging blur, severity of artifacts, sharpness of boundaries, clarity of the renal cortex and medulla, and overall image quality.
Conclusion: RT-DWI provides good image quality, sufficient CNR and highest ADC reproducibility on 3.0T MRI, which is thus recommended as the optimal kidney DWI sequence for clinical routine scan.

PU-066

# Investigated Diagnostic Value of Synthetic Relaxometry, Three-dimensional Pseudo-Continuous Arterial Spin Labelling and Diffusion-Weighted Imaging in the Grading of Glioma

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Background: To investigate the performance of synthetic relaxometry, three-dimensional pseudo-continuous arterial spin labelling (pCASL) and diffusion-weighted imaging (DWI) in differentiating high-grade gliomas (HGGs) from low-grade gliomas (LGGs).
Methods: Forty-six patients with gliomas (including 13 LGGs and 33 HGGs) were studied using synthetic magnetic resonance imaging (sy-MRI), pCASL, and DWI with a 3.0T MR scanner. Synthetic relaxometry including T1 relaxometry (T1) and T2 relaxometry (T2), as well as proton density (PD) from sy-MRI, cerebral blood flow (CBF) from pCASL and apparent diffusion coefficient (ADC) from DWI were analyzed by two radiologists (Reader A and Reader B). The *Student's t-test* or non-parametric *Mann-Whitney U test* was used to compare the parameters between LGGs and HGGs. The diagnostic performance was evaluated with multivariate logistic regression analysis and area under the receiver operating characteristic (ROC) analysis of all quantitative value. Correlations between the parameters and the label index of Ki-67 (Ki-67 LI) were analyzed by using *Spearman's* correlation analysis.
Results: Inter-observer agreement between the two experienced radiologists were great for T1 (ICC = 0.961), T2 (ICC = 0.949), ADC (ICC = 0.996) and CBF (ICC = 0.997), followed by PD (ICC = 0.909). T1 (1.58 ± 0.20 $10^3$msec), PD (86.03 ± 2.41 pu), and CBF (132.51 ± 48.07 (ml·100g$^-$

$^{1}\cdot min^{-1}$) values for HGGs were significantly higher than those in LGGs (1.41 ± 0.11 $10^{3}$msec, 82.67 ± 3.16 pu, 79.77 ± 49.92 ml·100$g^{-1}\cdot min^{-1}$) (all $P < 0.05$), whereas ADC values were significantly lower in HGGs (0.91 ± 0.23 $10^{-3}mm^{2}/s$) than LGGs (1.28 ± 0.16 $10^{-3}mm^{2}/s$) ($P < 0.01$). T2 were not significantly different between the 2 groups ($P$=0.21). The ADC values had higher discrimination abilities compared with other univariable parameters, with the AUC of 0.893. The combined T1, PD, and ADC or T1, PD, CBF and ADC model had the same best performance for differentiating LGGs and HGGs with AUC, sensitivity, specificity, positive predictive value, and negative predictive values of 0.988, 97.0%, 100%, 100%, and 92.9%, respectively. The ADC values were negatively correlated with the Ki-67 LI ($r$=-0.565, $P$<0.001), while PD ($r$=0.402, $P$<0.05) and CBF ($r$=0.309, $P$<0.05) values were positively correlated with it.
Conclusions: T1 relaxometry and PD derived from synthetic MRI were helpful for discriminating LGGs from HGGs whereas the overall diagnostic performance was inferior to the ADC. Combining T1, PD and ADC may explore as an effective and alternative strategy to improve the ability for discriminating glioma grade. Further, PD might be a novel predictor of Ki-67 LI.

# PU-067

## Synthetic MRI 联合 DSC 在胶质瘤分级及肿瘤细胞增殖活性预测中 的临床应用价值

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目的： 探讨合成磁共振成像(synthetic MRI, sy-MRI)联合动态磁敏感对比成像(dynamic susceptibility contrast, DSC)在胶质瘤分级及细胞增殖活性预测中的临床价值。
方法： 回顾性分析经手术病理证实的 60 例脑胶质瘤患者，其中低级别(low-grade glioma, LGG)22 例，高级别(high-grade glioma, HGG)38 例。所有患者术前行 sy-MRI 和 DSC 序列扫描，术后标本行 Ki-67 免疫组化染色。由两名放射科医师在自动生成的 T1 mapping、T2 mapping、相对脑血流量(relative cerebral flow, rCBF)和相对脑血容量(relative cerebral volume, rCBV)伪彩图上，选取肿瘤实质最大层面画取 ROI，并测量增强前 T1 值(native-T1)、T2 值(native-T2)、增强后 T1(enhanced-T1)、增强前后 T1 值变化的百分比(ΔT1)、rCBF 和 rCBV。利用参数检验(独立样本 t 检验)或非参数检验(Mann-Whitney U 检验)比较两组间 6 个参数的差异，利用 Spearman 法分析各参数与 Ki-67 标记指数(Ki-67 label index, Ki-67 LI)之间的相关性，采用受试者工作特征曲线(ROC)评估其在分级中的诊断效能。
结果： HGG 组 ΔT1(143.96 ± 82.21%)、rCBF(67.37 ± 45.77)和 rCBV(7.40 ± 3.97)均高于 LGG 组(10.82 ± 7.20%、30.73 ± 24.25、2.95 ± 2.32)(P<0.01)，HGG 组 enhanced-T1(698.27 ± 219.46ms)低于 LGG 组(1316.78 ± 143.73ms)(P<0.01)，native-T1(P=0.057)和 native-T2(P=0.121)在 LGG 和 HGG 之间没有统计学差异。ΔT1、rCBF、rCBV 与 Ki-67 LI 均成正相关(r 值分别为 0.643、0.324、0.411，P<0.05)，enhanced-T1 与 Ki-67 LI 成负相关(r=－0.619, P<0.01)。4 个参数鉴别高、低级别胶质瘤的 ROC 曲线下面积(AUC)分别为 0.972、0.990、0.775 和 0.849。
结论： Sy-MRI 能够反映组织微观结构信息，是胶质瘤分级诊断和预测肿瘤增殖活性的成像新技术，其中 ΔT1 的诊断效能最高。此外，DSC 可用于胶质瘤微血管灌注的评估，是评估分级的重要补充。

# PU-068

# 基于 DTI 探讨多发性硬化和视神经脊髓炎脑白质病灶区和看似正常的脑白质区损伤模式的差异

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目的：探讨多发性硬化（Multiple sclerosis, MS）和视神经脊髓炎谱系疾病（Neuromyelitis Optical Spectrum Disorder，NMOSD）在 20 条脑白质纤维束中脑病灶区(white matter lesions, WML)和看似正常脑白质区(normal-appearing white matter, NAWM)的 DTI 损伤差异，以及每条纤维束中 NAWM 的 DTI 参数值与 WML 的 DTI 参数值之间关联性。

方法：纳入 55 例健康对照组（HC）, 39 例 NMOSD 和 45 例 MS，并采集 3D-T1，Flair 和 DTI 序列图像。使用 LST 软件对每个患者的病灶进行分割，并基于病灶的分布将脑白质中 20 条纤维束分为纤维束病灶区及纤维束看似正常脑白质区。基于 FSL 计算每条纤维束中病灶区和看似正常脑白质区的 DTI 值进行组间比较。同时计算每条纤维束中看似正常脑白质区 DTI 参数值与病灶区之间的相关性。

结果：与 HC 相比，MS 和 NMOSD 的脑灰质和脑白质体积显著减低。与 NMOSD 比较，MS 的病灶体积显著增多，但是脑灰质体积和脑白质体积减低程度相似。MS 中 18 条纤维束存在病灶，在 NMOSD 中 13 条纤维束存在病灶。与 HC 相比，MS 和 NMOSD 各个纤维束的病灶区都存在下降的 FA，升高的 MD，AD 和 RD 值，而这些纤维束病灶中，与 NMOSD 相比，MS 仅有 2 条纤维的 FA 值更低，1 条纤维的 MD，AD 值和 2 条纤维的 RD 更高。与 HC 相比，MS 中 20 条 NAWM 中都存在下降的 FA，升高的 MD，AD 和 RD 值，而 NMOSD 仅 2 条纤维束中的 NAWM 中存在升高的 AD 值。与 NMOSD 相比，MS 有 19 条纤维束的 NAWM 的 FA 值更低，MD,AD 和 RD 值更高。在 MS 中，13 条纤维束的 NAWM 的扩散张量值与 WML 的扩散张量值显著相关，NMOSD 有 6 条 NAWM 的扩散张量值与 WML 的扩散张量值显著相关。
结论：MS 和 NMOSD 纤维束均存在微结构损伤，但 NAWM 和 WML 的损伤模式不同。MS 表现为 NAWM 和 WML 的广泛表现损伤，其中 WML 的损伤程度高于 NAWM。然而，在 NMOSD 患者中，纤维束中 NAWM 微结构损害程度低于 MS，但 WML 微结构损伤程度与 MS 相似。此外，MS 和 NMOSD 中 NAWM 的 DTI 参数值改变与 LWM 的损伤程度明显相关，且在 MS 疾病中更为明显。

PU-069

# 左右侧大脑半球缺血性脑卒中与左心室收缩功能关系的研究

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目的： 缺血性脑卒中与心功能不全之间存在一定联系，尤其是岛叶梗死会导致心脏自主神经功能紊乱。尽管研究表明缺血性脑卒中会引起心脏功能下降，但不同大脑半球卒中是否会改变左心室收缩功能尚不确定，因此有必要研究左右侧大脑半球梗塞与心脏收缩功能之间的关联。
方法： 我们回顾性收集 2020 年 1 月至 2021 年 5 月在我院神经内科住院治疗的脑梗死患者，所有患者入院后均完成了磁共振成像（包括弥散加权成像序列）、超声心动图检查，且具有脑梗前心电图、血液学检查数据，排除发生缺血性脑卒中前具有心功能不全（心电图或心肌酶异常）的患者，将这些入组患者按照梗死部位分为左半球梗死组和右半球梗死组。

结果： 纳入的 43 例患者中，左侧组有 21 例（63.6±3.5 岁），右侧半球组 22 例（64.0±3.5 岁）。两组间人口学特征无统计学差异（P>0.05），而左半球组左心室射血分数（LVEF）平均值（67.06±1.27）和左室短轴缩短率（FS）平均值（37.32±0.99）显着低于右半球组（71.04±1.22、40.49±1.04）(P<0.05)。
结论：本研究发现左右侧大脑半球梗死对应的左心室收缩功能（EF 和 FS）存在差异，这与左侧大脑半球受迷走神经调控，而迷走神经可保护机体，减轻炎症反应，降低心律失常发生率有关。因此为降低左心收缩功能下降的发生率，建议临床对于右半球脑卒中给予更多关注。

## PU-070

# 帕金森病患者基底节及小脑功能损伤与运动症状偏侧性及亚型相关

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背景：
帕金森病（Parkinson’s disease, PD）常表现为不对称的运动受累，且运动症状具有不同的受累特征，如不同的运动亚型，即以震颤为主型（Tremor-dominant, TD）和以强直为主型（Akinesia/Rigidity-dominant, AR）。拥有不同的运动症状偏侧性和运动亚型具有不同的疾病进展特征，然而其中的机制尚不清楚。本研究通过静息态功能磁共振（rs-fMRI）分析探索 PD 中运动症状的偏侧性与运动亚型对大脑区域内及区域间脑功能活动的影响以及潜在的机制。
材料与方法：
本研究共纳入 141 例 PD 患者和 40 例健康对照（NC），均为右利手。根据 PD 患者的症状偏重侧和运动亚型分为以下 4 组：（1）左侧-强直型（LAR，n=33）；（2）左侧-震颤型（LTD，n=31）；（3）右侧-强直型（RAR，n=35）；（4）右侧-震颤型（RTD，n=42）。所有被试均进行 MRI 扫描，对功能图像处理后获得低频振幅参数（ALFF），并以基底节区（包括双侧的尾状核、壳核、苍白球、丘脑）为种子点计算其与全脑体素水平的功能连接（FC）。我们采用单因素协方差分析和混合效应模型对上述指标进行分析。
结果：
全脑 ALFF 分析发现，右侧小脑功能活动在各组间存在差异，事后检验提示 LTD 的 ALFF 较 NC（P<0.001）、LAR（P<0.001）、RAR（P=0.008）升高（如图 1）；进一步发现 4 组 PD 患者于左侧岛叶和壳核存在交互作用（如图 2），在左侧症状为主的 PD 患者中，AR 上述脑区的 ALFF 较 TD 高（P=0.018）而右侧 AR 的 ALFF 较 TD 低（P=0.017）。基底节 FC 的分析发现，各组双侧基底节间及基底节-小脑间的 FC 存在差异，事后检验显示，4 组 PD 患者双侧基底节间的 FC 均较 NC 降低，而 PD 亚组间比较无差异；LAR 基底节-小脑间的 FC 较 NC 广泛降低，此外，发现 LAR 双侧尾状核与小脑的 FC 较 LTD 降低（如图 3）。进一步发现基底节区与小脑的 FC 存在症状偏侧性与运动亚型的交互作用（如图 4），其中左侧 AR 的 FC 较 TD 低，而右侧 AR 的 FC 较 TD 高。
结论：
本研究提示 PD 患者中，无论是何种亚型，左侧症状重者均较右侧有更严重的脑功能损伤特征，其中 TD 表现为大脑区域内，而 AR 表现为大脑区域间的功能损伤。此外，研究进一步提示基底节区和小脑及其网络的损伤可能是 PD 运动症状的偏侧性与运动亚型影响疾病的潜在脑部机制。

## PU-071

# Cholinergic relevant functional reactivity is associated with dopamine responsiveness of tremor in Parkinson's disease

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Background:
Tremor in Parkinson's disease (PD) has distinct responsiveness to dopamine, which is supposed not be exclusively related to dopamine deficiency but has a close relationship with cholinergic system. This phenomenon indicates that cholinergic system may be an important regulatory for distinct dopamine responsiveness of parkinsonian tremor.
Objective:
Through investigating the alterations of cholinergic and dopaminergic network during levodopa administration, we aimed at exploring the mechanisms of differed dopamine responsiveness of parkinsonian tremor.
Methods:
Fifty-two PD patients with tremor were enrolled. MRI scanning, UPDRS III and its sub-symptom scores were collected in OFF and ON status (dopaminergic challenge test). Then, patients were divided into two groups (dopamine-resistant tremor and dopamine-responsive tremor) according to the tremor change rate median score. Dopaminergic and cholinergic network were obtained. LASSO regression was conducted to identify functional connectivity with distinct reactivity during levodopa administration between groups (Fig 1). Afterwards, detailed group comparisons, interaction and correlation analyses were performed.
Results
The reactivity of cholinergic connectivity showed the highest possibility to distinguish two groups, especially connectivity of right basal forebrain 123 to right parietal operculum cortex (R.BF123-R.PO). After levodopa administration, connectivity of R.BF123-R.PO was decreased for dopamine-responsive tremor while which remained unchanged for dopamine-resistant tremor (Fig 2). The reactivity of R.BF123-R.PO was negatively correlated with tremor change rate.
Conclusions
Reduced cholinergic connectivity to parietal operculum may be an underlying mechanism for the responsive tremor in PD and the distinct cholinergic reactivity of parietal operculum to levodopa may be a core pathophysiology for the differed DA responsiveness of tremor in PD.

PU-072

# LI-RADS category 3, 4 and M observations: a multiple parameters diagnostic model based on serum biomarkers and MRI features for preoperative prediction of hepatocellular carcinoma

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Purpose: Hepatic lesions graded LR-1, LR-2 and LR-5 are commonly easy to assess, with high diagnostic accuracy, based on characteristic imaging features. LR-3, LR-4 and LR-M graded lesions are challenging to accurately assess and diagnose. This study attempts to combine potential clinical and/or MRI features for a more comprehensive hepatocellular carcinoma (HCC) vs. non-HCC diagnosis for patients with LR-3, LR-4 and LR-M graded lesions.

Methods: Data from eighty-two at-risk patients, with 86 LR-3, LR-4 and LR-M lesions, was retrieved from institutions 1. A prediction model was derived on the basis of multivariate logistic regression analysis. Furthermore, 66 patients from institution 1 (n = 35) and 2 (n = 31) with pathologically confirmed carcinomas (48 HCCs and 18 intrahepatic cholangiocarcinoma's (ICCs)) were selected for further analysis to identify the potential parameters for differentiation between HCC and ICC.
Results: Significant findings for differentiation of HCC and non-HCC, including MRI features and clinical factors, were identified with univariate and multivariate analyses. Serum α-fetoprotein (AFP) > 20 ng/mL (p = 0.006), septum (p = 0.011), and non-targetoid hepatobiliary phase (HBP) hyperintensity (p = 0.001) were confirmed as independent predictors of HCC. When combining the three predictors and mild-moderate T2 hyperintensity, the model showed good accuracy with a C index of 0.948. An AFP > 20 ng/mL (p = 0.033), carbohydrate antigen 19-9 (CA19-9) > 40 U/mL (p = 0.009) and targetoid appearance (p = 0.006) were significant parameters for differentiation between ICC and HCC. A model combining the three variables and septum demonstrated a C index of 0.934.
Conclusions: In at-risk patients with LR-3, LR-4 or LR-M lesions, integrating AFP, septum, non-targetoid HBP hypointensity and mild-moderate T2 hyperintensity achieved high diagnostic performance for HCC diagnosis. Combining CA19-9, AFP, septum, and targetoid appearance may be helpful for discriminating HCC from ICC.

# PU-073

# IVIM 直方图参数评价非特殊型浸润性乳腺癌预后因素的初步研究

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目的：探讨体素内不相干运动直方图参数评价非特殊型浸润性乳腺癌的多种预后因素，即雌、孕激素受体、人表皮生长因子受体-2 及增殖细胞核抗原、血管及淋巴管特异性标记物、腋窝淋巴结转移及分子分型。
材料与方法：回顾性分析 2018 年 9 月 20 日至 2020 年 11 月 10 日 125 例在兰州大学第一医院经病理确诊为 IBC-NST 的患者。所有患者在确诊前均行乳腺 MRI 检查，利用 FireVoxel 软件手动逐层勾画病灶边界，获得定量参数 ADC、D、D*和 f 图并进行直方图分析，所提取的直方图参数包括体积、均值、标准差、中位数、不均匀性、偏度、峰度、熵、最小值、最大值、百分位数。根据 ER、PR、Her-2、Ki-67、CD31、D2-40、ALNM、分子分型表达或状态进行分组，将所有 ADC、D、D*及 f 衍生直方图参数进行 Kolmogorov-Smirnov 检验验证其分布，再行 Mann-Whitney U 或独立样本 t 检验，以评估 IVIM 直方图指标在各预后因素组间是否存在差异，得到候选诊断指标；再通过 Spearman 秩相关分析补充 IVIM 直方图参数与 ER、PR、Her-2、Ki-67 间的潜在相关性；进而行主成分分析整合候选指标；利用 PCA 中的主成分基于 Logistic 回归建立 LG 模型，计算 ROC 曲线下面积评价 IVIM 直方图参数对多种预后因素的诊断效能。
结果：
1．Volume、ADC（Mean、Median、SD、Entropy、Kurtosis、Inhomogeneity、Min、Max、5th~45th、55th~95th）、D（Mean、SD、Entropy、Skewness、Kurtosis、Inhomogeneity、Min、Max、5th~80th、90th、95th）、f（Mean、SD、Kurtosis、Skewness、Inhomogeneity、5th、15th、20th、35th、85th）在不同预后因素分组中有不同程度的组间差异，差异有统计学意义（*P* 均＜0.05）。
2．ER 与 D 15th（$r_s$=-0.254，P=0.004），PR 与 D Max（$r_s$=0.266，*P*=0.046），Her-2 与 D 5th（$r_s$=0.191，*P*=0.033），Ki-67 与 ADC Max（$r_s$=0.300，*P*=0.001）分别在所对应组中相关性最强。

3．PCA 分析将 24、28、3、22、18、7、5、22、6、13 和 18 个候选诊断指标在 11 种二分类预后因素中分别“压缩”为 4、6、2、6、3、2、3、6、2、4 和 4 个 PCs, PCs 累积贡献率分别是 88.821%、86.382%、86.802%、88.815%、91.901%、86.190%、74.494%、91.275%、75.996%、88.474%、86.882%。ROC 结果显示 LG 模型相较于其他单个 IVIM 直方图参数（AUC 均＞0.5）显示出较好的诊断价值，其中 AUC 最大为 LG 预测 Luminal A 型（AUC=0.857，95%CI of AUC：0.751-0.962），AUC 最小为 LG 预测 Luminal B 型（AUC=0.645，95%CI of AUC：0.546-0.743）。
结论：IVIM 直方图参数可以预测 IBC-NST 的多种预后因素；不同 IVIM 直方图指标对 IBC-NST 多种预后因素的诊断效能存在差异，ADC 和 D 直方图衍生参数在预测本研究预后因素中优于 D*和 f 参数，最佳评价指标为 PCA 分析后的整合指标 LG 模型。

# PU-074

## 基于弥散加权成像在鉴别肝细胞肝癌级别及预后的价值

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研究背景 肝细胞肝癌（HCC）是第二大类致死肿瘤，弥散加权成像（DWI）在鉴别高低级别 HCC 中具有良好的诊断价值，但是 ADC 的鉴别阈值在不同的研究报道存在差异。本研究基于 ADC 图像的局部方差分析（LIV）以获得精确预测 HCC 级别和预后的影像生物学标志物。
研究方法 前瞻性收集 81 例 HCC 患者的术前数据（2018 年 1 月至 2021 年 1 月），纳排标准为：1）图像质量,2)肿瘤>1cm,3)术前没有行 TACE。最终 66 例 HCC 患者入组，包括 wd-HCC 16 例，md-HCC 30 例，pd-HCC 20 例，并完成随访获得患者的总体生存期（OS）。两位放射科医生利用 3D-slicer 软件独立勾画肿瘤区域 ROI，随后在 matlab 软件基于 Steiner translation theorem 公式计算 LIV 图像。基于动态磁敏感灌注 MRI 图像自动分割获得血管异质性相关的四个血流动力学生境。通过多重比较 ANOVA 比较不同级别 HCC 组间差异，。基于多变量 Cox 比例风险回归分析评价 LIV 在患者预后的应用价值。
结果 LIV 在 pd-HCC 与 md-HCC 具有显著性差异（p=0.048），pd-HCC 与 wd-HCC 具有统计趋势（p=0.069）。LIV 对预测 HCC 患者 OS 具有潜在效能（HR=20.77, p<0.05, 90%CI=2.3422~184.3507）。
结论 通过 LIV 分析精准定量 ADC 低信号区，可显著提高 ADC 在 HCC 鉴别诊断和预后的应用价值

# PU-075

## Functional connectivity of the central autonomic and default mode networks represent neural correlates and predictors of individual personality

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Background: There is solid evidence for the prominent involvement of the central autonomic and default mode systems in shaping personality. However, whether functional connectivity of these systems can represent neural correlates and predictors of individual variation in personality traits is largely unknown.
Methods: Resting-state functional magnetic resonance imaging data of 215 healthy young adults were used to construct the sympathetic (SN), parasympathetic (PN) and default mode (DMN) networks, with intra- and internetwork functional connectivity measured. Personality factors were

assessed using the five-factor model. We examined the associations between personality factors and functional network connectivity, followed by performance of personality prediction based on functional connectivity using connectome-based predictive modeling (CPM), a recently developed machine learning approach.
Results: All personality factors (neuroticism, extraversion, conscientiousness, and agreeableness) other than openness were significantly correlated with intra- and internetwork functional connectivity of the SN, PN and DMN. Moreover, the CPM models successfully predicted conscientiousness and agreeableness at the individual level using functional network connectivity.
Conclusion: Our findings of better personality correlation and prediction performances by focusing on these key networks may not only expand existing knowledge regarding the neural substrates underlying personality, but also highlight the superior sensitivity of hypothesis-driven over data-driven approaches for characterizing the relationship between functional connectivity and human behavior.

PU-076

## Brain structure and perfusion in relation to serum renal function indexes in healthy young adults

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Background: Prior neuroimaging studies of the relationship between the kidney and the brain have been limited to clinical populations and have largely relied on a single modality. We sought to examine the kidney-brain associations in healthy subjects using a combined analysis of multi-modal imaging data.
Methods: Structural, diffusion, and perfusion magnetic resonance imaging (MRI) scans were performed to measure cortical thickness, white matter integrity, and cerebral blood flow in 157 healthy young adults. Peripheral venous blood samples were collected to measure serum renal function indexes. Correlation analyses were performed to investigate the relations between brain MRI measures and renal function indexes.
Results: Results showed that higher serum uric acid level was associated with increased cortical thickness in the transverse temporal gyrus. We also found that decreased serum creatinine level was linked to lower white matter integrity in the sagittal stratum, anterior corona radiata, superior corona radiata, and external capsule. Furthermore, we observed that increased serum uric acid level was related to hyperperfusion in the opercular and triangular parts of inferior frontal gyrus and supramarginal gyrus, and hypoperfusion in the calcarine sulcus, cuneus and lingual gyrus. More importantly, mediation analysis revealed that the relationship between serum uric acid and working memory performance was mediated by perfusion in the supramarginal gyrus and lingual gyrus.
Conclusions: These findings not only may extend current knowledge regarding the relationship between the kidney and the brain, but also may inform real-world clinical practice by identification of potential brain regions vulnerable to renal dysfunction.

PU-077

# Associations of serum liver function markers with brain structure, function and perfusion in healthy young adults

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Background: Previous neuroimaging studies have demonstrated brain abnormalities in patients with hepatic diseases. However, the identified liver-brain associations are largely limited to disease-affected populations, and the nature and extent of such relations in healthy subjects remain unclear.
Method: 157 healthy young adults underwent structural, resting-state functional and arterial spin labeling MRI scans. Gray matter volume (GMV), regional homogeneity (ReHo) and cerebral blood flow (CBF) analyses were performed to assess brain structure, function and perfusion, respectively. Peripheral venous blood samples were collected to measure serum liver function markers. Correlation analyses were conducted to test potential associations between liver function markers and brain imaging parameters.
Results: First, serum proteins showed relations to brain structure characterized by higher albumin associated with increased GMV in the parahippocampal gyrus and amygdala, and lower globulin and higher albumin/globulin ratio with increased GMV in the olfactory cortex and parahippocampal gyrus. Second, serum bilirubin was linked to brain function characterized by higher bilirubin associated with increased ReHo in the precuneus, middle cingulate gyrus, inferior parietal lobule and supramarginal gyrus, and decreased ReHo in the caudate nucleus. Third, serum alanine transaminase (ALT) was related to brain perfusion characterized by higher ALT associated with increased CBF in the superior frontal gyrus and decreased CBF in the middle occipital gyrus, angular gyrus, precuneus and middle temporal gyrus. More importantly, we found that CBF in the superior frontal gyrus was a significant mediator of the association between serum ALT level and working memory performance.
Conclusion: These findings may not only expand existing knowledge about the relationship between the liver and the brain, but also have clinical implications for studying brain impairments secondary to liver diseases as well as providing potential neural targets for their diagnosis and treatment.

PU-078

# 磁共振小肠造影对克罗恩以外小肠疾病的评价

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横断面成像技术在小肠疾病无创性评估中的应用越来越多。磁共振小肠造影（MagneticResonanceEnterography, MRE）在评价克罗恩疾病方面的有效性在文献中有很好的描述。此外，尽管文献报道较少，但是 MRE 在评估其他小肠疾病方面的作用也在不断发展，包括起源于孤立性或息肉病综合征（如家族性粘膜皮肤色素沉着胃肠道息肉病，即 Peutz-Jeghers 综合征）的各种良、恶性肿瘤，炎症性疾病（如感染性小肠炎、缺血性肠病、治疗性肠炎），憩室疾病，结缔组织病。MRE 也可用于评估小肠梗阻。与计算机断层扫描（Computed Tomography, CT）相比，磁共振（Magnetic Resonance）在肠道成像评估中的优势包括良好的软组织分辨率，无电离辐射，能够获取多序列、多参数、多平面的原始图像数据以及安全性更好的静脉造影剂。MRE 还可以通过在口服对比剂后不同时间间隔的重复序列，动态评估小肠的蠕动情况、肠腔狭窄区域及肿块的扩张情况。本文归纳了我们对 MRE 评估克罗恩以外的小肠疾病方面的经验，并进行了相关的描述及图示。

PU-079

# The value of dynamic contrast-enhanced magnetic resonance imaging combined with apparent diffusion coefficient in the differentiation of benign and malignant diseases of the breast

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Purpose: To investigate the diagnostic value of DCE-MRI combined with ADC in benign and malignant breast lesions.Methods: The clinicopathological imaging data included 168 patients (177 lesions) with breast lesions who underwent convention breast MRI, DCE-MRI, and diffusion-weighted imaging (DWI); they were divided into the benign lesion group (n=39) and malignant lesion group (n=129) based on pathology.Results: Using the type III outflow curve as a diagnostic criterion for malignant breast lesions, the diagnostic sensitivity was 76.9%, the specificity was 80%, the correct rate was 72.2%, and its area under the curve (AUC) was 0.823. Using an enhancement ratio > 100% as a diagnostic criterion for malignant breast lesions, the sensitivity was 61.5%, specificity was 80%, and AUC was 0.723. Using > 3 ipsilateral vessels as a diagnostic criterion for malignant lesions in the breast resulted in a diagnostic sensitivity of 81.6%, a specificity of 80.8%, and an AUC of 0.805.Conclusion: The type of time intensity curve DCE-MRI, the early enhancement rate in the first phase, the number of ipsilateral vessels, and the ADC full volume histogram of the blood supply score and DWI are valuable in the diagnosis of benign and malignant breast lesions.

PU-080

# Quantitative magnetic resonance imaging shows brain microstructural abnormalities in children with autism

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Objective: To explore the application of quantitative magnetic resonance imaging of brain microstructural in children with autism.
Methods: Sixty autistic children aged 2-3 years and 60 age- and sex-matched healthy children participated in the study. All the children were scanned using head MRI conventional sequences, 3D-T1, diffusion kurtosis imaging (DKI), enhanced T2*-weighted angiography (ESWAN) and 3D-pseudo continuous Arterial Spin-Labeled (3D-pcASL) sequences. The iron content, cerebral blood flow and brain microstructure of each brain area were compared between the groups, and correlations were analyzed.
Results: The iron content and cerebral blood flow in the frontal lobe, temporal lobe, hippocampus, caudate nucleus, substantia nigra and red nucleus of the study group were lower than those in the corresponding brain areas of the control group ($p < 0.05$). The mean kurtosis (MK), radial kurtosis (RK) and axial kurtosis (AK) values of the frontal lobe, temporal lobe, putamen, hippocampus, caudate nucleus, substantia nigra and red nucleus in the study group were lower than those of the corresponding brain areas in the control group ($p < 0.05$). The mean diffusivity (MD) and fractional anisotropy of kurtosis (FAK) values of the frontal lobe, temporal lobe and hippocampus in the control group were lower than those in the corresponding brain areas in the study group ($p < 0.05$).

Conclusion: The iron content and cerebral blood flow in the frontal lobe, temporal lobe, and hippocampus of the autistic children were lower than those of the healthy children, and the brain microstructures of the autistic children also showed changes.

PU-081

## Dynamic functional connectome predicts individual working memory performance across diagnostic categories

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Working memory impairment is a common feature of psychiatric disorders. Although its neural mechanisms have been extensively examined in healthy subjects or individuals with a certain clinical condition, studies investigating neural predictors of working memory in a transdiagnostic sample are scarce. The objective of this study was to create a transdiagnostic predictive working memory model from whole-brain functional connectivity using connectome-based predictive modeling (CPM), a recently developed machine learning approach. Resting- state functional MRI data from 242 subjects across 4 diagnostic categories (healthy controls and individuals with schizophrenia, bipolar disorder, and attention deficit/hyperactivity) were used to construct dynamic and static functional connectomes. Spatial working memory was assessed by the spatial capacity task. CPM was conducted to predict individual working memory from dynamic and static functional connectivity patterns. Results showed that dynamic connectivity-based CPM models successfully predicted overall working memory capacity and accuracy as well as mean reaction time, yet their static counterparts fell short in the prediction. At the neural level, we found that dynamic connectivity of the frontoparietal and somato-motor networks were negatively correlated with working memory capacity and accuracy, and those of the default mode and visual networks were positively associated with mean reaction time. Moreover, different feature selection thresholds, parcellation strategies and model validation methods as well as diagnostic categories did not significantly influence the prediction results. Our findings not only are coherent with prior reports that dynamic functional connectivity encodes more behavioral information than static connectivity, but also help advance the translation of cognitive “connectome fingerprinting” into real-world application.

PU-082

## Cerebellar-cerebral dynamic functional connectivity alterations in major depressive disorder

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BACKGROUND: The cerebellum plays an important role in the neural mechanism of depression and its static functional connectivity (FC) with the cerebrum is disrupted in patients with major depressive disorder (MDD). However, cerebellar-cerebral dynamic FC alterations in MDD remain largely unknown. METHODS: 50 patients with MDD and 36 well-matched healthy controls underwent resting-state functional magnetic resonance imaging. Cerebellar-cerebral dynamic FC analyses were performed using the cerebellar seeds previously identified as being involved in the executive, default-mode, affective-limbic, and motor networks. Inter-group differences in the

cerebellar dynamic FC and their associations with clinical and cognitive variables were examined. RESULTS: Compared to healthy controls, patients with MDD had decreased cerebellar-cerebral dynamic FC of the cerebellar subregions connecting with the executive, default-mode and affective-limbic networks. The dynamic FC of the cerebellar subregion connecting with the affective-limbic network was related to severity of depression and anxiety symptoms in MDD patients. The dynamic FC of the cerebellar subregions connecting with the default-mode and affective-limbic networks were related to sustained attention and prospective memory in controls, while the correlations were inverse or non-significant in patients. LIMITATIONS: The fairly modest sample size and potential medication effect may increase the instability of the results. CONCLUSIONS: Our findings provide further evidence for the pivotal role of the cerebellum in the neuropathology of depression, pointing to potential targets of cerebellar-cerebral pathways for alternative intervention or monitoring therapeutic responses.

## PU-083

# Large-Scale Internetwork Functional Connectivity Mediates the Relationship between Serum Triglyceride and Working Memory in Young Adulthood.

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Previous research has demonstrated that serum lipid profile is associated with cognitive function as well as brain structure and function in middle-aged, elderly and clinical populations. However, the nature and extent of lipids-brain-cognition relationships in young adulthood are largely unknown. In this study, 157 healthy young adults underwent resting-state functional MRI scans. Functional connectivity between and within 14 functional networks were calculated using independent component analysis. Peripheral venous blood samples were collected to measure serum lipids. Working memory was assessed using a 3-back task. Linear regression, correlation and mediation analyses were conducted to test for potential associations between serum lipids, inter- and intranetwork functional connectivity, and working memory performance. We found that higher serum triglyceride (TG) level was correlated with stronger connectivity between left frontoparietal and ventral attention networks, between right frontoparietal and dorsal attention networks, between right frontoparietal and dorsal sensorimotor networks, between right frontoparietal and lateral visual networks, and between salience (SN) and ventral sensorimotor (vSMN) networks, as well as lower connectivity between posterior default mode and left frontoparietal networks, between left frontoparietal and medial visual networks, and between ventral attention and dorsal sensorimotor networks. In addition, higher SN-vSMN connectivity was related to lower 3-back accuracy. More importantly, the relationship between serum TG and 3-back accuracy was mediated by SN-vSMN connectivity. Our findings not only may expand existing knowledge regarding serum lipids-brain-cognition relations from the perspective of large-scale functional network organization, but also may inform a translational conceptualization of how to improve cognitive function through regulating serum lipids.

## PU-084

# Relationship between illness duration, corpus callosum changes, and sustained attention dysfunction in major depressive disorder

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Background: Illness duration is the main index of cumulative illness severity during depression progression. Corpus callosum (CC) damage is among the most replicated neurobiological findings in major depressive disorder (MDD). We aimed to investigate the nature and extent of the association between illness duration and CC changes.
Methods: Ninety-six MDD patients and 50 controls underwent diffusion and resting-state functional magnetic resonance imaging (fMRI). White matter micro-structure and inter-hemispheric functional connectivity were quantified by fractional anisotropy (FA) and voxel-mirrored homotopic connectivity (VMHC). The CC was reconstructed by tractography and divided into five sub-regions. The associations of illness duration with FA of each CC sub-region and voxel-wise VMHC were examined using correlation analyses. Also, we investigated the potential relationship between illness duration, CC changes, and clinical variables using mediation analyses.
Results: In MDD patients, longer illness duration was selectively associated with lower FA of CC sub-regions 2 [partial correlation coefficient (pr) =–0.269, P=0.009] and 5 (pr=–0.296, P=0.004) as well as higher VMHC in the supplementary motor areas (pr=0.378, P<0.001), precuneus (pr=0.384, P<0.001), and lingual gyrus (pr=0.373, P<0.001) connected by the affected CC sub-regions. Further subgroup analyses demonstrated pronounced FA decrease and VMHC increase in patients with illness duration over 20 years relative to healthy controls (HC) and other patient subgroups with shorter illness durations. Moreover, lower FA of CC sub-regions 2 and 5 mediated the association between longer illness duration and more severe sustained attention dysfunction.
Conclusions: These findings provide evidence for compromised structure yet compensatory function of the CC with increasing depression illness duration, which may inform effective antidepressant treatment strategies at different disease stages.

PU-085

## Neural correlates of the association between depression, serum concentration of vitamin D change and cognitive dysfunction in female

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Background: Depression has been linked to vitamin D deficiency. Female has the higher morbidity in depression and lower serum concentration of vitamin D (SCVD) than male. Previous studies have demonstrated that abnormities of both resting-state brain activity and cognitive

dysfunction are frequently observed in patients with major depressive disorder (MDD). However, there is a paucity of literature investigating the underlying relationship among these aspects.
Methods: One hundred and twenty-two patients with MDD and 119 matched controls underwent resting-state functional MRI. Fractional amplitude of low-frequency fluctuation (fALFF) was used to measure brain function. Peripheral venous blood samples were collected to measure SCVD. The interaction effect of group × gender on SCVD as well as inter-group differences in cognition and fALFF were tested. The relationship among SCVD, fALFF changes and cognition were investigated using correlation and mediation analyses.
Results: A significant interaction effect of group × gender on SCVD. Specifically, there were significant inter-group differences in females, but not males, and females had lower SCVD both in patient and control groups. Meanwhile, patients exhibited cognitive decline, and significant positive correlations were demonstrated between SCVD and cognition only in females. Moreover, compared with female controls, the female patients exhibited incresed fALFF in middle temporal gyrus, angular gyrus, middle cingulate cortex, precuneus, cuneus and middle occipital gyrus, and decreased fALFF in supramarginal gyrus and middle frontal gyrus. The further correlation analyses revealed significant negative correlations between SCVD and fALFF of middle temporal gyrus, angular gyrus, precuneus, middle cingulate cortex and cuneus, and significant positive correlation between SCVD and fALFF of middle frontal gyrus in females. In addition, in females, cognition was correlated with the SCVD-sensitive neural activity, which could serve as mediators of the associations between SCVD and these cognition variables.
Conclusion: These findings help to identify neural correlates of the associations between depression, SCVD change and cognitive dysfunction in females, which may provide new insight into intervention, treatment and prevention of depression and cognitive deficits from the perspective of regulating serum vitamin D level.

PU-086

# Serum concentration of vitamin D deficiency, cognitive dysfunction and functional connectivity abnormalities in female patients with major depressive disorder

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Background: Major depressive disorder (MDD) has been linked to vitamin D deficiency. Female has the higher morbidity in depression and lower serum concentration of vitamin D (SCVD) than male. Previous studies have reaveled that abnormities of functional connectivity density (FCD) and functional connectivity (FC), and cognitive dysfunction are frequently observed in patients with MDD. However, there is no literature investigating the underlying relationship among these aspects.
Methods: One hundred and twenty-two patients with MDD and 119 matched controls underwent resting-state functional MRI. FCD and FC were used to measure brain function. Peripheral venous blood samples were collected to measure SCVD. The interaction effect of group × gender on SCVD as well as inter-group differences in cognition and brain imaging measures were tested. The relationship among SCVD, brain imaging measures and cognition were investigated using correlation and mediation analyses.
Results: A significant interaction effect of group × gender on SCVD. Specifically, there were significant inter-group differences in females, but not males, and females had lower SCVD both in patient and control groups. Meanwhile, patients exhibited cognitive decline, and significant positive correlations were demonstrated between SCVD and cognition only in females. Moreover, compared with female controls, female patients exhibited incresed FCD in middle cingulate cortex, decreased FCD in putamen and middle frontal gyrus (MFG), and decreased FC

between MFG seed and lateral temporal cortex, inferior temporal gyrus and inferior frontal gyrus. The further correlation analyses revealed significant positive correlations between SCVD and FCD of MFG as well as above FC in females. In addition, in females, cognition was positively correlated with SCVD-sensitive imaging measures, which could serve as mediators of the associations between SCVD and these cognition variables.
Conclusion: Our findings suggest that SCVD deficiency may help elucidate the neural mechanisms of cognitive deficits in female depression, which may provide new insight into intervention, treatment and prevention of depression and cognitive decline from the perspective of regulating SCVD.

PU-087

# The relationship between large-scale functional network connectivity, serum concentration of vitamin D and cognition in female patients with major depressive disorder

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Background: Major depressive disorder (MDD) has been linked to vitamin D deficiency. Female has the higher morbidity in depression and lower serum concentration of vitamin D (SCVD) than male. Previous studies have reaveled that abnormity of large-scale neural networks, and cognitive dysfunctions are frequently observed in patients with MDD. However, there is no literature investigating the underlying relationship among them.
Methods: One hundred and twenty-two patients with MDD and 119 matched controls underwent resting-state functional MRI. Large-scale inter- and intranetwork functional connectivity were used to measure brain function. Peripheral venous blood samples were collected to measure SCVD. The interaction effect of group × gender on SCVD as well as inter-group differences in cognition and inter- and intranetwork functional connectivity were tested. The relationship among SCVD, functional network connectivity, and cognition were investigated using correlation and mediation analyses.
Results: A significant interaction effect of group × gender on SCVD. Specifically, there were significant inter-group differences in females, but not males, and females had lower SCVD both in patient and control groups. Meanwhile, patients exhibited cognitive decline, and significant positive correlations were demonstrated between SCVD and cognition only in females. Moreover, compared with female controls, female patients exhibited reduced internetwork connectivity in auditory network (AN) to dorsal attention network (DAN) and posterior visual network to left frontoparietal network, and increased internetwork connectivity in AN to anterior default mode network, ventral attention network (VAN) to sensorimotor network (SMN) and SMN to salience network, and increased intranetwork connectivity in DAN, posterior default mode network (pDMN), right frontoparietal network, SMN and medial visual network. The further correlation analyses revealed significant negative correlations between SCVD and internetwork connectivity in VAN to SMN as well as intranetwork connectivity in DAN and pDMN in females. Moreover, depressive and anxietive symptoms were negatively associated with internetwork connectivity in VAN to SMN in female patients. In addition, in females, cognition was negatively correlated with the SCVD-sensitive connectivity, which could serve as mediators of the associations between SCVD and these cognition variables.
Conclusion: These findings might expand existing depressive biological knowledge concerning the SCVD-brain-behavior relationships from the perspective of large-scale functional network organization. More generally, they may provide new insight into intervention, treatment and prevention of depression and cognitive deficits from the perspective of regulating SCVD.

PU-088

# ZOOMit DWI Compared With Conventional full-field-of-view DWI for the Detection of Early Gastric Cancer

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**Objective**: To assess the diagnostic performance of ZOOMit diffusion-weighted imaging (ZOOMit DWI) and conventional full field of view DWI in detecting patients with early gastric cancer (EGC).

**Methods:** Eight patients with pathologically-proven EGC were included in the respective study. All patients underwent pre-treatment magnetic resonance imaging (MRI) studies including ZOOMit DWI and conventional DWI on a 3.0T MRI scanner. The apparent diffusion coefficient (ADC) values of the tumor and adjacent normal gastric tissue were derived and the mean, standard deviation (SD) were calculated. Quantitatively and qualitatively image quality assessment were compared with ZOOMit DWI and conventional DWI, as well as the capability of lesion identification.
**Results:** The contrast-to-noise ratio (CNR) of the ZOOMit DWI was significantly higher than that of the conventional DWI ($P < 0.01$), while the signal-to-noise ratio (SNR) was significantly lower than that of conventional DWI ($P < 0.01$). The subjective score of ZOOMit DWI was significantly higher than that of conventional DWI ($P < 0.01$). A reduction in ADC values with ZOOMit DWI emerged for both lesion and normal gastric tissue. The ADC value calculated from ZOOMit DWI was significantly lower than that of the conventional DWI group. The number of lesions detected from the ZOOMit DWI was higher than that detected from the conventional DWI.
**Conclusion:** The application of ZOOMit DWI in patients of EGC is feasible and promising, based on both qualitative and quantitative analyses. ZOOMit DWI showed significantly better performance for detecting EGC than conventional DWI. This technique has potential for improving the diagnostic accuracy of conventional DWI for the study of EGC.

PU-089

# MR 扩散张量成像技术在急性前交叉韧带损伤中的应用价值

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**目的：**探讨 3.0T 磁共振扩散张量成像（DTI）技术在急性前交叉韧带（ACL）损伤中的应用价值。
**方法：**对 40 例急性 ACL 损伤者和年龄匹配的 35 例健康志愿者行常规 MRI 及 DTI 扫描，分别测量 ACL 股骨端、中间段、胫骨端感兴趣区（ROI）的各向异性值（fractional anisotropy，FA）、表观扩散系数值（apparent diffusion coefficient，ADC），同时应用纤维束示踪成像（DTT）追踪 ACL 的纤维走向，直观显示纤维束的细微结构及空间分布。比较急性前交叉韧带损伤组与对照组的 FA 值及 ADC 值差异；比较 DTI 与常规 MRI 成像对 ACL 损伤的诊断效能；对 ACL 进行 DTI 测量的可重复性研究。
**结果：**ACL 损伤组、对照组的平均 FA 值分别为 0.279±0.041、0.495±0.038，平均 ADC 值分别为 2.884±0.163（×10-3mm2/s）、1.582±0.320（×10-3mm2/s），两者间均有显著性差异（P＜0.001）。DTI 对 ACL 损伤的敏感度、特异度、精确度及 Kappa 值分别为 96.8%、81%、92.7%、0.798，常规 MRI 对 ACL 损伤的敏感度、特异度、精确度及 Kappa 值分别为 79%、71%、

77.6%、0.453，DTI 各项数据均高于常规 MRI，两者间差异具有统计学意义（P＝0.012）。ACL 损伤组 DTT 成像均表现为纤维束走行中断，断端形态增粗，结构不规则，色阶混杂；对照组 32 例 ACL 整体纤维束规则，走行连续、自然，色阶较均匀，其余 3 例 ACL 局部纤维束毛糙，但连续性存在。ACL 两组 DTI 重复资料的 FA 值及 ADC 值之间的差异均不具有统计学意义 (P>0.05)，且具有明显相关性。

**结论：**DTI 能够定量评价急性 ACL 损伤的走行和连续性，其诊断价值较高。

PU-090

## Metabolic and neural mechanisms underlying the associations between gut Bacteroides and cognition: a large-scale functional network connectivity study

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Background: There is a proof-of-concept that microbial metabolites provide a molecular connection between the gut and the brain. Extensive research has established a link between gut Bacteroides and human cognition, yet the metabolic and neural mechanisms underlying this association remain largely unknown.
Methods: We collected fecal samples, resting-state functional MRI, and cognitive data from a large and homogeneous sample of 157 healthy young adults. 16S rRNA gene sequencing was conducted with abundances of Bacteroides and metabolic pathways quantified by species annotation and functional prediction analyses, respectively. Large-scale intra- and internetwork functional connectivity was measured using independent component analysis.
Results: Results showed that gut Bacteroides were related to multiple metabolic pathways, which in turn were associated with widespread functional network connectivity. Furthermore, functional network connectivity mediated the associations between some Bacteroides-related metabolic pathways and cognition. Remarkably, arginine and proline metabolism, phenylalanine metabolism, and biosynthesis of unsaturated fatty acids act as the key metabolic pathways that are most contributive, and the executive control and sensorimotor systems contribute most strongly at the neural level.
Conclusions: Our findings suggest complex poly-pathway and poly-network processes linking Bacteroides to cognition, more generally yielding a novel conceptualization of targeting gut Bacteroides as an intervention strategy for individuals with cognitive impairment.

PU-091

## Conventional and three-dimensional magnetic resonance imaging as a noninvasive method in the diagnosis of polycystic ovary syndrome

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Purpose To investigate the diagnostic performance of ovarian morphology parameters measured by ultrasound (US), conventional and three-dimensional (3D) magnetic resonance imaging (MRI) in patients with polycystic ovary syndrome (PCOS), and to compare the value of different commodities.
Materials and methods In this prospective study, 58 PCOS patients and 60 healthy women were recruited and performed US, conventional and 3D MRI. The ovarian morphology parameters including ovary volume, total follicle number were measured on the three modalites, and the largest follicle number was counted on a single transverse, sagittal and coronal section of conventional and 3D T2-weighted imaging (T2WI). These parameters were compared between PCOS and control groups using two independent-sample t-tests or Mann-Whitney U tests. Receiver operating characteristic (ROC) curve analysis and DeLong test were performed to evaluate the diagnostic performance of these parameters.
Results The ovary volume (OV) and follicle numbers were significantly larger in the PCOS group than in the control group. There were significant differences in the diagnostic efficacy of follicle numbers on US, conventional and 3D MRI. For follicle counts, the area under the curves (AUC) of both conventional and 3D MRI were superior to US. The diagnostic efficacy of FN-1 (mean follicle number of 1-9 mm on 3D MRI) was superior to FNC (mean follicle number with diameter of 1-9 mm on conventional MRI). FN-1 was superior to FN-2 (mean follicle number of 2-9 mm on 3D MRI). For follicle numbers of a single section, MFNC-1 (maximum follicle number of 1-9 mm on single coronal section) was superior to MFNC-2 (maximum follicle number of 2-9 mm on single coronal section), MFNS-1 (maximum follicle number of 1-9 mm on single sagittal section) and MFNC-1 were superior to MFNT-1 (maximum follicle number with diameter of 1-9 mm on single transverse section), and MFNS-2 (maximum follicle number of 2-9 mm on single sagittal section) was superior to MFNT-2 (maximum follicle number of 2-9 mm on single transverse section). Among them, the best diagnostic performances were found in the FN-1, MFNS-1, MFNC-1 and MFNS-2. The optimal cut-off FN-1 of 21.5 follicles yielded an highest AUC of 0.943 (95% CI: 0.906, 0.981), with the sensitivity, specificity and accuracy of 82.8%, 91.7% and 87.3%, respectively. There were no significant differences in the diagnostic efficacy of ovarian volume among US, conventional and 3D MRI.
Conclusions MRI was superior to US in the diagnosis of PCOS. 3D MRI could display small follicles of less than 2 mm and improve diagnostic performance for PCOS. The MFNC-1 or MFNS-1 on single T2WI section was suggested if 3D MRI was not available.

PU-092

# Gd-EOB-DTPA 增强 MRI T1 mapping 鉴别不同分化程度肝细胞癌的价值

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目的：探讨钆塞酸二钠（Gd-EOB-DTPA）增强 MRI T1 mapping 技术对不同分化程度肝细胞癌（HCC）的鉴别诊断价值。方法：回顾性分析 2017 年 7 月至 2020 年 5 月桂林医学院附属医院经手术病理证实为肝细胞癌患者 50 例，所有患者术前 1 个月内均进行过 Gd-EOB-DTPA 增强 MRI 扫描，采用可变多翻转角 T1 mapping 成像技术，获得增强前、增强后 20min 的 T1 mapping 图像，分别测量增强前及增强后 20min 的 T1 弛豫时间 T1pre、T1post，并计算 T1 弛豫时间减低率（ΔT1%）。根据病理结果，将患者分为 3 组，高分化 HCC 16 例，中分化 HCC 27 例，低分化 HCC 7 例。采用单因素方差分析比较不同组之间 T1pre、T1post、ΔT1%的差异。采用 Spearman 等级相关分析评价 T1pre、T1post、ΔT1%与不同分化程度 HCC 的相关性。采用受试者工作特征曲线（ROC）评估 T1pre、T1post、ΔT1%对不同分化程度 HCC 的鉴别诊断效能。结果：3 组不同分化程度 HCC 间的 T1post、ΔT1%差异具有统计学意义（P<0.05），T1pre 差异无统计学意义

（P>0.05）。T1post 和 ΔT1%对于鉴别高分化与中分化、高分化与低分化、低分化与中分化 HCC 的 ROC 曲线下面积分别为 0.752、0.911、0.709，0.775、0.973、0.857；T1post 与 HCC 的分化程度呈负相关（r 值为-0.512，p<0.05），ΔT1%与 HCC 的分化程度呈正相关（r 值为 0.614，p<0.05）。ΔT1%的诊断效能更高。结论：Gd-EOB-DTPA 增强 MRI T1 mapping 成像对不同分化程度 HCC 具有鉴别诊断价值，可以作为术前预测 HCC 病理分级的一种较为可靠的无创检查手段。

PU-093

# 3D-动态增强 MRI 在肺部实性孤立结节的血管构筑评估的应用研究

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目的：探讨动态增强 MRI 定量参数在肺部实性孤立结节的血管构筑评估的应用价值。方法：收集广西医科大学第一附属医院经手术证实为肺部良恶性结节 32 例患者资料，所有患者术前均使用德国西门子 3.0TMR 扫描仪行常规胸部 MRI 平扫和 DCE-MRI 扫描，运用 8 通道体部线圈加以固定；将原始数据手动导入图像灌注处理软件 Tissu4D 行多参数测值，获取肺部实性孤立结节的 Ktrans、Kep 和 Ve 值最终平均数据及时间-信号（TIC）曲线，所有患者标本均采用 CD31、VEGF、SMA 免疫组化标记，运用图像分析软件 ImageJ 获取血管构筑各参数值。采用独立样本 t 检验比较肺良恶性结节间 DCE-MRI 各定量参数的差异，评价 DCE-MRI 各定量参数在不同分化程度及与病理分期的差异分别采用单因素 ANOVA 检验及 Kruskal-Wilk H 检验统计学方法；运用 Pearson 相关分析找到 DCE-MRI 各定量参数与各血管构筑参数的相关性。分析 DCE-MRI 定量参数诊断效能依靠绘制 ROC 曲线，计算出曲线下面积（AUC），并获得约登指数及有助于鉴别诊断疾病的最佳阈值。结果：所有入组病人以病理结果分为两大组：良性组和恶性组，后者再以分化程度及病理分期分为高、中、低分化组和 T1、T2、T3、T4 组。不同良、恶性肺结节组间 Ktrans 及 Ve 值存在统计学意义（P＜0.05）；不同分化程度组别间进行分析，Ktrans 值随着分化程度降低而逐渐升高，且具有统计学意义（P＜0.05）；在不同病理分期组别间进行比较，Ktrans、Kep、Ve 值随着分期增高逐渐升高，且均有统计学意义（P＜0.05）；Ktrans、Kep 与微血管参数（CD31-MVD、VEGF、MPI）均有相关性（P＜0.05）；Ve 与微血管参数（CD31-MVD、VEGF）有相关性（P＜0.05），但与表示血管成熟度参数 MPI 无相关性；经绘制 ROC 曲线分析显示，Ktrans、Kep 及 Ve 值诊断肺部恶性结节的 ROC 下面积分别为 0.922、0.521 和 0.911，其阈值可作为鉴别诊断的临界值。结论：1、磁共振动态增强扫描对于评估肺结节病理分级及分化程度具有一定的诊断价值，其中 Ktrans 值在不同分化程度中具有诊断价值，并具有显著差异； Ktrans、Kep 及 Ve 值在不同病理分级中均具有诊断价值，其中 Ve、Kep 值较 Ktrans 值差异更为显著；2、DCE-MRI 定量渗透性参数可以间接量化肿瘤微血管生成量、血流灌注特性，反映肿瘤微血管成熟度，进而动态、重复的观察评价肺实性孤立结节血管的构筑情况；3、血管构筑参数 SMA-MVD 及 MPI 值能量化反映在良恶性结节中成熟血管与不成熟血管的情况；VEGF 及 CD31-MVD 能否评估不同性质实性孤立肺结节血管构筑，还需要加大样本量进一步研究；4、磁共振动态增强能够作为鉴别不同性质肺结节的一种有效辅助手段，绘制 ROC 曲线后找到鉴别诊断的临界值，并且具有较高的灵敏性、特意性，对其临床治疗及预后评估有一定的指导意义。

PU-094

# 术前不同 DWI-MRI 序列预测胃癌恶性程度的对比分析

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背景与目的：探讨胃癌术前常规弥散加权成像(fFOV-DWI）、小视野弥散加权成像（reduced FOV DWI，(Zoomit-DWI）、集成动态匀场弥散加权成像（individual shimming DWI，ishimDWI）三组序列在胃癌术前预测胃癌恶性程度的诊断性能。
方法：前瞻性收集我院 2019 年 7 月-2020 年 9 月已由内镜确诊为胃癌患者 259 例，进行常规弥散加权成像(fFOV-DWI）、小视野弥散加权成像（reduced FOV DWI，(Zoomit-DWI）)、集成动态匀场弥散加权成像（individual shimming DWI，ishimDWI）扫描，测量肿瘤感兴趣区的 ADC 值，对比分析其与经手术病理证实的胃癌分化程度之间的相关性在三组 DWI-MRI 序列差异是否有统计学意义，评估三组弥散加权成像的诊断性能。采用受试者工作特征（receiver operating，ROC）曲线分析（Added value of diffusion-weighted）ADC 值的最佳诊断阈值，评价诊断效能。
结果：本研究共检查 259 例病例，手术 188 例，排除早期胃癌及图像变形、伪影病例 71 例，根据病理结果排除特殊类型胃癌 6 例、混合性腺神经内分泌癌 6 例、混合性腺癌 22 例，共纳入 81 例，以术后病理学检查结果为金标准，分为中分化组（n=25）、低分化组（n=37）、低粘附性癌（n=19），单因素分析结果提示性别（χ2=0.750，P=0.575）、病变部位（χ2=0.939，P=0.797）、强化方式（χ2=0.937，P=0.131）、年龄（F=0.713，P=0.[1]493）、病灶长径（F=0.1.396，P=0.0.254）在三组间差异均无统计学意义，病灶 fADC（F=4.413，P=0.015）、Zoomit-ADC（F=8.366，P=0.001）、ishimADC（F=17.81，P=0.000）三组间差异均有统计学意义。其中 ishimDWI 对恶性程度高的胃癌诊断效能最高，以 0.839×10-3mm/s 为最佳诊断阈值，其灵敏度为 96%，特异性为 55.4%，准确性为 81.5%，曲线下面积（area under curve,AUC）为 0.829。
结论：术前 DWI-MRI 成像的定量参数可预测胃癌的恶性程度，ishimDWI 对恶性程度高的胃癌的诊断效能最高，且较常规 MRI 征象在诊断胃癌恶性程度具有更高的准确性。

PU-095

# 退行性腰椎滑脱疾病磁共振上棘间韧带高信号的发生率及意义

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目的： 研究腰椎退行性滑脱疾病磁共振上棘间韧带高信号的发生率及其意义，以提高对棘间韧带信号改变的认识。 材料与方法： 收集 2019 年 1 月至 2020 年 1 月 48 例临床诊断为腰椎退行性滑脱疾病患者的磁共振资料，男性 22 例，女性 26 例，年龄为 49~89 岁，平均 67 岁。利用 PACS 系统（picture archiving and communication systems）调取影像，记录棘间韧带在腰椎滑脱节段与非滑脱节段中高信号的发生率和分布情况，利用卡方检验和 Spearman 统计方法分析棘间韧带高信号的发生与腰椎滑脱病变之间的关系。 结果： 48 例患者共计 240 个腰椎椎体以及相对应的棘间韧带被纳入研究。依据 Meyerding 法分型，48 例患者的腰椎有 47 个节段出现滑脱，其中Ⅰ度滑脱 40 个节段，Ⅱ度滑脱 7 个节段。滑脱节段中出现棘间韧带高信号的有 31 例，分别位于 L2，3 节段 2 例，L3，4 节段 3 例，L4，5 节段 21 例，L5S1 节段 5 例；193 个非滑脱节段出现的棘间韧带高信号 61 例，其中 L1，2 节段 4 例，L2，3 节段 5 例，L3，4 节段 18 例，L4，5 节段 10 例，L5S1 节段 24 例。滑脱节段与非滑脱节段相比，棘间韧带 T2WI 高信号的发生率分别为 66%和 31.6%，差异有统计学意义（χ2=18.87，P<0.01）。通过 Spearman 方法进一步分析显示棘间韧带高信号

的出现与腰椎滑脱程度呈正相关关系（r=0.32，P<0.01）。 结论： 腰椎退行性滑脱疾病患者中滑脱椎体的棘间韧带在磁共振上出现高信号更多，此高信号的出现与腰椎椎体滑脱的程度呈正相关，在日常影像诊断中应引起足够重视。

## PU-096

# MRI 动态增强定量参数对 UIP 及 NSIP 的鉴别价值

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目的: 研究的 3.0T 动态增强 MRI（dynamic contrast-enhanced MR ima
ging，DCE－MRI)定量参数对鉴别普通型间质性肺炎（usual interstitial pneumonia，UIP)及非特异性间质性肺炎（nonspecific interstitial pneumonia,NSIP）的价值，为临床治疗间质性肺炎指导方向。
资料与方法 所有间质性肺炎患者在 HRCT 上的影像符合 UIP 及 NSIP 患者均进一步行动态增强 MRI 检查。而后继续随访，经病理证实 UIP，或经治疗无效且影像学特征符合 UIP 的患者，归为 UIP 组（n=9）。另经病理证实 NSIP，或经治疗有效且影像学特征符合 NSIP 的归为另一组（n=18）。所有患者均行高分辨率 CT 平扫及 MRI 平扫+动态增强扫描，比较不同类型间质性肺炎获取病理处的动态增强定量参数数值或临床确诊后选取最为严重的层面进行感兴趣区（Region of interest,ROI）划定所得的定量参数数值，然后比较各组 MRI 动态增强定量参数数值。
结果 UIP 组及 NSIP 组的动态增强定量参数差异具有统计学意义，相应这两组病灶所形成的伪彩图表现不一样。UIP 组的 Ktrans、iAUC 值低于 NSIP 组，P 值分别为 0.000 和 0.043；Kep、Ve 值两组比较无意义。在伪彩图上 UIP 的病灶主要呈蓝色-无色，NSIP 病灶主要呈浅黄色-浅蓝色。
结论 MRI 动态增强检查的定量参数对鉴别 UIP 及 NSIP 具有一定的价值。

## PU-097

# IVIM-DWI 联合 T1-mapping 技术对肝癌 CalliSpheres 载药微球治疗效果评估的研究

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**目的** 本研究通过应用基于体素内不相干运动（IVIM）双指数模型肝脏多 b 值 DWI 扫描联合 T1mapping 技术对肝癌 CalliSpheres 载药微球介入治疗前、后的病灶的 ADC 值及增强前、后的 T1 值进行分析，对肝癌介入治疗后的效果进行定量分析，从而以定量的方式评估肝癌患者介入治疗的疗效及预后。**材料与方法** 选取 30 例确诊为肝细胞肝癌的患者，进行 CalliSpheres 载药微球介入治疗，在每次行介入治疗前及治疗后 1、3、6 个月分别行 DWI、IVIM-DWI 及 T1mapping 扫描，共取兴趣病灶 40 个，对每一次的病灶的 ADC 值及增强前、后的 T1 值进行分析。**结果** 1、40 个兴趣病灶 CalliSpheres 载药微球介入治疗前、后的 ADC 值及 T1 值均具有差异性；2、介入治疗后 ADC 值明显高于治疗前，两者呈明显负相关，相关系数 r2 为-0.69； 治疗后 T1 值低于治疗前，两者呈显著正相关，相关系数 r2 为 0.72 ，差异有统计学意义（P＜0.05）；3、同一病灶治疗后 1、3、6 个月的 T1 值具有显著差异性。**结论** IVIM-DWI 联合 T1-mapping 技术，可以定量的判断肝癌 CalliSpheres 载药微球介入治疗前、后的病灶活性度，有效的评估肝癌介入治疗的疗效及病灶预后情况。

PU-098

# 多模态 3.0T MRI 对近侧坐骨神经卡压诊断价值研究

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目的：评价多模态 3.0T 磁共振（MERGE、Ideal、DTI）对近侧坐骨神经卡压的诊断价值。
方法：按照纳入排除标准收集健康志愿者及单侧近侧坐骨神经卡压患者，均完成常规 MRI 扫描及 MERGE、Ideal、DTI 扫描。分别对比坐骨神经卡压组患侧卡压处 FA 值与同层面健侧 FA 值、健康对照组对应层面神经 FA 值平均值的差异；分析坐骨神经卡压组患侧卡压处 FA 值、FA 变化值与患者 VAS 评分的相关性。2 名神经影像医师采用盲法阅片，对比分析常规磁共振检查和多模态磁共振检查对近侧坐骨神经卡压的诊断价值，并采用 MedCalc 绘制 ROC 曲线，对比曲线下面积。
结果：共纳入患者 21 例，合计 42 侧坐骨神经成像。坐骨神经卡压组患侧卡压处 FA 值与同层面健侧神经 FA 值分别是：0.270±0.032、0.399±0.011，*P*<0.05；与健康对照组对应层面 FA 值平均值分别是：0.270±0.032、0.401±0.007， *P*<0.05；坐骨神经卡压组患侧卡压处 FA 值、健侧同层面 FA 值与患侧神经卡压处 FA 值的差值与病人 VAS 相关系数分别为：-0.418、0.436，*P*>0.05。常规磁共振序列诊断近侧坐骨神经卡诊断敏感度为 61.90%，特异度为 71.43%，准确度为 66.67%。多模态磁共振诊断近侧坐骨神经卡压敏感度为 80.95%，特异度为 90.48%，准确度为 85.71%。常规磁共振序列及多模态磁共振诊断近侧坐骨神经卡压 ROC 曲线下面积分别为：0.667、0.857，*P*＜0.05。
结论：与常规 MRI 扫描相比，3.0T 磁共振多模态成像技术对于近侧坐骨神经卡压具有良好显示效果及较高的诊断价值。功能性成像 DTI、FT 有助于辅助诊断，提高准确性。

PU-099

# 急性缺血性卒中 DWI-ASPECTS 与梗死体积 相关性及影响因素研究

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摘要　目的 评价基于 DWI-ASPECTS 与梗死体积（Vol-DWI）的相关性及影响因素，以及 DWI-ASPECTS 对不同梗死体积的诊断效能。资料和方法 回顾性分析急性缺血性卒中患者 356 例。DWI-ASPECTS 由两位不同年资神经影像医生协商评估，Vol-DWI 采用基于机器学习的自动化分析工具计算。根据梗死部位分为皮层组、白质及基底节组、混合组。利用 Spearman 秩相关分析分别计算总体及亚组的 DWI-ASPECTS 与 Vol-DWI 的相关性。采用 ROC 曲线分析，确定 DWI-ASPECTS 预测不同梗死体积的 ROC 曲线下面积（AUC），最佳阈值，并计算敏感性、特异性等。结果 共纳入 309 例患者，总体上 DWI-ASPECTS 与 Vol-DWI 呈显著负相关(r=0.899，P<0.001)；皮层组及混合组的相关性下降（皮层组: r=-0.546，P<0.001;混合组：r=-0.561，P<0.001）。DWI-ASPECTS 对 Vol-DWI＞15ml、70ml、100ml 具有显著的诊断价值（AUC: 0.952～0.966，P＜0.001）, 通过截取最佳阈值，当 DWI-ASPECTS≤6、≤5、≤4 对 Vol-DWI＞15ml、70ml、100 ml 的诊断敏感性分别为 93.18%、93.85%、89.62%，特异性分别为 87.22%、84.36%、88.67%。结论 DWI-ASPECTS 能够取代繁琐的梗死体积测量，根据其阈值判断不同梗死体积能够敏感、有效的筛选适合再灌注治疗以及预后不良的患者。但是，利用 DWI-ASPECTS 评估时除了考虑分值外，还需考虑梗死部位的影响进行综合判断。

PU-100

# Comparison of Diffusion Kurtosis Imaging and Amide Proton Transfer imaging in the diagnosis and risk assessment of prostate cancer

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Objectives: This study aims to evaluate and compare the diagnostic value of DKI and APT in prostate cancer (PCa), and their correlation with Gleason Score (GS).
Materials and methods: DKI and APT imaging of 49 patients with PCa and 51 patients with benign prostatic hyperplasia (BPH) were collected and analyzed, respectively. According to the GS, the patients with PCa were divided into high-risk, intermediate-risk and low-risk groups. The mean kurtosis (MK), mean diffusion (MD) and magnetization transfer ratio asymmetry (MTRasym, 3.5ppm)values among PCa, BPH, and different GS groups of PCa were compared and analyzed respectively. The diagnostic accuracy of each parameter was evaluated by using the receiver operating characteristic (ROC) curve. The correlation between each parameter and GS was analyzed by using Spearman's rank correlation.
Results: The MK and MTRasym(3.5ppm) values were significantly higher in PCa group than in BPH group, while the MD value was significantly lower than in BPH group. The differences of MK/MD/MTRasym (3.5ppm) between each two of the low-risk, intermediate-risk, and high-risk groups were all statistically significant($p < 0.05$). The MK value showed the highest diagnostic accuracy in differentiating PCa and BPH, BPH and low-risk, low-risk and intermediate-risk, intermediate-risk and high-risk (AUC=0.965, 0.882, 0.839, 0.836). The MK/MD/MTRasym(3.5ppm) values showed extremely and moderate strong correlation with GS ( $r=0.844$, $-0.811$, $0.640$, $p < 0.05$), respectively.
Conclusion: DKI and APT imaging are valuable in the diagnosis of PCa and demonstrate strong correlation with GS, which has great significance in the risk assessment of PCa.

PU-101

# Prognostic and predictive value of radiomics features at MRI in nasopharyngeal carcinoma

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Purposes：To explore the feasibility of radiomics features based on MRI to predict disease progression (DP) and improve risk stratification in nasopharyngeal carcinoma (NPC).
Materials and Methods：This study retrospectively included 199 patients with NPC, divided into a training cohort (n=159) and a validation cohort (n=40). Discriminative radiomic features were selected with Wilcoxon signed-rank test from tumors and normal masticatory muscles of 37 NPC patients. LASSO Cox regression and Pearson correlation analysis were applied to further confirm differential expression of the radiomic features in the training set. Using the LASSO Cox regression model, we built a radiomic features-based classifier, Rad-Score. The prognostic and predictive performance of Rad-Score was validated in both the validation cohort and the whole cohort with 199 patients.

Results：We identified 1846 differentially expressed radiomic features between tumors and normal tissue. Rad-Score were built based on one radiomic feature: CET1-w_wavelet.LLH_GLDM_Dependence-Entropy. Rad-Score showed a satisfactory performance to predict DP in NPC with an area under the curve (AUC) of 0.604, 0.732, 0.626 in the training, validation, and the whole patient cohort respectively. Rad-Score improved risk stratification, and disease progression-free survival was significantly different between these groups in every cohort of patients ($p=0.044$ or $p<0.01$). Rad-Score had better prognostic value than most clinicopathological risk factors. The nomogram, comprising Rad-Score, N stage, and histopathology, showed more favorable discrimination than any clinicopathological risk factor (0.722 vs. 0.677 vs. 0.573).
Conclusion: The radiomics classifier, Rad-Score, may serve as a reliable tool for pretreatment prognostic prediction and risk stratification for NPC.

PU-102

# Effects of APOE ε2 allele on basal forebrain functional connectivity in prodrome Alzheimer's disease

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Abstract
Background and Objection: Apolipoprotein E (APOE) ε2 is considered as a protective genetic factor for Alzheimer's disease (AD). Previous studies revealed that APOE ε2 carriers were related to fewer Aβ plaques accumulation, more effective Aβ clearance, and milder Braak NFT stages. Also accumulated evidences have supported that the basal forebrain cholinergic system (BFCS) was vulnerable to AD related pathology. Several imaging studies have investigated change of BFCS by using structural and functional MRI. Mild cognitive impairment (MCI) is regarded as the transitional stage between healthy aging and AD. Thus, studies should pay more attentions to MCI for reducing the incidence of AD. However, there is still a lack of studies focusing on the effect of APOE ε2 allele on functional connectivity between BFCS and other brain regions in MCI.
Method: We included 60 MCI with APOE ε3/ε3, 18 MCI with APOE ε2/ε3, 73 HC with APOE ε3/ε3, and 36 HC with APOE ε2/ε3 from the ADNI database. All subjects underwent resting-state functional MRI. We used seed-based functional connectivity (FC) to explore the interregional functional changes. Based on the mixed-effects analysis, we explored the interaction effects between APOE ε2 allele × disease status on functional connectivity in a voxel-wised level (GRF corrected, $p < 0.01$), followed by post hoc two-sample t-tests (Bonferroni corrected, $p < 0.05$). We then tested the relationship between mean imaging metrics and cognitive abilities. We further examined the potential relationship between the imaging metrics and cognitive assessment as well as pathological indices (AV-45 and AV-1451 SUVR) among four groups.
Results: There were no significant differences in gender, age, or education among the four groups. The interaction effect on functional connectivity was found between the right basal nucleus of Meynert and left insula. The FC between right Ch4 and left Insular was positively correlated with memory function (Logical Memory Immediate, $r=0.148$, $p<0.05$; Logical Memory Delay, $r=0.145$, $p<0.05$) but negatively associated with AV-1451 Braak-1 summary SUVR ($r=-0.213$, $P<0.05$).
Conclusion: APOE ε2 genotype may play a protective role during degeneration of basal forebrain cholinergic system in prodromal stage of AD, and it could delay the occurrence of the disease to a certain extent.

PU-103

# 磁敏感血管征在显示超急性脑梗死颅内动脉血栓中的临床应用

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**目的** 探讨磁敏感加权成像（SWI）技术在显示超急性脑梗死颅内动脉血栓中的应用价值。材料与方法 选取 46 例发病 6h 内的超急性脑梗死患者进行回顾性分析。术前进行头部 CT 平扫、常规 MRI、3D-TOF-MRA、弥散加权成像（DWI）、SWI（发病 6h 以内），之后进行数字减影血管造影（DSA）检查。分析 CT 脑动脉高密度征（CHAS）、SWI 磁敏感血管征（SVS）诊断颅内动脉血栓的灵敏度、特异度、诊断效率、阳性预测值、阴性预测值，利用 Kappa 检验 CHAS 与 SVS 之间的一致性。**结果** 在选取的 46 例患者中，经 DSA 证实颅内动脉血栓 15 例。以 DSA 为参考标准，CHAS 和 SVS 诊断超急性脑梗死颅内动脉血栓的灵敏度、特异度、诊断效率、阳性预测值、阴性预测值分别为 86.7%（13/15）、93.5%（29/31）、91.3%（42/46）、86.7%（13/15）、93.5%（29/31）和 100%（15/15）、93.5%（29/31）、95.7%（44/46）、91.3%（42/46）、100%（29/29），CHAS 与 SVS 诊断颅内动脉血栓的一致性较好（k=0.758，P<0.05)。**结论** SVS 对显示超急性期脑梗死颅内大动脉血栓有重要意义，其与 CHAS 有较好的一致性，SWI 序列可常规用于超急性期脑梗死患者的影像诊断。

# PU-104

# 不同扩散加权成像技术在鉴别乳腺良恶性病变中的应用

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目的 探讨基于 DW-MRI 的 ADC、IVIM 和 DKI 模型在鉴别乳腺良恶性病变的价值。 方法 前瞻性收集临床可疑乳腺病变患者行乳腺 MR 检查。DW- MRI 采用 b 值分别为 0、30、50、80、120、160、200、500、1000、1500、2000s/mm2。单指数模型选取在 b=0、1000s/mm2 计算 ADC 值。IVIM 模型选取 b=0、30、50、80、120、160、200、500、1000s/mm2 计算，获得以下参数：1）灌注分数（f），2）真实扩散系数（D），3）灌注相关扩散系数（D*）。DKI 模型选取 b=0、500、1000、1500 和 2000s/mm2 计算，获得以下参数：1）平均峰度（MK），2）平均扩散率（MD）。分别对比上述参数在经病理证实乳腺良恶性病变组中是否有统计学差异。采用 ROC 曲线分析有各参数的最佳诊断阈值，评价单参数及联合参数的诊断效能。 结果 ADC、D、MK 和 MD 值在乳腺良恶性病变的鉴别诊断中的差异具有统计学意义（P<0.001）。在单参数指标中，ADC 值诊断效能最高（敏感性 91.45%，特异性 82.54%，准确度 88.84%和 AUC 0.915），最佳诊断阈值为 0.983μm 2/ms。联合 ADC 和 MK 值具有更高的诊断效能（敏感性 90.79%，特异性 85.71%，准确度 89.30%和 AUC 0.923），但与单参数 ADC 值的诊断效能之间无统计学差异（P=0.268）。 结论 不同扩散加权成像技术参数 ADC、D、MK 和 MD 值在鉴别乳腺良恶性病变中均有较高诊断价值，其中 ADC 值具有最佳诊断效能。同时，ADC 和 MK 值的联合应用可以获得更高的诊断准确性。

# PU-105

# MRI Features of Thyroid Nodules

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Purpose: To study the MRI features of thyroid nodules and to evaluate their diagnostic values. Methods: The preoperative MR findings and postoperative pathological results of 60 patients with

thyroid lesions (86 nodules) were analyzed retrospectively. Results: The MR findings of 86 thyroid nodules, including 61 benign nodules and 25 malignant nodules, existed significant differences between benign and malignant ones in shape, border, cystic change, anteroposterior-vertical diameter ratio and enhancement of solid part (P<0.05), but there were no significant difference in hemorrhage, calcification, anteroposterior-transversal diameter ratio and enlargement of peripheral lymph node (P>0.05). Conclusion: Irregular shape, less cystic change, anteroposterior-vertical diameter ratio over one and heterogeneous enhancement of solid part indicated malignant lesions. Incomplete boundary and discontinuous peritumoral pseudo-capsule were characteristic features of malignant nodules.

PU-106

# A Comparison of apparent diffusion coefficient (ADC), intravoxel incoherent motion (IVIM) and diffusional kurtosis imaging (DKI) in distinguishing benign and malignant breast lesions

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Introduction
In recent years, the value of conventional quantitative diffusion, i.e. apparent diffusion coefficient (ADC), in the differentiation of benign and malignant breast nodules has been proven. Recently, advanced multi b value diffusion post processing model, such as intravoxel incoherent motion (IVIM) and diffusional kurtosis imaging (DKI) are reported to be useful in distinguishing benign and malignant tumor in liver, prostate and sinus tumor (1-3). However, there are few literatures compare ADC, IVIM and DKI for breast tumor in one study. Therefore, this study aim to analyze the value of ADC, IVIM and DKI in differentiating benign and malignant breast nodules. The combination of all the quantitative diffusion parameters is also evaluated.
Methods
From June 2019 to October 2020, 215 lesions from 202 female patients(mean age, 49.7 years; range, 27–80 years) were enrolled in this study, including 152 cases of malignant lesions and 63 cases of benign ones, which were confirmed pathologically and clinically. All MR exams were performed on a 3T MRI scanner (MAGNETOM Prisma, Siemens Healthcare, Erlangen, Germany) with an 18-channel breast coil. The parameters of the DWI sequences was: TR/TE =5700/62/ms, slice thickness = 4 mm, slices = 35, bandwidth =2024 Hz/Px, FOV = 340 × 60 mm2, b = 0, 30, 50, 80, 120, 160, 200, 500,1000, 1500 and 2000 sec/mm2, segments=1, acquisition time = 5 min 08s. The ADC value were calculated using the b values of 0 and 1000 sec/mm2, the IVIM parameters were obtained using the b value of 0, 30, 50, 80, 120, 160, 200, 500, and 1000 sec/mm2 and the DKI parameters were acquired using the b values of 0, 500, 1000, 1500 and 2000 sec/mm2. The data were processed by a prototype software, body diffusion toolbox, (Siemens Healthcare, Erlangen, Germany) to obtain the following quantitative parameters: 1) apparent diffusion coefficient (ADC), 2) perfusion fraction (IVIM-FP), 3) molecular diffusion coefficient (IVIM-D), 4) pseudo-diffusion coefficient, IVIM-DP) , 5) mean kurtosis (DKI-K), 6) mean diffusivity (DKI-D). All quantitative parameter between benign and malignant lesions were measured three times based on regions of interest (ROI). Quantitative variables are shown as mean ± standard deviation. Two independent samples t-tests were used to compare normal distribution data, and the Mann–Whitney U test was used to compare nonnormal distribution parameters from DWI (ADC), DKI (DKI-K, DKI-D) and IVIM (IVIM-FP, IVIM-D, IVIM-DP). Receiver operating characteristic (ROC) curve analysis was used to determine the diagnostic value of quantitative parameters for differentiating benign and malignant lesions. Optimal cutoff points

were estimated for each parameter, according to the point on the ROC curve with the maximum Youden index. The sensitivity, specificity, accuracy values of the qualitative and quantitative parameters were calculated, with 95% confidence intervals, using a standard formula.
Results
ADC, IVIM-D, DKI-K and DKI-D value show statistically significant differences between the benign and malignant lesions($p<0.001$) (Table 1) (Figure1-6). The best quantitative parameter is ADC, which enjoyes the highest sensitivity(91.45%), specificity(82.54%) and accuracy(88.84%) (table 2). The area under the ROC curve (AUC) of ADC value is 0.915 with the optimal cut-off point is 0.983 μm2/ms. The combined application of ADC and DKI-K shows the best diagnostic effectiveness. It has sensitivity (90.79%), specificity (85.71%) , accuracy(89.30%) and AUC (0.923) (Figure 7). The calculated quantitative maps of the representative patients were shown in Figure 8.
Conclusions
The value of ADC, IVIM-D, KDI-K and DKI-D can be used as a diagnostic tool for evaluating benign and malignant breast lesions. Compared with IVIM-D, DKI-K and DKI-D, ADC value is the best single discriminative parameters to differentiate breast lesions. Further, the combination of ADC and DKI-K value shows the best diagnostic efficacy.

## PU-107
# RESOLVE-DWI 眼外肌定量测量在 Graves 眼病分期中的应用价值

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目的：探讨 RESOLVE-DWI 眼外肌定量测量在 Graves 眼病（Graves' ophthalmopathy，GO）分期中的应用价值，并与常规核磁共振成像比较。
方法：连续收集自 2014 年 8 月至 2020 年 11 月在本院收治的 GO 患者 58 例，根据临床活动性评分分为活动期和非活动期组。测量冠状位压脂 T2WI 上眼外肌的最高信号强度与同侧脑白质的信号强度比（signal intensity ratio，SIR）及轴位 RESOLVE-DWI 上眼外肌对应区域的 ADC 值。分别比较活动期与非活动期组的 SIR 与 ADC 值差异，以受试者工作特征曲线（receiver operating characteristic ，ROC）评价 SIR 及 ADC 值在 GO 分期中的价值，并采用 DeLong 等的多重 ROC 曲线比较方法比较两者在 GO 分期中的性能差异。
结果：活动期组眼外肌的 SIR 及 ADC 值均高于非活动期组, 差异有统计学意义($P <0.001$) 。ROC 曲线结果显示，SIR 及 ADC 值在 GO 分期中的最佳截断点分别为 2.2 和 $1467.64 \times 10^{-6} mm^2/s$ (曲线下面积 0.846、0.770；敏感度 64%、59%; 特异度 88%、86%)。此外，多重 ROC 曲线比较结果显示，SIR 及 ADC 值在 GO 分期中的性能差异无统计学意义（$P >0.05$）。
结论：相比常规核磁共振成像，基于 RESOLVE-DWI 的眼外肌 ADC 值测量作为一个更加直接、客观的定量指标，可辅助 GO 分期。

## PU-108
# 动态增强 MRI 对普通型及非特异性间质性肺炎的鉴别价值

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目的 研究 3.0T 动态增强 MRI 对普通型间质性肺炎（UIP）及非特异性间质性肺炎（NSIP）的鉴别价值，为临床治疗间质性肺炎提供参考。
资料与方法 所有间质性肺炎患者在 HRCT 上的影像符合 UIP 及 NSIP 患者均进一步行动态增强 MRI 检查。而后继续随访，经病理证实 UIP，或经治疗无效且影像学特征符合 UIP 的患者，归为 UIP 组（n=9）。另经病理证实 NSIP，或经治疗有效且影像学特征符合 NSIP 的归为另一组（n=18）。所有患者均行高分辨率 CT 平扫及 MRI 平扫+动态增强扫描，比较不同类型间质性肺炎获取病理处的动态增强影像表现或临床确诊后整体病灶的动态增强影像表现及相应伪彩图表现；比较两组 MRI 动态增强模式的差异进行前瞻性研究。
结果 UIP 组及 NSIP 组的动态增强表现模式数量差异具有统计学意义（P＜0.05）。2 组病灶所形成的伪彩图表现不一，其中 UIP 组中 2 例表现为无明显强化或略强化，另 7 例表现为缓慢持续强化；NSIP 组中 16 例表现为“快进快出”模式，另 2 例表现为缓慢持续强化；相应地快进快出模式（n=16）、无明显强化或略强化（n=2）、缓慢持续强化模式（n=9）中的 P 值分别为 0.000、0.103、0.001。
结论 MRI 动态增强对于区分 UIP 与 NSIP 具有重要价值。

# PU-109
# 基于多期磁共振影像生物标记物的影像组学模型预测肝细胞癌的微血管侵犯

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目的：微血管侵犯(MVI)阳性表明肝细胞癌(HCC)的侵袭性强和生存预后较差。本研究拟建立一个基于术前磁共振成像(MRI)数据的影像组学分析模型来预测 HCC 的 MVI。
方法：143 名确诊为 HCC 患者(训练组：n=113；验证组：n=30)，其中 86 例为 MVI 阳性，57 例为 MVI 阴性。所有患者术前都接受了钆剂增强磁共振成像检查，并且都接受了肝切除手术。手动勾画了肿瘤 3 幅图像，包括最大横截面上的图像及相邻的两幅图像，即勾画了感兴趣区域(ROIs)。定量分析包括使用 MaZda 软件的线性判别分析(LDA)算法得到的最大判别因子(MDFs)和直方图分析。通过单因素和多因素逻辑回归分析，评估了预测 MVI 的临床、影像学特征和 MDFs 的独立预测因素，并用多因素逻辑回归分析建立了预测模型。最后通过接收器工作特性(ROC)曲线来评估上述参数或模型的预测能力。
结果：MDF（0.77-0.85）的 ROC 曲线下(AUC）的面积优于直方图参数（0.51-0.74）。经多因素逻辑回归分析，动脉期和门静脉期的 MDF 值、肝胆期肿瘤周边低信号是 MVI 的独立预测因素（p<0.050）。该模型的 AUC 值为 0.939(95% CI 0.893-0.984，标准误差 0.023)，在验证组中为 0.980(95% CI 0.930-1.000，标准误差 0.021)。
结论：MDF 值和影像生物标记物的无创影像组学模型可以帮助术前预测肝细胞癌患者是否存在 MVI。

# PU-110
# 基于 MRI 影像组学列线图预测小肝癌手术切除 或射频消融术后早期复发的研究

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目的: 本研究旨在构建并验证术前预测小肝癌早期复发（≤2 年）的影像组学列线图模型。
方法：本研究共纳入 2015 年 1 月至 2018 年 12 月期间在我院接受了手术切除（SR）或射频消融术（RFA）的 137 例小肝癌患者，并将其分为训练组（111 例）和验证组（26 例）。使用 MaZda 软件在磁共振图像上提取出基于肿瘤全体积的影像组学特征。使用最小绝对收缩选择算子（LASSO）方法进行数据降维、特征选择和影像组学特征构建，并计算影像组学评分（Rad-score）。通过单因素和多因素逻辑回归分析寻找潜在的独立危险因素，包括临床因素、影像学特征和 Rad-score，建立一个组合模型。构建基于该组合模型的影像组学列线图，为临床提供可定量预测小肝癌患者早期复发概率的方法。进一步分析预测模型在训练组及验证组的曲线下面积（AUC），评估影像组学列线图模型的预测效能。
结果：62 例（62/137，45.2%）患者在 SR 或 RFA 后发生了早期复发。在训练组中，通过单因素逻辑回归分析显示，肝硬化、乙肝感染、肝胆期低信号、Child-Pugh 分级、血小板计数及 Rad-score 与早期复发相关。进一步通过多因素逻辑回归分析，结果显示仅有血小板计数（P = 0.049）和 Rad-score（P = 0.001）是预测小肝癌早期复发的独立危险因素。基于该组合模型的影像组学列线图在训练组（AUC，0.981；95% CI，0.856-1.000）和验证组（AUC，0.771；95% CI: 0.572，0.970）中表现出较好的预测小肝癌早期复发的作用。
结论：基于术前磁共振的影像组学列线图，联合了血小板计数和 Rad-score，对小肝癌患者发生早期复发的概率具有较好的预测效果。影像组学列线图模型可以作为一种有效便捷的方法用于小肝癌患者的个体化决策过程。

PU-111

# The prognostic value of enhancing lesion volume in patients with breast cancer that were evaluated as stable disease by RECIST1.1 criterion after early neoadjuvant chemotherapy

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Objective: To explore the prognostic value of enhancing lesion volume (ELV) in patients with breast cancer that were evaluated as stable disease (SD) by RECIST1.1 criterion after early neoadjuvant chemotherapy (NAC).
Methods: Seventy-three patients with 73 unilateral lesions which were evaluated as SD by RECIST1.1 criterion after early NAC were included in this study. The lesions with decreased maximum diameter were regarded as responders, otherwise were non-responders. All the lesions were then assessed by ELV method, and the lesions with complete or partial response, or SD but decreased ELV were considered as responders, lesions with progressive disease or SD but increased ELC were classified as non-responders. According to the Miller-Payne (MP) grading system, the lesions with Grade1-2 were defined as non-responders, and Grade3-5 were responders. The diagnostic performance of the two methods were compared with pathological results. The change rate of maximum diameter based on RECIST1.1 and enhancing lesion volume based on ELV method before and after NAC were analyzed and compared for pathological predictive performances via receiver operating characteristic (ROC) curve.
Results: Fifty-five lesions were diagnosed as responders and other 23 lesions were non-responders according to pathological MP grading results, and RECIST1.1 and TLV criteria

identified 59 and 66 responders, 14 and 7 non-responders, respectively. The values of sensitivity (SE) specificity (SP), positive predictive value (PPV), negative predictive value (NPV), and accuracy based on ELV and RECIST1.1 criteria for predicting pathologic response were 94% vs. 87.3% (P<0.05), 22.2% vs. 38.9% (P<0.05), 78.8 vs. 81.4%, 57.1 vs. 50%, and 76.7% vs. 75.3% (P<0.05), respectively. The areas under the ROC curves (AUC) according to TLV and RECIST1.1 were 0.79 (95%CI: 0.68 to 0.88) and 0.64 (95%CI: 0.52 to 0.75), respectively (P<0.05).
Conclusion: ELV is a more sensitive and accurate method than RECIST1.1 in predicting the prognosis of patients with breast cancer that were evaluated as SD by RECIST1.1 after early NAC.

## PU-112

# 评估海洛因依赖者在美沙酮维持治疗下的大脑活动: 一项静息状态功能磁共振成像研究

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目的：探讨美沙酮维持治疗对海洛因依赖者静息状态下局部和整体脑活动的影响。
材料与方法：纳入美沙酮维持治疗(MMT) 25 例海洛因依赖者、短期戒断(HA) 26 例海洛因依赖者和 42 例健康对照者。对所有受试者在暴露海洛因线索前和暴露后的渴求进行了评估。分析三组受试者在渴望、区域同质性及相关全脑功能连接方面的差异。
结果：HC 组和 MMT 组海洛因线索暴露前和暴露后对海洛因的渴求显著低于 HA 组。HC 组与 MMT 组间差异无统计学意义。MMT 组在右侧眶额皮质、右侧颞中回及双侧中央后皮层 ReHo 值均高于 HA 组。三组间基于 ReHo 区差异的整体脑连通性无明显差异。
结论：长期美沙酮维持治疗可改善海洛因依赖者执行控制、体感相关脑区局部活动。这表明 MMT 可能有助于恢复执行控制和体感觉功能，朝着健康控制的方向。

## PU-113

# 颅内节细胞胶质瘤多模态 MRI 影像诊断

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目的：探讨多模态 MRI 检查对颅内节细胞胶质瘤的诊断价值。
方法：回顾性分析经病理证实的 30 例颅内节细胞胶质瘤的 MRI 平扫、增强以及功能 MRI 影像特征，重点观察肿瘤发生部位、平扫 MRI 信号特点、瘤周水肿、强化程度、扩散加权成像(diffusion weighted imaging，DWI)信号强度、磁敏感加权成像(susceptibility weighted imaging, SWI)中肿瘤内磁敏感性信号(intratumoral susceptibility signal intensity，ITSS) 分级、动脉自旋标记灌注(arterial spin labeling，ASL)以及扩散张量纤维束成像(diffusion tensor tractography，DTT)图中纤维束状态特点。测定肿瘤实性区及对侧对应部位正常脑组织扩散张量成像像(diffusion tensor imaging，DTI)中部分各向异性值(fractional anisotropy，FA)、表观扩散系数值数(apparent diffusion coefficient，ADC)、磁共振波谱成像(MR spectroscopy，MRS)中胆碱(choline，Cho) /肌酸(creatine，Cr)、N-乙酰天门冬氨酸(N-acetyl aspartic acid，NAA) /Cr 和 Cho/NAA 比值，两者差异行统计学分析。
结果：病灶均为单发，22 例位于幕上，其中颞叶 8 例，额叶 12 例，顶叶 2 例；8 例位于小脑。MRI 形态学表现实性病灶 11 例，囊实性病灶 16 例，囊性病灶 3 例，增强可见实性成分轻到中度

不均匀强化。7 例无瘤周水肿，轻中重度瘤周水肿分别为 3 例、11 例、9 例。与对侧正常脑组织对比，节细胞胶质瘤病灶实性区域测定 ADC 值范围 1.04±0.12 ~1.41±0.07×10-3 mm2 /s，FA 值范围 0.21±0.05 ~0.36±0.07，Cho/Cr、NAA/Cr 和 Cho/NAA 比值范围分别为 3.88±1.23 ~1.75±0.35、0.37±0.16 ~1.14±0.09、5.78±1.24 ~1.65±0.33；ASL 灌注、DTT 纤维束状态、ADC 值、FA 值以及 1 H-MRS 代谢物比值 Cho/Cr、NAA/Cr 和 Cho/NAA 差异间差异有统计学意义(P＜0.05)，SWI 中 ITSS 分级无统计学差异(P＞0.05)，AUC 分别为 0.871、0.814、0.768、0.923、0.863、0.436。
结论:多模态 MRI 成像技术能够展现颅内节细胞胶质瘤一定的影像特征性及量化差异，能够为临床诊治提供更多有效信息。

## PU-114

# 2018 版 LI-RADS 肝胆期低信号对肝细胞癌的诊断价值

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目的：探究肝癌高危因素背景下，2018 版 LI-RADS 结合钆塞酸二钠增强 MRI 肝胆期低信号对小肝癌（sHCC）的诊断价值。材料和方法：回顾性分析桂林医学院附属医院放射科 2014 年 1 月至 2020 年 12 月，行钆塞酸二钠增强 MRI 检查的 159 例具有肝癌高风险的患者，共 179 个肝结节。两名放射科医师采用双盲法分析每一个患者的影像学资料，分别记录每一个肝脏结节的大小、动脉期非环形高强化、门脉期非边缘性廓清、强化假包膜和阈值增长、肝胆期低信号，根据 2018 版 LI-RADS 指南的诊断表将每一个肝结节分类为 LR-3、LR-4、LR-5。统计分析各征象以及 LR-5、LR-4/5 分类对 sHCC 的诊断效能。将肝胆期低信号作为 2018 版 LI-RADS 分类的主要征象时，在新诊断模型下将每一个肝脏结节重新分类，并重新统计分析 LR-5、LR-4/5 分类对 sHCC 的诊断效能。结果：医师 1 和医师 2 评估的肝胆期低信号诊断 sHCC 的灵敏度、特异度和准确度分别为 99.38%、77.78%和 97.21%，阳性预测值为 97.56%。两名医师评估的 LR-5 诊断 sHCC 的灵敏度、特异度与准确度分别为 80.12%、88.89%、81.01%，阳性预测值为 98.47%；LR-4/5 诊断 sHCC 的灵敏度、特异度与准确度均为 94.41%、61.11%、91.06%，阳性预测值为 95.60%。把肝胆期低信号作为主要征象时，新诊断模型下两名医师评估的 LR-5 诊断 sHCC 的灵敏度、特异度、准确度和阳性预测值分别为 82%、83.33%、82.12%和 97.78%。两名医师评估的 LR-4/5 诊断 sHCC 的灵敏度、特异度与准确度分别为 99.38%、55.56%、94.97%，阳性预测值为 95.81%。结论：2018 版 LI-RADS 结合钆塞酸二钠增强 MRI 对 sHCC 的诊断效能较高，把肝胆期低信号作为主要征象时，新诊断模型能提高 LR-5、LR-4/5 分类对 sHCC 的诊断效能。

## PU-115

# 轻型缺血性脑卒中颅内动脉高分辨血管壁成像

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目的：研究轻型缺血性卒中患者颅内动脉的高分辨率磁共振管壁特征。
方法：回顾性分析从 2019 年 7 月至 2021 年 9 月在哈尔滨医科大学附属第一医院神经内科或神经外科的急性缺血性脑卒中患者影像资料与临床资料。根据波士顿急性缺血性卒中影像评分（boston acute ischemic stroke imaging scale，BASIS）将患者分为重型卒中组和轻型卒中组。比较两组患者的血管壁影像特征和临床资料。

结果： 74 患者纳入研究（轻型卒中组:36 例、重型卒中组:38 例）。轻型卒中组病变位置分布，颈内动脉 2 例，基底动脉 21 例，大脑中动脉例 9，椎动脉 4 例，重型卒中组病变位置分布，颈内动脉 1 例，基底动脉 18 例，大脑中动脉 17 例，椎动脉 2 例。除了狭窄管壁面积（P>0.05），最狭窄层面的斑块形态学指标组间差异均有统计学意义（P 均<0.05）。强化等级、临床因素差异均无统计学意义（P 均>0.05）。重型卒中患者管壁表现为多非正性重构，管腔面积更小，狭窄率更高，斑块面积更大，斑块负荷更大（P 均<0.05）。而绝大多数轻型卒中患者表现为正性重构，管腔面积较大，狭窄率较轻，斑块面积较小，斑块负荷较小（P 均<0.05）。
结论：轻型缺血性脑卒中患者的血管构型多为正性重构，稳定性较差，提示轻型缺血性脑卒中患者治疗应更注重稳定斑块防止复发。高分辨率磁共振可以评估轻型缺血性脑卒中的血管壁形态，为轻型缺血性脑卒中超早期治疗提供更合理的依据。

## PU-116

# 基于压缩感知技术的颈动脉 3D-TOF-MRA 快速成像

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**目的** 探索压缩感知技术 CS（Compressed SENSE,CS）对颈动脉 3D-TOF-MRA 序列图像质量的影响。**材料与方法** 招募健康志愿者 22 例(男 15 例，平均 54.41±18.18 岁），Philips Ingenia CX 3.0T MRI（Philips Healthcare，Best，the Netherlands）设备行颈动脉 3D-TOF 扫描，以传统的 SENSE=1.6 为 A 组，分别设 CS=4、6、8 为 B、C、D 组。扫描时间分别是 258s、206s、138s、106s。在颈动脉分叉以下三个层面的两侧血管以及胸锁乳突肌勾画感兴趣区（Region Of Interest, ROI），测量其信号强度（Signal Intensity, SI）和噪声强度（Standard Deviation, SD），计算图像信噪比（Signal to Noise Ratio, SNR）和对比噪声比（Contrast to Noise Ratio, CNR）。在相同三个层面测量两侧颈总动脉最大径与最小径。由两名放射科医师用四分法对四组重建图像进行图像质量评分。Wilcoxon 检验两侧 SNR、CNR 的差异性，若无差异，选择左侧进行下一步的检验。使用 Kappa 检验两观察者评分的一致性，若一致性良好，选择高年资医师主观评分进行后续分析。使用 Kruskal-Wallis 检验四组 SNR、CNR、两侧颈总动脉最大径、最小径以及主观评分的差异性。若差异性有统计学意义，使用 Mann-Whitney U 检验进行两两比较。**结果** 四组测量数据两侧 SNR、CNR 差异无统计学意义(p 值均大于 0.05)。两观察者图像质量主观评分一致性良好（p=0.880）。四组的 SNR、CNR、两侧颈总动脉最大径和最小径差异无统计学意义(p>0.05)，主观评分差异有统计学意义(p=0.00)。两两比较结果 A 组与 B、C 组主观评分差异无统计学意义(p＞0.05)，与 D 组差异有统计学意义(p=0.00)。**结论** 颈动脉 3D-TOF 序列随着加速因子 CS 的增加，扫描时间逐渐降低。CS=6 对比 SENSE=1.6，在确保图像质量前提下，扫描时间降低了 46.51%，临床推荐使用 CS=6 行颈动脉 3D-TOF 序列扫描。

## PU-117

# Performance of abbreviated protocols versus unenhanced MRI for detecting mammographically occult breast cancer in women with dense breasts

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**Objective:** To evaluate the diagnostic performance of unenhanced MRI (UE-MRI) compared with abbreviated protocols(AP) of MRI in mammographically occult cancers in women with dense breast tissue.
**Materials and Methods:** The retrospective analysis included 104 patients without positive findings on mammographybetween July 2016 and March 2019. All patients received preoperative MRI full diagnostic protocol (FDP) and mammography. The subjects were analyzed as follows: diffuse-weighted imaging and T2 weighted imaging were performed in combination and referred to as UE-MRI; AP-MRI consisted of maximum-intensity projection imaging and first post-contrast subtracted MRI, with optional inclusion of non-subtracted source images. Appropriate statistical tests were used to compare the diagnostic performance of UE-MRI, AP-MRI, and FDP-MRI.
**Results:** Among 104 subjects, there were 68 tumors in 64 patients and 40 patients had benign findings. For both readers, there was no significant difference in sensitivity and specificity between AP-MRI( R1, 95.58%, 80.00%; R2, 94.12%, 77.50%)and UE-MRI(R1, 88.24%, 85.00%; R2, 83.82%, 82.50%)or between AP-MRI and FDP-MRI(R1, 98.53%, 87.50%; R2, 98.53%, 90.00%) ($p$>0.05), whereas the sensitivity of UE-MRI was significantly lower than that of FDP-MRI (R1, $p$=0.023; R2, $p$=0.004). There was no significant difference in AUC between UE-MRI and AP-MRI ($p$>0.05).
For different lesion size groups, one of the readers found that the sensitivity of AP-MRI and FDP-MRI was significantly higher than that of UE-MRI in lesions ≤10 mm in diameter ($p$=0.041, $p$=0.023), whereas there was no significant difference in the sensitivity of the three protocols in lesions >10 mm in diameter for both readers ($p$>0.05).
The average reading time of UE-MRI and AP-MRI was 27.1 and 33.4 seconds, respectively, which was significantly lower than that of FDP-MRI (260.23 seconds, $p$ < 0.001).
**Conclusion:** AP-MRI has more advantages than UE-MRI when used as a supplementary tool for breast cancer screening, especially for breast tumors ≤10 mm in diameter.

# PU-118

# 用种子点相关的静息态功能连接的方法探究 ADHD 患者中脑多巴胺系统相关区域与全脑功能连接的改变

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目的: 了解中脑异常的多巴胺(DA)信号与 ADHD 患者注意力异常和多动冲动行为之间的关系。之前已经有许多关于多动大鼠中脑 DA 神经元活动的研究，且发现了很多的结果，如腹侧被盖区(VTA)、黑质(SNc)和蓝斑(LC)等部位激活的改变。但人脑相关的研究还相对较少，临床试验的证据尚不充分。例如，很少有研究关注功能连接(FC)的改变与临床表现异常之间的关系。因此，本研究的目的是研究大样本的 ADHD 患者和健康参与者中脑 DA 系统功能（特别是半球间不对称的功能改变）的差异，并探究这种改变在 ADHD 亚型中的表现。
材料与方法: 在 ADHD-200 数据库中选取正常发育儿童 297 例，选取符合美国精神障碍诊断与统计手册第 4 版 ( DSM-IV)诊断标准的成人 ADHD 患者 241 例，使用基于种子点的静息态功能连接的方法来评估脑网络的改变与功能连接的异常。根据之前的研究结果，我们选取了腹侧被盖区(VTA)、黑质(SNc)和蓝斑(LC)作为种子点，研究 ADHD 患者和健康参与者中脑 DA 系统功能额差异，并进一步探究 ADHD 亚型相关的功能连接的差异。
结果: 对功能连接的结果分析，我们发现：以左侧腹侧被盖区为种子点时，ADHD 患者组相比于正常组可以发现两侧脑干功能连接的升高；以左侧黑质为种子点时，ADHD 患者组相比于正常组可以发现两侧基底节以及背侧丘脑功能连接的升高；以左侧蓝斑为种子点时，ADHD 患者组相比于正常组可以发现两侧颞叶及脑干功能连接的升高。同时，对于 ADHD 患者亚型的研究结果显示：以两

侧被盖区为种子点时，ADHD 混合型相比于 ADHD 注意力缺陷型患者可以发现两侧额叶功能连接的升高。
结论: 本次实验的结果表明，多动症患者注意力不集中和多动冲动的症状的发生于中脑功能连接的改变有明显的联系，且 VTA、SNc 和 LC 在脑功能连接的表现上既有共同的模式，也有不同的模式。结合以往的研究，ADHD 儿童表现出非典型的半球不对称模式，因此，基于中脑的多巴胺网络的研究可能有助于了解 ADHD 的病理生理机制，中脑多巴胺神经元可能可以作为 ADHD 患者药物治疗的靶点。

## PU-119

# 基于 HR-MRI 的三维可视化模型在复杂型肛瘘临床诊疗中的应用价值初探

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【摘要】目的 建立基于高分辨率核磁共振成像（HR-MRI）的复杂型肛瘘三维可视化数字模型，探讨其可行性及临床诊疗应用价值。方法 选取杭州市萧山区第一人民医院 2020 年 1 月至 2021 年 5 月的 10 例复杂性肛瘘患者行术前 HR-MRI 检查，原始数据导入医学三维重建系统行靶区及毗邻脏器手工勾画，重新三维可视化模型后评估 parks 分型并模拟规划手术路径。结果 成功重建出 10 例复杂型肛瘘的三维可视化模型，重建模型包括肛提肌、肛门内括约肌、肛门外括约肌及主瘘管、分支瘘管、内口、外口、脓肿的立体结果及其毗邻关系。评估分型包括 9 例经括约肌型肛瘘（2 例马蹄形肛瘘）和 1 例括约肌间型肛瘘，经三维软件可任意角度观察病灶与邻近组织的毗邻关系并以此为基础行模拟手术路径的方案规划。结论 基于 HR-MRI 的复杂型肛瘘三维可视化模型，能辅助判断其临床分型，为临床手术路径规划提供影像学依据。

## PU-120

# MRI 纹理分析技术在胚胎发育不良性神经上皮瘤（DNET）和低级别星形细胞瘤鉴别的应用价值研究

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目的：通过应用 MRI 纹理分析技术研究肿瘤纹理改变在胚胎发育不良性神经上皮瘤（DNET）和低级别星形细胞瘤（LGA）鉴别诊断中的临床应用价值。
材料与方法：回顾性分析 2014 年 12 月-2020 年 12 月在新疆医科大学第一附属医院神经外科接受手术并经病理活检证实的 13 例 DNET 和 20 例 LGA 患者，勾画其术前 MRI 的 T2FLAIR 轴位图像中的瘤体并进行纹理分析，提取瘤体的平均值、中位数、标准差、异质性、峰度、偏度及熵等纹理参数，比较 DNET 和 LGA 纹理参数并进行统计学分析，观察比较各参数对疾病诊断的功能。
结果：DNET 及 LGA 患者的一般资料如年龄、性别及肿瘤发生部位进行比较，差异无统计学意义（P＞0.05）。比较 DNET 和 LGA 的 7 个纹理参数后发现，二者的平均值、中位数及峰度三个参

数差异存在统计学意义（P＜0.05），其中峰度的鉴别诊断价值意义最大，其 ROC 曲线的 AUC 值为 0.708，灵敏度及特异度分别为 0.95 和 0.615。对平均值、中位数及峰度进行多参数联合分析，中位数结合峰度的鉴别诊断效能高于单个纹理分析参数鉴别效能。
结论：对于常规 MRI 检查难以鉴别的 DNET 和 LGA，采用纹理分析技术可以获得二者之间难以通过直接观察发现的差异。

## PU-121

# AP-MRI 在致密性乳腺中的应用价值

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目的：探讨 AP-MRI(abbreviated protocols magnetic resonance imaging，AP-MRI)单独应用于乳腺癌筛查及作为乳腺 X 线摄影(mammography，MMG)筛查乳腺癌的补充方式在致密性乳腺中的诊断效能，并对比分析其与动态增强磁共振成像(dynamic contrast enhanced magnetic resonance imaging，DCE-MRI)诊断价值的差异。
方法：回顾性分析 2019 年 10 月至 2021 年 3 月经病理确诊的 194 例乳腺癌患者及 98 例健康或病理证实为良性病变的阴性病例作为模拟筛查人群，所有患者均接受术前 DCE-MRI 和乳腺 X 线摄影。AP-MRI 由最大强度投影成像和第一期对比增强后减影图像组成，分析 MMG、AP-MRI、MMG/AP、DCE-MRI 影像学资料，比较 4 种检查方法对乳腺疾病诊断的敏感性和特异性。
结果： MMG、AP-MRI、MMG/AP 及 DCE-MRI 诊断的敏感性分别为 52.44%、89.83%、91.33%、93.90%;特异性分别为 51.22%、76.85%、78.05%、85.36%。单独应用 AP-MRI 检查及 MMG/AP 的敏感度和特异度显著高于 MMG(P<0.001)，但与 DCE-MRI 相比无显著差异(P>0.05)。AP-MRI 、MMG/AP、DCE-MRI 三种检查方法的受试者工作特性(receiver operating characteristic，ROC)曲线下面积(area under curve ，AUC)无显著差异（P>0.05），均显著高于单独的 MMG (AUC 0.518)（P<0.05）。
结论：在乳腺组织致密的女性中，单独应用 AP-MRI 或 AP-MRI 与 MMG 相联合，可以发现大部分 MMG 漏诊的乳腺癌，明显提高诊断的敏感性和特异性。AP-MRI 可作为一种快速辅助筛查乳腺癌的工具。

## PU-122

# 直肠腺癌原发灶的 IVIM-DWI 参数联合纹理分析术前预测非肿大淋巴结转移的价值

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目的　探讨直肠腺癌原发灶的体素内不相干运动扩散加权成像（IVIM-DWI）参数联合 T2WI 纹理分析（TA）术前预测短径≤9 mm 淋巴结转移的价值。方法 回顾性分析我院经手术病理证实的直肠腺癌 115 例，所有患者术前均接受直肠常规 MRI 和 IVIM-DWI 扫描后在我院行全直肠系膜切除术（TME），根据术后病理结果将患者分为淋巴结转移组和非转移组。在 GE AW4.5 工作站测量直肠腺癌原发灶 IVIM-DWI 表观扩散系数（ADC）、真扩散系数(D)、假扩散系数(D*)和灌注分数(f）值。在轴位 T2WI 图像上逐层勾画直肠腺癌全病灶感兴趣区，导入 GE Analysis Kit（AK）软件提取三维纹理特征，并用受试者工作特性（ROC）曲线对有统计学意义的参数进行分析。结果　淋巴结转移组 44 例，非转移组 71 例。在 IVIM-DWI 参数中，转移组的 D*值明显低于非转移组（P<0.05），ROC 曲线下面积（AUC）为 0.689，转移组的 f 值明显高于非转移组（P<0.05），

ROC 曲线下面积（AUC）为 0.670，其余参数均无统计学意义。使用 AK 软件共获得 828 个纹理参数，采用独立样本 t 检验或 Mann-Whitney U 检验、Multivariate_Logistic 对纹理参数进行筛选，得到 3 个有独立预测作用的纹理参数：firstorder_Skewness、shape_Sphericity 和 glcm_Idn。基于这 3 个纹理参数构建的预测模型 AUC 值为 0.775，进一步联合 3 个纹理参数与 D*值、f 值的预测模型 AUC 值为 0.803，诊断效能高于 IVIM-DWI 或 TA 的单一参数。结论　直肠腺癌原发灶的 IVIM-DWI 参数联合基于 T2WI 的 TA 术前预测短径≤9 mm 的淋巴结转移具有一定的价值。

## PU-123

# Danon 病：临床与心血管磁共振研究

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目的 表型为肥厚型心肌病(hypertrophic cardiomyopathy, HCM) 的 Danon 病与 HCM 往往很难鉴别，目前也没有相关的对比性研究。本文拟通过对比 HCM 表型 Danon 病与 HCM 的心脏磁共振(cardiac magnetic resonance, CMR)特征，寻找鉴别二者的最佳无创性影像学参数。
材料和方法 回顾性检索 2014 至 2020 年在中国医学科学院阜外医院行 CMR 检查的患者，依据性别和左室流出道是否梗阻，以 1:2 的案例为 HCM 表型的 Danon 病患者匹配 HCM 患者。在电子病历中收集总结他们的临床表现、实验室检查及 CMR 特征，并于 2021 年 3 月通过电话进行随访。
结果 最终共纳入 7 例 HCM 表型的 Danon 病患者和 14 例 HCM 患者。Danon 病通常较 HCM 发病年龄更早（15 (8, 23) vs. 30 (25, 37)岁，P=0.001），且实验室指标多为正常高限的 4-6 倍。此外，Danon 病的 LGE 更倾向于沿心内膜下分布（42.9% vs.0.0%, P=0.026），左室游离壁（100% vs. 28.6%, P=0.004）及心尖部（85.7% vs.14.3%, P=0.003）更易受累，伴有室间隔保留（100% vs. 35.7%, P=0.007）现象；而 HCM 的 LGE 更易分布于肌壁间（78.6% vs14.3%，P=0.016）。特征追踪技术显示 Danon 病患者左室及左房应变不同程度受损，且较 HCM 受损更为显著。
结论 特征性的 LGE 是 HCM 表型 Danon 病与 HCM 鉴别诊断的最佳无创性影像学参数。对具有与年龄不匹配的较高 LGE 质量、心内膜下 LGE、心尖部、左室游离壁 LGE，以及有室间隔保留倾向等特征的“HCM 患者”，应考虑 Danon 病的可能。

## PU-124

# 颅内动脉粥样硬化斑块特征及下游灌注与脑梗死的关系

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目的 探讨大脑中动脉(MCA)粥样硬化斑块特征及下游灌注与脑梗死的关系。材料与方法 收集 62 例症状性大脑中动脉狭窄患者，根据扩散加权成像（DWI）分为急性脑梗死组（42 例）和非急性脑梗死（20 例）。使用脑血流量（CBF）结合阿尔伯塔省卒中项目早期 CT 评分(CBF-ASPECTS)评估脑灌注信息。将管腔狭窄程度、斑块特征与 CBF-ASPECTS 作为影响脑梗死发生的分析变量，先采用二元 Logistic 回归模型对纳入变量进行分析，筛选出急性梗死组和非急性梗死组有统计学差异的变量，再绘制受试者操作特征(ROC)曲线，，评估单个变量及其组合的预测效能。应用 Spearman 相关分析评估大脑中动脉斑块强化特征与 CBF-ASPECTS 之间的关系。结果 单因素分析结果：斑块强化等级（OR=4.414，P=0.044）及 CBF-ASPECTS（OR=8.554，P=0.006）是急性脑梗死的独立危险因素。ROC 曲线分析显示：管腔狭窄程度［曲线下面积（AUC）0.707，P=0.002］；斑块强化等级（AUC 0.719，P=0.006）；CBF-ASPECTS（AUC 0.808，P＜0.001）；三者结合（AUC 0.858，P＜0.001）。斑块强化等级与 CBF-ASPECTS 之间呈负相关

（r=-0.588，P＜0.001）。结论 斑块强化等级和 CBF-ASPECTS 是脑梗死的独立预测因素，两者在预测急性脑梗死的发生方面优于管腔狭窄，三者结合可以提高预测能力。

## PU-125

# QSM 对复发缓解型多发性硬化与视神经脊髓炎 谱系疾病深部灰质铁含量对比研究

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背景 视神经脊髓炎(NMO)和多发性硬化症(MS)的临床表现、实验室检查及影像表现有很大相似之处，组织病理和 MRI 提示 MS 相较 NMOSD 患者白质病灶存在异常的铁沉积[1-2]，但二者灰质的铁含量差异尚无定论[3-4]，且研究[4-5]纳入患者多为长期病程（＞10 年），疾病早期患者灰质铁含量变化尚不清楚。
目的 通过定量磁化率图（QSM）分析复发缓解型多发性硬化（RRMS）和视神经脊髓炎谱系疾病（NMOSD）患者（病程 < 10 年）深部灰质铁含量差异，及其与患者残疾及认知障碍的相关性。
方法 用 3.0T MRI 采集性别、年龄相匹配的 35 例 RRMS、30 例 NMOSD 和 30 例健康对照组（HC）的 QSM 数据。采用单因素方差分析比较三组间灰质核团定量磁化率值（QSV）差异，秩相关分析评估灰质核团 QSV 异常与患者残疾及认知障碍之间的相关性。
结果 ① RRMS、NMOSD 及 HC 三组间丘脑及黑质 QSV 具有统计学差异（F = 9.24，P < 0.01；F = 4.68，P = 0.01），两两比较结果显示 RRMS 患者相较 NMOSD 和 HC 组，丘脑 QSV 显著降低（P = 0.04；P < 0.01），黑质 QSV 显著升高（P 均 = 0.03）；② NMOSD 患者各灰质核团 QSV 与 HC 比较差异均无统计学意义（P = 0.28 ~ 1.00）；③ RRMS 患者异常的丘脑和黑质 QSV 与扩展残疾状态量表评分（EDSS）无显著相关性（rs = -0.26，P = 0.13；rs = -0.10，P = 0.55），但丘脑 QSV 与数字广度任务（DST）呈正相关（rp = 0.41，P = 0.02）。
结论 QSM 可用于 RRMS 及 NMOSD 深部灰质铁沉积的定量检测，RRMS 患者相较 NMOSD 在疾病相对早期阶段深部灰质即有明显铁稳态紊乱，QSV 的异常反映了两者潜在的病理差异，从而有助于制定针对性治疗。

## PU-126

# 基于静息态脑功能成像在自闭症谱系障碍患者中的网络拓扑研究

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目的:自闭症谱系障碍（autism spectrum disorder, ASD），又称孤独症，是一种常见的高度遗传的异质神经发育障碍性疾病。本研究主要目的是研究 ASD 患者与典型发育（typical development, TD）正常对照的大脑网络的拓扑结构，旨在探索其神经影像学特征，为其病因研究提供线索。
材料与方法：在国际自闭症脑成像交换数据库中，提取其中 4 个站点中符合纳入标准的 65 例 ASD 患儿（男性 50 例、女性 15 例）及 65 例正常对照者（男性 51 例、女性 14 例）的大脑部静息态功能磁共振成像（rs-fMRI）及 T1WI 结构像数据。应用图论分析来研究大脑网络的拓扑组织，包括全局和局部拓扑参数。
结果：图论网络分析在阈值范围内，ASD 患儿仅有聚类系数（clusteringcoefficient, Cp）和特征路径长度（path length, Lp）低于 TD 组，具有统计学差异（P<0.05）。全局效率（global efficiency, Eglob）、局部效率（local efficiency, Eloc）等全局指标的曲线下面积均无统计学差异。ASD 患儿

和 TD 组的功能连接网络均具有“小世界”属性，γ 和 λ 均随着稀疏度的增加而逐渐减低，γ 明显大于 1 而 λ 接近于 1，但两组间的 γ 和 λ 值并无统计学差异。节点水平分析结果显示双侧前扣带回、双侧尾状核、双侧海马、右侧顶下小叶的节点效率减低（P<0.05）。
结论：与 TD 组相比，ASD 患儿大脑拓扑学改变仍符合小世界网络属性，但其内部特性有所改变，揭示了 ASD 患儿脑功能网络的异常拓扑组织，这可能有助于我们从脑功能网络拓扑组织的角度理解 ASD 的病理生理机制。

## PU-127
# 体素内不相干运动扩散加权成像预测肝细胞癌 CK19 状态的价值

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目的：讨体素内不相干运动扩散加权成像（IVIM-DWI）预测肝细胞癌（HCC）CK19 状态的价值。方法：回顾性收集我院 2015 年 10 月至 2020 年 7 月期间经术后病理证实为 HCC 的 38 例患者，其中 CK19 阳性者 8 例，CK19 阴性者 30 例。所有患者行上腹 MRI 检查，包括 T1WI、T2WI、动态增强扫描和 IVIM-DWI。在 GE AW4.6 工作站，使用 Functool 软件重建 IVIM-DWI 图像，生成定量参数图，包括标准化扩散加权系数（standard apparent diffusion coefficient，standard ADC）、D Mono、D* Mono、f Mono、D Bi, D* Bi 和 f Bi。参照 DWI 图像，将大小相等的 3 个类圆形感兴趣区放置在病变的最大层面。采用 Mann-Whitney U 检验比较两组间各参数的差异。采用 logistic 回归分析，建立不同参数组合的预测模型。采用受试者操作特征（ROC）分析评估鉴别诊断效能，Delong 检验比较不同参数的 AUC 值间的差异。结果：CK19 阳性 HCC 组的 D Mono 和 D Bi（6.04×10-4 和 5.70×10-4（mm2/s））低于 CK19 阴性 HCC 组（7.31×10-4 和 8.91×10-4（mm2/s），P<0.05）。其余参数在两组间无统计学差异（P>0.05）。D Mono 鉴别 CK19 阳性和阴性 HCC 的曲线下面积（AUC）为 0.817，D Bi 的 AUC 为 0.988。D Mono 和 D Bi 联合后效能提高，AUC 为 0.992。Delong 检验表明，两个参数联合及 D Bi 比 D Mono 的效能显著提升（P<0.05）。结论：IVIM-DWI 的 D Mono 和 D Bi 对鉴别 CK19 阳性和阴性 HCC 有一定的价值。

## PU-128
# 体素内不相干运动扩散加权成像评估双表型肝细胞癌的价值

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目的：探讨体素内不相干运动扩散加权成像（IVIM-DWI）诊断双表型肝细胞癌（DPHCC）的价值。方法：回顾性收集我院 2015 年 10 月至 2020 年 7 月期间经术后病理证实为 HCC 的 34 例患者，其中 DPHCC 15 例（同时表达 HCC 和肝内胆管细胞癌标志物）和非 DPHCC 19 例（只表达 HCC 标志物）。所有患者行上腹 MRI 检查，包括 T1WI、T2WI、动态增强扫描和 IVIM-DWI。在 GE AW4.6 工作站，使用 Functool 软件重建 IVIM-DWI 图像，生成定量参数图，包括标准化扩散加权系数（standard ADC）、D Mono、D* Mono、f Mono、D Bi, D* Bi 和 f Bi。参照 DWI 图像，将大小相等的 3 个类圆形感兴趣区放置在病变的最大层面。采用 Mann-Whitney U 检验比较 DPHCC 组与非 DPHCC 组间各参数的差异。采用 logistic 回归分析，建立不同参数组合的预测模型。采用受试者操作特征（ROC）分析评估鉴别诊断效能，Delong 检验比较不同参数的 AUC 值间的差异。结果：DPHCC 组的 D Mono 和 D Bi（6.11×10-4 和 7.93×10-4（mm2/s））低于非 DPHCC 组（7.37×10-4 和 1.00×10-3（mm2/s），P<0.05）。其余参数在两组间无统计学差异（P>0.05）。

D Mono 和 D Bi 鉴别 DPHCC 和非 DPHCC 的曲线下面积（AUC）分别为 0.775 和 0.856。D Mono 和 D Bi 联合后效能提高，AUC 为 0.888。Delong 检验表明，D Mono 和 D Bi 联合的效能显著高于 D Mono（P<0.05）。结论：IVIM-DWI 的 D Mono 和 D Bi 对鉴别 DPHCC 和非 DPHCC 有一定的价值。

## PU-129

# 增强 T2*血管加权成像评估双表型肝细胞癌的价值

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目的：探讨增强 T2*血管加权成像（enhanced T2-star weighted angiography，ESWAN）诊断双表型肝细胞癌（dual-phenotype hepatocellular carcinoma，DPHCC）的价值。
方法：回顾性收集我院 2014 年 3 月至 2020 年 7 月期间经术后病理证实为 HCC 的 44 例患者，其中 DPHCC 20 例（同时表达 HCC 和肝内胆管细胞癌标志物）和非 DPHCC 22 例（只表达 HCC 标志物）。所有患者行上腹 MRI 检查，包括 T1WI、T2WI、动态增强扫描和 ESWAN 序列。在 GE AW4.6 工作站，使用 Functool 软件重建 ESWAN 序列，生成得到幅度图、相位图、R2*图和 T2*图。参照 T2WI 图像，将大小相等的 3 个类圆形感兴趣区放置在病变的最大层面，记录幅度值、相位值、R2*值和 T2*值。采用 Mann-Whitney U 检验比较 DPHCC 组与非 DPHCC 组间各参数的差异。采用受试者操作特征（ROC）分析评估鉴别诊断效能。结果：DPHCC 组 R2*值（34.89（33.42，43.15）HZ）高于非 DPHCC 组（23.19（14.97，30.01）HZ），差异有统计学意义（P<0.001）。两组间的幅度值、相位值和 T2*值无统计学差异（P 值分别为 0.406、0.199 和 0.801）。R2*值鉴别 DPHCC 和非 DPHCC 曲线下面积（AUC）为 0.830，敏感度为 85.0%，特异度为 77.3%。结论：ESWAN 序列的 R2*对鉴别 DPHCC 和非 DPHCC 具有一定的价值。

## PU-130

# 主动脉弓钙化积分对高血压病患者颅内微出血灶的预测价值

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**目的** 探讨主动脉弓钙化积分对高血压病患者颅内微出血灶（CMBs）的预测价值。**方法** 选取 63 例临床确诊的高血压病患者，均行头颅磁共振磁敏感加权成像（SWI）检查和胸部 CT 平扫检查，回顾性分析患者的临床表现和影像学表现，SWI 记录 CMBs 数目，胸部 CT 平扫计算主动脉弓钙化积分，按照 CMBs 数目分为≤5 个、>5 个两组。采用独立样本 t 检验和 χ2 检验对数据进行分析，并将 CMBs 数目与主动脉弓钙化积分行简单线性相关分析，采用受试者工作特征（ROC）曲线评估主动脉弓钙化积分对 CMBs 预测的诊断价值。**结果** CMBs≤5 个患者 20 例，CMBs>5 个患者 43 例。CMBs>5 个患者患高血压病时间长于 CMBs≤5 个患者（P<0.05），并且血压控制情况不如 CMBs≤5 个患者（P<0.05）；CMBs>5 个患者既往有脑梗塞多于 CMBs≤5 个患者（P<0.05）；CMBs>5 个患者的主动脉弓钙化积分明显高于 CMBs≤5 个患者（P<0.05）。CMBs 数目与主动脉弓钙化积分呈一定正相关（R2=0.38，P<0.05）。主动脉弓钙化积分预测 CMBs>5 个的 ROC 曲线下面积为 0.876，最佳阈值为 337.47，敏感性 76.7%，特异性 90.0%。**结论** 主动脉弓钙化积分对高血压病患者 CMBs 具有较高的预测价值，可作为临床诊断的重要依据，有助于存在 MRI 禁忌症的高血压患者抗栓方案的指定。

## PU-131

# 心外膜脂肪含量与肥厚性心肌病心肌纤维化关系的 MRI 研究

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目的：利用磁共振多模态成像特点，通过 T1mapping 技术定量评估心外膜脂肪组织（epicardial adipose tissue，EAT）对肥厚性心肌病（hypertrophic cardiomyopathy，HCM）心肌纤维化、梗阻性心肌肥厚发生比率的影响。
材料与方法：使用 1.5T 磁共振扫描仪（Siemens Amira）及其后处理工作站（Siemens Argus），通过磁共振电影序列、对比增强前、后 T1 mapping 序列分别对 52 名临床明确诊断 HCM 患者的 EAT 含量、心肌对比增强前后 T1 值、细胞外容积比率（extracellular volume fraction，ECV）值进行测量。其中，ECV 值用于衡量心肌间质纤维化水平。使用后处理工作站软件工具在心脏四腔、左室长轴、短轴电影图像上分别勾画 EAT 轮廓、测量 EAT 面积，将 EAT 量以中位数划分为高、低两组，分析 EAT 与心肌 ECV 值的关系，并利用线性回归分析经共线性诊断，排除自变量 EAT 与相关临床因素间的干扰，以此来评估 EAT 对心肌 ECV 值的独立影响。最后，根据超声心动图左室流出道与主动脉峰值压力差是否≥30mmHg，将患者分为梗阻型（包括隐匿梗阻型）与非梗阻型，进一步比较高、低 EAT 量患者梗阻性心肌肥厚的发生比率是否存在差异。
结果：高量 EAT 组患者心肌 ECV 值（41.3± 9.3%）高于低量 EAT 组患者（33.5± 9.0%），差异具有统计学意义（P=0.003）。高量 EAT 组患者梗阻性心肌肥厚的发生比率（61.5%）多于低量 EAT 组患者（26.9%），差异具有统计学意义（P=0.012）。男性入组患者心肌 ECV 值高于女性（P=0.047），且经共线性诊断，性别与 EAT 之间不存在多重共线性（容差≥0.1，VIF≤5）。其他临床因素[年龄、高血压、糖尿病、家族史]与入组患者心肌 ECV 值无显著相关（P＞0.05）。
结论：EAT 是 HCM 心肌间质纤维化的独立危险因素，EAT 量越高，患者发生梗阻性心肌肥厚的比率越大。

## PU-132

# 注意缺陷多动障碍患者静息态自发脑活动的动态性及一致性异常

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**目的：**注意缺陷多动障碍（ADHD）是儿童常见的神经精神障碍，以注意力不集中、多动、冲动为特征。应用静息态功能磁共振成像技术（R-fMRI），已经对 ADHD 患者自发脑活动的静态和动态特征进行了研究。然而，目前尚不清楚 R-fMRI 指标动态特征之间的整合能力是否在 ADHD 中发生改变。
**方法：**对 50 例 ADHD 患者和 28 例健康对照进行 R-fMRI 扫描。采用滑动时间窗方法计算一系列 R-fMRI 局部指标（ALFF、ReHo、DC、VMHC、GSC）的动态特征，并比较了 ADHD 患者与健康对照组局部指标动态性特征的差异。同时对这些指标动态特征的一致性进行了计算和比较。最后，研究了这些指标的动态性及一致性特征与 ADHD 相关临床量表分数的关系。
**结果：**与健康对照相比，ADHD 患者的左侧额中回显示出 ALFF 动态性降低，在右侧枕中回显示出 ALFF 动态性增加。在进一步计算了这些指标的动态一致性特征后，我们发现 ADHD 患者的左侧额

中回存在动态一致性特征降低。此外，我们发现 ADHD 患者额叶的一致性特征指数与威斯康星卡片分类测试（WCST）的非持续错误呈负相关。
**结论：**ADHD 患者存在自发脑活动动态性及一致性的异常。此外，较低的动态一致性与较差的认知控制相关。

## PU-133

# Diagnostic Accuracy of MRI for Detecting Cervical Invasion in Patients with Endometrial Carcinoma: A Meta-Analysis

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Objectives: To evaluate the diagnostic accuracy of magnetic resonance imaging (MRI) in the preoperative assessment of cervical invasion and to analyse the influence of different imaging protocols in patients with endometrial carcinoma.
Methods: An extensive search of articles about MRI for assessing cervical invasion in patients with endometrial carcinoma was performed on PubMed, Embase, Web of Science, Cochrane Library, and Clinical Trials from January 2000 to July 2020. Two reviewers independently evaluated the methodological quality of each study by using the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2). Diagnostic accuracy results and additional useful information were extracted. The pooled estimation data was obtained by statistical analysis.
Results: A total of 42 eligible studies were included in the meta-analysis. Significant evidence of heterogeneity was found for detecting cervical invasion (I2 = 74.1%, P = 0.00 for sensitivity and I2 = 56.2%, P = 0.00 for specificity). The pooled sensitivity and specificity of MRI were 0.58 and 0.95 respectively. The use of higher field strength (3.0 T) demonstrated higher pooled sensitivity (0.74). Using diffusion weighted imaging (DWI) alone presented higher pooled sensitivity (0.86) than using other sequences. The studies that used dynamic contrast-enhanced MRI (DCE-MRI) alone showed higher sensitivity (0.80) and specificity (0.96) than those that used T2-weighted imaging (T2WI) alone.
Conclusions: MRI shows high specificity for detecting cervical infiltration in endometrial carcinoma. Using DWI or a 3.0-T device may improve the pooled sensitivity. DCE-MRI demonstrates higher pooled sensitivity and specificity than T2WI.

## PU-134

# The role of three-dimensional MRI in the differentiation between angular pregnancy and interstitial pregnancy

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Objectives It is difficult to distinguish between angular pregnancy and interstitial pregnancy in clinical practice. The objective of this study is to investigate the MRI features of three-dimensional(3D) T2W images in discriminating angular pregnancy from interstitial pregnancy.
Materials and methods We reviewed 3D MRI images of 50 patients with interstitial pregnancy and 55 patients with angular pregnancy retrospectively. Imaging features were identified to distinguished the two ectopic pregnancies and the ROC (Receiver operating characteristic) analysis was used to assess the diagnostic performance.
Results The significant imaging features were the outline of uterus cavity ($p < 0.001$), involvement of junctional zone ($p < 0.001$), signal of surroundings ($p = 0.005$), relationship with round ligament

(p= 0.042), and overlying myometrial thickness (p=0.041) between interstitial pregnancy and angular pregnancy. Multivariate logistic regression analysis identified junctional zone involvement, surrounded by hyper/iso-intensity on 3D T2W images, and asymmetric outline of uterus cavity as significant indicators for angular pregnancy. Combined the three imaging features, the AUC (Area under the curve) of ROC curve was 0.87 in distinguishing interstitial pregnancy and angular pregnancy.
Conclusions 3D MRI findings suggestive of angular pregnancy in comparison with interstitial pregnancy are the junctional zone involvement, surrounded by hyper/iso-intensity on 3D T2W images and asymmetric outline of uterus cavity. It should be considered after indistinct ultrasound findings, providing accurate evaluation of the location of the gestational sac, which is helpful in the management of these patients.

## PU-135

# 定量 CT 联合 MR 扩散加权成像在预测肺癌表皮生长因子受体突变中的应用价值

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目的：本研究采用定量 CT 及 MR 扩散加权成像（DWI）预测肺癌 EGFR 基因突变状态，并评估二者的诊断效能。方法：回顾性收集 47 例经 EGFR 基因检测的肺腺癌患者，其中 EGFR 突变 19 例，未突变 28 例。全部患者治疗前均接受 CT、MR 扫描，并进行活检。将 CAD“数字肺”定量分析结果及 ADC 值进行分析，并将有统计学意义的参数使用二元 Logistic 回归分析，用于筛选预测 EGFR 突变的影响因子。绘制受试者工作特征曲线（ROC），评估预测效能。结果：两组间性别、年龄无统计学差异（p＞0.05），病灶体积有统计学差异（p=0.020）。两名放射科医师对 ADC 值测量的一致性较好（ICC=0.978）。EGFR 突变与野生组两组间 ADC 值有统计学差异（p=0.045）。肿瘤体积、表观扩散系数（ADC 值）均是预测肺癌 EGFR 基因突变状态的独立危险因素。肿瘤体积、ADC 值及联合二者的预测 EGFR 突变状态的敏感性差，特异性高，AUC 分别为 0.701、0.674、0.805。结论：肿瘤体积、MR-DWI ADC 值可用来无创的预测肺癌 EGFR 基因突变状态，联合二者可提高预测能力，为临床制定治疗策略提供影像学依据。

## PU-136

# DKI 推算序列优化直肠癌术前分期的应用研究

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**目的** 探索基于 DKI 扫描参数的推算序列代替常规 DWI 序列扫描的应用价值。
**材料与方法** 回顾性分析 2019 年 11 月至 2020 年 10 月在我院经手术病理确诊的 62 例直肠癌患者资料，所有患者均于手术前 2 周内接受 3.0T Siemens Prisma 的直肠 MR 扫描，选取 DKI（b=0、700、1400、2100s/mm2）图像中较低 b 值部分（b=0、700s/mm2），在 Siemens SyngoVia 后处理站推算出 b=1000s/mm2 弥散图像。两名医生分别对推算序列与常规 DWI（b=0、1000s/mm2）序列的 b=1000s/mm2 的弥散图像进行主观图像质量评分，并测算肿瘤信噪比

（SNR）、对比度噪声比（CNR）和信号强度比（SIR），同时分析比较基于两种图像局部 T、N 分期的准确性。采用 Friedman 检验、Wilcoxon 配对检验、McNemar 检验或 Fisher 确切概率法进行统计分析。
**结果** 直肠肿瘤主观图像质量、SNR、CNR 及 SIR 在 DKI 推算序列均优于常规 DWI 序列（P<0.05）。两者术前诊断直肠癌 T 分期的准确率分别为 91.94%（57/62）、74.19%（46/62），差异有统计学意义（P<0.05）。两者术前诊断直肠癌 N 分期的准确率分别为 70.97%（44/62）、66.13%（41/62），差异无统计学意义（P>0.05）。
**结论** DKI 推算序列的图像质量及病灶显示效果优于常规 DWI 图像，并且可提高术前 T 分期的诊断效能，具有代替常规 DWI 序列、减少扫描时间、优化扫描流程的潜在应用价值。

## PU-137
# 基于弥散加权成像高信号脑肿瘤的影像诊断的应用初探

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**目的**:总结分析弥散加权成像（DWI）高信号的脑肿瘤的 CT、MRI 影像学特征，探讨其诊断及鉴别诊断价值。**方法**:回顾性分析经病理证实的脑原发淋巴瘤 17 例、生殖细胞瘤 6 例、髓母细胞瘤 8 例、高级别胶质瘤 45 例、脑膜瘤 30 例、脑转移瘤 18 例。所有病例均行 CT 平扫、MRI 平扫加增强扫描，弥散成像（DWI）、灌注成像（PWI）、波谱（MRS）成像等多模态 MRI 扫描。观察其常规 CT、MRI 表现和弥散成像（DWI）、灌注成像（PWI）、波谱（MRS）成像表现，并进行总结归纳分析。**结果**:淋巴瘤 15 例（15/17）、生殖细胞瘤 5 例（5/6）、髓母细胞瘤 7 例（7/8）、高级别胶质瘤 25 例（25/45）、脑膜瘤 25 例（25/30）、脑转移瘤 8 例（8/18）中具有以下影像表现（排除出血）：CT 平扫表现为高密度，MRI 平扫 T2WI 为等信号，DWI 为高或稍高信号，ADC 图为低信号。除此之外，脑原发淋巴瘤密度/信号均匀，强化明显，PWI:rCBV 降低，MRS：NAA 下降，Cho 上升。生殖细胞瘤好发松果体区、鞍上区、基底节区、丘脑。髓母细胞瘤好发第四脑室顶部、小脑半球，明显强化，MRS：NAA 下降，Cho 上升。高级别胶质瘤密度/信号不均，强化不均，PWI:rCBV 增高，MRS：NAA 下降，Cho 上升，坏死明显者 Cho 下降。脑膜瘤为脑外肿瘤，信号多均匀，强化明显，PWI:rCBV 升高，MRS：无 NAA 峰，Ala 升高。转移瘤信号不均，环形强化多见，PWI:rCBV 升高，MRS：瘤周水肿 Cho 正常。**结论**: 脑原发淋巴瘤、生殖细胞瘤、髓母细胞瘤、高级别胶质瘤、脑膜瘤、脑转移瘤等脑肿瘤因为肿瘤细胞的高密度排列，DWI 表现为高信号，同时 CT 平扫为高密度，MRI 平扫 T2WI 为等信号，ADC 图为低信号，根据此表现，要考虑到上述脑肿瘤，并根据其他影像特点进行鉴别诊断，可减少诊断误差。

## PU-138
# 非哺乳期乳腺炎 MRI 影像学表现与病理对照研究

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摘要：目的 探讨非哺乳期乳腺炎 MRI 影像特征与临床病理相关性研究。方法 回顾性分析 29 例经我院手术或穿刺活检病理证实为非哺乳期乳腺炎 MRI 图像资料，总结其 MRI 图像病变形态、分布特点、信号特点及增强强化特征，并与病理结果对照研究。结果 29 例非哺乳期乳腺炎中包括：浆细胞性乳腺炎 8 例，肉芽肿性乳腺炎 12 例，急慢性化脓性乳腺炎 5 例，急性乳腺炎 4 例。29 例均为单侧乳腺发病，病程长短不一，5 例病灶周围局部皮肤水肿增厚，4 例乳头稍凹陷。T1WI 序列以低信号为主（6 例可见病变区局部导管管腔内见条状、斑点状高信号灶），T2WI 序列以稍高信号

（22 例）或等信号（7 例）为主，DWI 像多呈稍高信号（11 例病灶局部见囊状明显高亮信号灶），ADC 值多高于 1.16×10-3mm2/s（DWI 像明显高亮区，增强无强化，ADC 值平均约 1.07×10-3mm2/s）。增强扫描见 13 例呈段样或区段样明显强化，8 例呈类圆形蜂窝状强化，6 例呈弥漫性非肿块样强化，2 例呈多发小结节样强化，27 例病灶增强扫描Ⅰ型曲线 9 例，Ⅱ型曲线 20 例。结论 非哺乳期乳腺炎 MRI 影像学表现具有一定特征性，同时结合临床病史，可以明显提高诊断准确率。

PU-139

# Signal intensity ratio of draining vein on silent MR angiography as an indicator of high flow arteriovenous shunt in brain arteriovenous malformation

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Objectives: To evaluate whether signal intensity ratio (rSI) of draining vein on Silent MR angiography is correlated with arteriovenous (A-V) transit time on digital subtraction angiography (DSA), thereby identifies high flow A-V shunt in brain arteriovenous malformation (BAVM), and to analyze whether the rSI and the characteristic of draining veins on Silent MRA are associated with hemorrhage presentation.
Methods: Eighty-one draining veins of 46 participants with BAVM (mean age 33.2 ± 16.9 years) who underwent Silent MRA and DSA were evaluated retrospectively. The correlation between rSI of draining vein on Silent MRA and A-V transit time on DSA were examined. The AUC-ROC was obtained to evaluate the performance of the rSI in determining the presence of high flow A-V shunt. The characteristics of draining veins with the maximum rSI (rSImax) were further compared between hemorrhagic and non-hemorrhagic untreated BAVM.
Results: The rSI of each draining vein on Silent MRA were significantly correlated with A-V transit time from DSA ($r = -0.81$, $p < .001$). The AUC-ROC was 0.89 for using rSI to determine the presence of high flow A-V shunt. A cut-off rSI value of 1.09 yielded a sensitivity of 82.4% and a specificity of 82.8%. The Draining vein with rSImax and no ectasia was significantly more observed in the hemorrhagic group ($p = 0.045$).
Conclusions: rSI of draining vein on Silent MRA is significantly correlated with A-V transit time on DSA and it can be used as an indicator of high flow A-V shunt in BAVM.

PU-140

# 合成磁共振成像(synthetic MRI)联合三维动脉自旋标记成像(3D-ASL)在弥漫性胶质瘤分级及肿瘤细胞增殖活性预测中的应用研究

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目的 探讨合成磁共振成像(synthetic MRI)联合三维动脉自旋标记成像(3D-ASL)对弥漫性胶质瘤分级诊断的应用价值及与肿瘤细胞增殖活性(Ki-67)的相关性。
方法 2020 年 8 月至 2021 年 6 月共收集 66 例弥漫性胶质瘤患者，包括低级别组(LGG)25 例(WHO II 级)和高级别组(HGG)41 例(WHO III、IV 级)。所有患者术前行常规 MRI、Synthetic MRI 及 3D-ASL 检查，利用 GE ADW4.7 后处理软件测量肿瘤实质部分纵向弛豫时间(T1)、横向弛豫时间(T2)、质子密度(PD)、脑血流量(CBF)，术后病理切片通过免疫组化检测 Ki-67 标记指数(Ki-67 label index, Ki-67 LI)。应用秩和检验(*Mann-Whitney U* 检验)比较高低级别胶质瘤各定量参数的差异，采用 ROC 曲线和 Binary 逻辑回归分析 T1、PD、CBF 和三者联合的诊断效能，利用 *Spearman* 检验分析各参数与 Ki-67 LI 的相关性。
结果 HGG 组 T1、PD、CBF 值均高于 LGG 组(1572.62 ± 173.13ms VS 1375.89 ± 133.76ms、86.19 ± 2.44 pu VS 83.01 ± 2.52 pu、129.39 ± 48.12 ml·100g$^{-1}$·min$^{-1}$ VS 77.23 ± 49.03 ml·100g$^{-1}$·min$^{-1}$)，差异具有统计学意义($P$<0.01)，T2 值无统计学差异($P$=0.124)。单参数 ROC 分析中，T1、PD、CBF 鉴别高低级别胶质瘤的 ROC 曲线下面积(AUC)分别为 0.847、0.843、0.777，多参数分析中，三者联合的诊断效能最高(AUC=0.973)，敏感度和特异度分别为 87.8%和 100%。T1、PD、CBF 均与 Ki-67 具有中等程度正相关，其中 PD 的相关性最高($r$=0.411, $P$<0.01)，T2 值与 Ki-67 没有相关性($r$=-0.100, $P$=0.423)。
结论 Synthetic MRI 和 3D-ASL 可无创地评估胶质瘤的病理分级并预测 Ki-67 的表达情况，其中 T1 和 PD 是较好的影像学新指标。

# PU-141

## 后循环短暂性脑缺血发作患者的基底动脉 HR-MRI 研究

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目的：动脉管腔狭窄程度不能精准地反映缺血性脑血管疾病的原因和严重程度，管壁的形态和特征对缺血性脑血管疾病的病因诊断、治疗计划的制订和预后评估具有更重要的价值。高分辨磁共振成像（high-resolution magnetic resonance imaging，HR-MRI）管壁成像不仅能对缺血性脑血管疾病的责任血管做出准确的定位、定性诊断，还可以对斑块进行定量分析。本研究应用 HR-MRI 管壁成像探究后循环短暂性脑缺血发作（transient ischemic attack，TIA）频发患者与非频发患者间基底动脉的管壁差异，并分析两组患者的临床特点。
材料与方法：回顾性搜集本院从 2019 年 1 月至 2020 年 1 月的后循环 TIA 患者，根据患者 1 天内后循环 TIA 的频次分为频发组（不少于两次）和非频发组（少于两次）。对后循环 TIA 患者实施基底动脉 HR-MRI 管壁扫描，将发现粥样硬化斑块的患者纳入研究。得到原始图像后进行三维重建，测量和记录两组患者基底动脉斑块形态学参数（最狭窄层面的最大管壁厚度、管腔直径）、狭窄程度、斑块负荷、血管重构和斑块分布，并对两组结果进行比较。同时，收集并比较两组患者相关临床资料（年龄、性别、吸烟史、饮酒史、高血压史、血脂异常、糖尿病史、卒中家族史）的差异。
结果：本研究共纳入 68 例后循环 TIA 患者（频发组：38 例，非频发组：30 例），检出 184 个基底动脉斑块（频发组：108 个，非频发组：76 个）。在血管最狭窄层面，频发组最大管壁厚度大于非频发组，频发组管腔直径小于非频发组，差异均有统计学意义（$P$ 均＜0.05）。频发组基底动脉狭窄程度、斑块负荷、重构指数比非频发组高，且更多的表现为正性重构，差异均有统计学意义（$P$ 均＜0.05）。频发组腹侧斑块的百分比大于非频发组（38.0%*vs*22.4%），非频发组背侧斑块的百分比大于频发组（35.5%*vs*17.6%），差异均有统计学意义（$P$=0.025、0.006）；然而两组侧壁斑块的百分比相似（44.4%*vs*42.1%），差异无统计学意义（$P$=0.753）。后循环 TIA 频发患者与非频发患者各临床因素的统计学差异不显著（$P$ 均＞0.05）。

结论：后循环 TIA 频发组基底动脉狭窄程度、斑块负荷、重构指数高于非频发组，且正性重构更常见。后循环 TIA 频发组基底动脉斑块多数位于腹侧，非频发组多数位于背侧，两组侧壁斑块的比例相似。

PU-142

# Magnetic Resonance Spectroscopy for Identifying Preeclampsia in Patients with Hypertensive Disorders of Pregnancy

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Objectives: To investigate the feasibility of magnetic resonance spectroscopy (MRS) for identifying preeclampsia (PE) in patients with hypertensive disorders of pregnancy (HDP).
Materials and Methods: Conventional magnetic resonance imaging (MRI), diffusion-weighted imaging (DWI), and MRS were performed in 66 women with HDP. The patients were divided into two groups: gestational hypertension (GH, n=27), PE (n=39). The 35 healthy unpregnant women with matching age and 20 healthy pregnant women were selected as healthy control groups 1 and 2. The quantitative parameters, including T1 signal intensity index (T1SI), apparent diffusion coefficient (ADC) and metabolites on MRS were measured in the bilateral globus pallidus. One-way analysis of variance was used to compare differences between groups. The receiver operating characteristic (ROC) curve was used to analyze the diagnostic performance of significant parameters for identifying PE in patients with HDP.
Results: T1SI and ADC value progressively increased in HDP and were significantly higher in GH and PE patients than in controls (all $P<0.05$). Lactate (Lac)/creatine (Cr) and glutamine (Glx)/Cr ratios progressively increased and myo-inositol (mI)/Cr ratio progressively decreased in HDP and had a significant difference in GH and PE patients as compared to controls (both $P<0.001$).
Conclusions:Increased T1SI value, Lac/Cr, Glx/Cr ratios, and decreased ADC value and mI/Cr ratio in the bilateral globus pallidus were useful for identifying PE from GH patients. MRS is expected to be a noninvasive and effective tool to identify PE in patients with HDP.

PU-143

# 基于 DTI 的纹理分析鉴别肝细胞癌和肝内胆管细胞癌的价值

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目的：探讨弥散张量成像（diffusion tensor imaging，DTI）纹理分析鉴别肝细胞癌（hepatocellular carcinoma，HCC）和肝内胆管细胞癌（intrahepatic cholangiocarcinoma，ICC）的价值。方法： 回顾性研究于大连医科大学附属第一医院接受上腹部 1.5T MRI（Signa HDXT，GE healthcare）检查且病理证实为 HCC（52 例）和 ICC（28 例）的患者资料。重建 DTI 图像，生成表观扩散系数（apparent diffusion coefficient，ADC）和各向异性分数（fractional anisotropy，FA）图。两位观察者（分别具有 2 年和 8 年影像诊断经验）勾画肿瘤所有层面的 ROI，使用 AK（artificial intelligent kit，GE Healthcare）软件提取纹理特征。采用组内相关系数评估一致性，独立样本 t 检验或 Mann-Whitney U 检验比较各参数的差异，对有统计学差异的参数绘制 ROC 曲线。采用 Logistic 回归建立联合诊断模型。DeLong 检验比较单一参数与联合诊断效能

的差异。结果： 两观察者测量结果一致性良好（组内相关系数>0.75）。HCC 组 ADC 信号强度图的最大值、平均值、方差、标准差及熵小于 ICC 组；能量、峰度及相关性大于 ICC 组（P<0.05）。HCC 组 FA 信号强度图的最大值、方差、标准差及长游程优势小于 ICC 组；相关性及短游程优势大于 ICC 组（P<0.05）。其余参数差异无统计学意义（P>0.05）。单个参数中，ADC-相关性鉴别 HCC 与 ICC 的效能最高，AUC 为 0.856，敏感度为 75％，特异度为 82.1％。当 ADC-能量、FA-最大值、FA-短游程优势三个参数联合或者 ADC-能量、ADC-相关性、FA-最大值、FA-短游程优势四个参数联合时均可获得最佳诊断效能，AUC 值为 0.877，敏感度为 78.6％，特异度为 84.6％。Delong 检验显示联合诊断与多个参数相比较效能有显著提升（P<0.05）。结论： 基于 DTI 的纹理分析可以提供多个参数鉴别诊断 HCC 与 ICC。

## PU-144

# 快速 MRI 成像技术诊断前置胎盘的应用价值

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目的 探讨快速 MRI 成像技术在前置胎盘以及前置胎盘并发胎盘植入诊断中的应用价值。
方法 采用单激发快速自旋回波（single shot fast spin echo, SSFSE）序列和快速稳态进动采集（fast imaging employing steady state acquisition, FIESTA）序列对 25 例前置胎盘孕妇行 MRI 扫描，观察和分析该 25 例病例前置胎盘的 MRI 表现特征。
结果 25 例病例均顺利完成检查，其中边缘型前置胎盘 1 例，表现为胎盘下缘离子宫颈内口 1.3cm，但并没有覆盖宫颈内口；部分型前置胎盘 6 例，表现为胎盘边缘覆盖了一部分宫颈内口；完全型前置胎盘 18 例，表现为宫颈内口完全由胎盘覆盖。另外，前置胎盘合并胎盘植入 9 例，其中胎盘粘连 3 例，表现为胎盘基底部局部组织增厚，内部信号混杂，胎盘与子宫肌层分界模糊，子宫肌层局部受压变薄；胎盘植入 5 例，表现为胎盘与子宫肌层分界模糊，中等信号胎盘组织部分侵入低信号的子宫肌层；胎盘穿透 1 例，表现为子宫肌层局部中断，胎盘组织由中断处完全侵入子宫肌层，子宫浆膜层与膀胱分界模糊。
结论 MRI 可以直接显示前置胎盘与子宫颈内口之间的关系，合并有胎盘植入的病例，可直观评估胎盘组织侵入到子宫肌层的程度。MRI 快速成像技术在前置胎盘以及胎盘植入的诊断中有较高的临床应用价值。

## PU-145

# 原发性泪腺导管腺癌一例

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原发性泪腺导管腺癌是一种极为罕见的上皮源性恶性肿瘤，侵袭性强，因肿瘤早期临床症状较轻，就诊时多已属于晚期，并且影像学缺乏特异性征象，容易误诊。笔者回顾性分析一例原发性泪腺导管腺癌患者的临床、CT 及 MRI 表现，旨在增加对该肿瘤的认识，以提高诊断与鉴别诊断水平。

## PU-146

# 流入反转恢复序列在门静脉非对比增强成像中的应用

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目的 探讨国产 1.5T MR 流入反转恢复（FIRM）序列对门静脉系统进行对比增强成像的可行性。
方法 收集我院 30 例疑似有门静脉病变的患者，在联影 1.5T MRI 上行门静脉冠状位 FIRM 序列扫描及门静脉 CTA 增强扫描，将扫描图像在工作站行 3D 和 MIP 重建，由两名影像诊断医生分析两种方法对门静脉及其分支的显示，并进行评分，比较两者对门静脉显示的差异。
结果 两种方法门静脉图像质量评分的差异无统计学意义（P<0.05），两位诊断医师对 NCE-MRA 门静脉成像质量评分的一致性较高，Kappa 值为 0.95 。
结论 国产 1.5T MRI FIRM 成像序列是一种无需使用对比剂的非侵入性血管成像方法，能在不用对比剂情况下获得与门静脉 CTA 相似成像效果的门静脉系统图像，并能有效地对肝脏门静脉进行评估。

## PU-147
## 流入反转恢复 MR 血管成像在肾动脉成像的可行性研究

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目的 比较肾动脉流入反转恢复 MR 血管成像（NC FIRM MRA）和增强 MR 血管成像（CE-MRA）的图像质量，探讨肾动脉 NC FIRM MRA 的价值。
方法 前瞻性收集因病情所需行肾动脉 CE-MRA 检查的 73 例患者，均行肾动脉 NC FIRM MRA 检查。由 2 名高年资放射科医师单独阅片，分别对不同检查方法的图像行肾动脉图像质量评分及肾动脉分支显示评分，分别采用配对样本的 Wilcoxon 符号秩检验和  2 检验进行比较。结果 NC FIRM MRA 和 CE-MRA 的肾动脉图像质量评分差异无统计学意义（P＞0.05），对各程度狭窄的正确诊断率之间不具有统计学差异(P＞0.05)。NC FIRM MRA 和 CE-MRA 图像的肾动脉分支显示差异有统计学意义（P<0.05）。
结果 NC FIRM MRA 和 CE-MRA 的肾动脉图像质量评分差异无统计学意义（P＞0.05）。NC FIRM MRA 和 CE-MRA 图像的肾动脉分支显示差异有统计学意义（P<0.05）。
结论 CE-MRA 和 NC FIRM MRA 对肾动脉各级分支的显示差异有统计学意义，而对于肾动脉主干及狭窄及图像质量的显示差异无统计学意义。由于 NC FIRM MRA 成像无需注入对比剂，没有对比剂肾病的潜在危险，并且可以短期内重复检查，可以作为肾动脉狭窄的初步筛查手段。

## PU-148
## 帕金森病患者层级性脑拓扑属性改变及左旋多巴对其的修饰作用

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**目的**：探索帕金森病（PD）患者的脑功能连接网络层级性拓扑结构改变特征，以及左旋多巴替代治疗对脑功能连接网络的神经效应。
**材料与方法**：纳入 61 例 PD 患者和 89 例正常对照。所有 PD 患者在撤药 12 小时后接受第一次 MRI 扫描（高分辨率 T1 加权成像和功能磁共振成像），同时对所有患者进行临床评估；之后所有 PD 患者口服一片美多芭（苄丝肼/左旋多巴 50/200mg），一小时之后，重新评估 PD 患者的运动症状并且对患者进行功能磁共振扫描。采用同样的扫描序列采集正常对照的高分辨率 T1 加权成像和功能磁共振成像的图像。利用预处理后的功能磁共振图像构建全脑功能网络，分析 PD 患者大脑

拓扑层级属性（rich-club 和 diverse-club）的改变情况，并且将全脑网络分为三个层级的子网络，包括 rich-club 节点构成的子网络，feeder 节点构成的子网络以及 peripheral 节点构成的子网络（图 1），分析 PD 患者脑功能网络层级性改变，以及左旋多巴对脑网络的影响。
**结果**：与正常对照相比，PD 患者 diverse-club 内部的连接强度及效率无改变，rich-club 内部的连接强度及效率下降（图 2）。进一步分析层级性脑网络改变特征，PD 患者 rich-club 及相关脑区构成的子网络连接强度及效率下降，peripheral 脑区构成的子网络内部连接强度及效率无显著改变；同时，rich-club 节点等中心节点的度中心性下降，而 peripheral 脑区节点的度中心性升高，并且两者具有显著的相关（图 3）；服用左旋多巴后，异常的网络属性趋向于正常化。
**结论**：本研究揭示了 PD 患者存在脑拓扑组织形式的分化现象：rich-club 功能受损而 diverse-club 功能相对完整。此外，PD 病理下不同类型的节点具有不同的功能模式：拓扑学中心节点的功能受损伴有拓扑学外周节点的功能代偿。最后，多巴胺能治疗对大脑拓扑属性具有弹性的调控作用，能够使其趋于正常状态。

## PU-149
# 非增强 MRI 多定量参数鉴别富细胞型与退变型子宫平滑肌瘤

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【摘要】目的 探讨非增强 MRI 定量参数鉴别富细胞型与退变型子宫平滑肌瘤（CUL 与 DUL）的价值。资料与方法 回顾性分析 68 例经手术病理证实为非典型子宫平滑肌瘤的患者资料，按照病理类型分为两组，其中 CUL 17 例， DUL 51 例，所有患者术前均行盆腔 1.5T MRI 扫描，扫描序列包括 T1WI、脂肪抑制 T2WI、扩散峰度成像（DKI）和增强 T2*加权血管成像（ESWAN）。测量病灶 DKI 序列的平均扩散峰度（MK）、平均扩散系数（MD）、各向异性分数（FA）值；ESWAN 序列的幅度、相位、R2*和 T2*值；测量并计算病灶与髂腰肌 T1WI 和 T2WI 的信号比值，即 T1R、T2R。采用独立样本 t 检验或 Mann-Whitney U 检验比较两组病例各参数值的差异，采用 ROC 曲线分析有差异的参数鉴别两组病灶的效能，对于诊断效能中等以上的参数，采用 Logistics 回归计算参数联合的诊断效能。结果 CUL 组的 T2R、T2*值（3.383±1.412、71.110±29.288 ms）大于 DUL 组（2.596±0.955、51.907±19.261 ms），CUL 组的 MD 值、R2*值（1.539±0.248 μm2/ms、17.370±6.877 Hz）小于 DUL 组（1.742±0.268 μm2/ms、22.401±7.015 Hz），差异具有统计学意义（P<0.05）；两组间的 T1R、MK 值、FA 值、幅度值和相位值无统计学差异（P>0.05）。T2R、MD 值、R2*值和 T2*值鉴别两组病例的 ROC 曲线下面积（AUC）分别为 0.657、0.703、0.707 和 0.705，MD+R2*值、MD+T2*值、MD+R2*+T2*值联合鉴别两组病例的 AUC 分别为 0.813、0.799、0.802。结论 DKI、ESWAN 序列多个定量参数在 CUL 和 DUL 间存在差异，联合应用时鉴别诊断的 AUC 值提高。

## PU-150
# 基于 DKI 序列 MK 图的影像组学方法鉴别宫颈鳞癌与腺癌的应用价值

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【摘要】目的 探讨基于扩散峰度成像（DKI）序列平均扩散峰度（MK）图的影像组学方法鉴别宫颈鳞状细胞癌（CSCC）和宫颈腺癌（CA）的应用价值。方法 回顾性收集 2017 年 1 月至 2019 年

12 月在我院接受 MRI 检查（含 DKI 序列）并经手术病理证实为宫颈癌（CC）的患者 63 例，其中 CSCC 42 例，CA 21 例。将患者分为训练组（n=43）和验证组（n=20）。使用 ITK-SNAP 软件在 MK 图像上逐层手动勾画感兴趣区（ROI），而后合成肿瘤全域感兴趣容积（VOI），之后导入 A.K.分析软件进行高维影像组学特征提取，使用 Spearman 相关性分析和梯度提升决策树（GBDT）方法进行组学特征的筛选和降维，最终构建多元 logistic 回归预测模型，采用受试者操作特征（ROC）曲线评价该模型在训练组和验证组的诊断效能。结果 提取得到影像组学特征共计 386 个，最终筛选出 7 个与 CC 病理分型相关度最高的组学特征。构建的模型在训练组鉴别不同病理类型 CC 的准确度、ROC 曲线下面积（AUC）、灵敏度、特异度分别为 74.4%、0.867、85.7%、69.0%，在验证组分别为 80.0%、0.846、85.7%、76.9%。结论 基于 DKI 序列 MK 图的影像组学方法可有效鉴别不同病理类型的 CC，有助于临床决策的制定。

## PU-151

# 慢性吸烟者动态和静态功能连接密度的变化

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研究目的：先前已有研究表明慢性吸烟者的大脑区域存在异常的功能协调。先前的神经影像学研究采用静息态功能连接(resting-state functional connectivity, rs-FC)方法，通过任意选择特定的网络或种子点证明了脑连接的变化，但并不能提供慢性吸烟者全脑的 FC 变化。研究方法：本研究以功能连接密度(functional connectivity density, FCD)测量全脑功能协调能力。考虑到脑活动的动态变异性，本文联合滑窗法，通过计算动态 FCD 来研究慢性吸烟者全脑整合的动态变化。本研究共招募 120 名慢性男性吸烟者和 56 名年龄、性别匹配的健康对照者，采用静态功能连接密度(FCD)和动态功能连接密度(dFCD)研究全脑功能协调和动态变化的异常。研究结果：结果表明，与健康对照组相比，重度吸烟者和轻度吸烟者双侧距状回、右楔叶和左楔叶的 dFCD 均降低，而右眶额皮质、左尾状核、右壳核和左丘脑的 dFCD 均升高。此外，在重度吸烟者和轻度吸烟者之间，一些归属于默认模式网络的脑区的 dFCD 存在差异。静态 FCD 与动态 FCD 在视觉皮层中都存在异常。此外，慢性吸烟者左颞中回(MTG)的 dFCD 与烟龄及 FTND 评分呈显著正相关，且右侧丘脑的 dFCD 与 FTND 呈显著正相关。结论：研究结果表明，在静态 FCD 研究中，长期吸烟者只在低阶脑区发生变化，而动态 FCD 同时监测到低阶脑区和高阶脑区的变化，这表明动态的研究方法可以提供长期吸烟者脑更能连接密度更细微的变化。

## PU-152

# 眼眶周围神经鞘肿瘤的 MRI 特征分析

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目的 探讨眼眶周围神经鞘肿瘤(peripheral nerve sheath tumors，PNST)的 MRI 影像学特征，以提高对该类疾病的影像学诊断水平。
方法 回顾性分析 2014 年 12 月至 2021 年 4 月经组织病理学确诊的 23 例眼眶 PNST 的住院患者，包括临床、病理、CT 及 MRI 影像学资料，对比不同病理类型的肿瘤在位置、形态、MR 信号强度、增强程度等方面的差异。
结果 在 23 例眼眶 PNST 中，包括 13 例神经鞘瘤，9 例神经纤维瘤及 1 例丛状神经纤维瘤（plexiform neurofibroma，PNF）。三种肿瘤的好发年龄及性别没有显著性差异（P>0.05）,临床

症状均以眼睑肿胀、眼球突出及眼球运动受限最常见。眼眶神经鞘瘤和神经纤维瘤在肿瘤的好发位置、骨质是否受累上具有显著性差异（P<0.05），神经鞘瘤较多发生于肌锥内间隙，骨质受累较少见；神经纤维瘤较多发生于肌锥外间隙，骨质受累多见。神经鞘瘤和神经纤维瘤两者在肿瘤形态及信号均匀度上没有显著性差异（P>0.05），两者形态多规则，信号多不均匀。1 例 PNF MRI 表现具有特征性。
结论 眼眶 PNST 的影像学表现具有一定的特征性，神经鞘瘤和神经纤维瘤形态多规则，信号多不均匀；神经鞘瘤较多发生于肌锥内间隙，骨质受累少见，神经纤维瘤较多发生于肌锥外间隙，骨质受累多见。综合考虑患者的年龄、临床表现及影像学表现对眼眶周围神经鞘肿瘤的诊断具有重要价值。

PU-153

# 体素内不相干运动与 mDIXON-Quant 鉴别肝血管瘤和原发性肝恶性肿瘤的价值

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目的：
探讨体素内不相干运动（intravoxel incoherent motion diffusion-weighted imaging，IVIM-DWI）联合 mDIXON-Quant 鉴别肝血管瘤和原发性肝恶性肿瘤的价值。
方法：
回顾性收集 46 例在本院做过 3.0TMRI（(Ingenia CX, Philips Healthcare, the Netherlands）检查（包括 IVIM 及 mDIXON-Quant 序列）的肝占位患者，其中肝血管瘤 20 例，年龄在 31~76 岁；原发肝恶性肿瘤 26 例（18 例肝细胞肝癌、8 例肝内胆管细胞癌），年龄在 44~70 岁。入组患者的 mDIXON-Quant 原始数据被传输至 ISP（Ingenia CX, Philips Healthcare, the Netherlands）工作站用于后处理，生成 FF、R2*功能参数图，相应的 IVIM 原始数据在 GE AW 4.6 工作站进行后处理并生成功能参数图，包括慢扩散系数（D）、快扩散系数（D*）、灌注分数（f）。由一位经验丰富的放射学医师参照 T2W，在最大病灶层（避开囊变、坏死区域）放置 3 个相同的 ROI（100 - 200 mm2），记录自动生成的定量参数值。采用 Mann-Whitney U/两独立样本 t 检验比较两组间定量参数的差异性。曲线下面积（ROC）用于评价各有差异参数鉴别肝良性实性占位的价值。采用逻辑回归评估联合参数的鉴别效能。使用 delong 检验比较各 AUC 之间的差异性。当统计值 P<0.05 时，视为有统计学差异。
结果：
肝血管瘤的 FF 值和 R2*（1.82（1.41，2.73）%和 25.40（22.62，34.63））低于原发肝恶性肿瘤（3.61 (2.74， 4.59)和 35.68（26.64，44.83））， 差异有统计学意义（P<0.05）。肝血管瘤的 D 值和 f 值（0.77（0.67，0.82）×10-3um2 ms−1 和 0.68±0.17）大于原发肝恶性肿瘤（0.52（0.46，0.61）×10-3um2 ms−1 和 0.52±0.15），差异有统计学意义（P<0.05）。FF、R2*、D 及 f 值鉴别两组间的 AUC 分别为 0.883/0.683/0.894/0.744，当 FF、R2*、D 及 f 值联合时，相比于 FF 联合 R2*，AUC 能得到显著的提升（P<0.05）。
结论：
体素内不相干运动（intravoxel incoherent motion diffusion-weighted imaging，IVIM-DWI）联合 mDIXON-Quant 鉴别肝血管瘤和原发性肝恶性肿瘤具有较高的价值。

PU-154

# 直肠扩张对双参数 MRI 前列腺成像质量的影响

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目的 MRI 定量评价直肠扩张对前列腺 T2WI 及 DWI 成像质量的影响。资料与方法 2018 年 8 月至 2020 年 9 月期间，回顾性分析 236 例来我院就诊行前列腺 MRI 检查患者图像资料。由两名阅片者采用双盲法对 MRI 图像进行客观及主观评价，评价参数包括直肠体积、直肠负荷、T2WI 成像锐利度、T2WI 成像伪影、DWI 成像伪影和 DWI 成像变形。T2WI、DWI 及 ADC 图总体成像质量评价采用 Likert 5 分法。直肠扩张程度与前列腺 MRI 图像质量参数的相关性比较采用 Spearman 相关性分析。两位阅片者评分间的一致性评价采用 κ 检验。结果 两位阅片者在评价前列腺 MRI 直肠负荷、T2WI 质量、DWI 质量、DWI 伪影、DWI 变形及 ADC 质量评分的 κ 值分别是 0.87、0.84、0.77、0.71、0.73、0.73。直肠负荷与直肠前后径、体积呈正相关，r 值分别为 0.883、0.819（P 值均<0.05），与直肠左右径、上下径并无相关性（P 值均>0.05）。DWI 成像质量与直肠负荷显著相关（r= −0.628，P< 0.01），与直肠体积亦相关（r= −0.552，P<0.01）。DWI 成像变形与直肠负荷相关（r= 0.814，P<0.01），与直肠体积亦相关（r= 0.887，P<0.01）。DWI 成像伪影与直肠负荷相关（r= 0.425，P<0.05），与直肠体积显著相关（r= 0.614，P<0.01）。直肠扩张导致 T2 运动伪影增加（P<0.05），但并没有显著影响 T2WI 成像的锐利度（P>0.05）。结论 直肠扩张影响前列腺 T2WI 及 DWI 的成像质量，在临床上行前列腺 MRI 检查前，必要的的肠道准备，可能将有助于提高图像质量。

PU-155

# DTI 对胰腺癌与胰腺假乳头状瘤的鉴别诊断

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目的
探讨 DTI 序列多项定量参数在胰腺实性假乳头状瘤（SPTP）与胰腺癌（PDAC）鉴别诊断中的价值。
材料与方法
本研究纳入 31 例 PDAC 和 15 例 SPTP 患者。扫描序列，T1WI，T2WI，DTI A 1.5T MR 超导型扫描仪。
T1WI 扫描序列及参数：TR/TE，620ms/90ms，矩阵，320×192，NEX，1，层厚/层间隔，6.0mm/1.5mm，FOV，38cm×38cm，扫描时间 17s；T2WI：TR/TE，6000ms/102ms，矩阵 288×224，NEX，3，层厚 / 层间隔，6.0mm/1.5mm，FOV，38cm×38cm，扫描时间 17s。DTI: 层厚,7mm，层间距,2mm，FOV,300mm，矩阵 128×128，NEX,4，扫描时间，2 分 5 秒。
将各序列图像传输至 GE AW 4.6 工作站。DTI 定量参数 ADC， FA、Iso、VRA、EA 和 T2-T 用 Functool 软件处理。用 Functool 软件对序列图像进行处理，由 MRI 诊断经验分别为 5 年和 10 年的 2 名放射科医师，双盲法在工作站上完成病灶的测量：选择病灶轴位最大截面放置 3 个圆形 ROI，ROI 面积大约 25-100 $mm^2$，取其平均值（图 1，图 2）。采用 SPSS 26.0 统计分析软件，采用 KolmogorovSmirov 检验各参数是否符合正态分布，符合者采用独立样本 t 检验，均值以±s 表示，P<0.05 为差异有统计学意义，不符合者采用 Mann-Whitney 秩和检验，用 M±s 四分位间距表示。采用组内相关系数检验，两名观察者对两组病灶 DTI 序列的参数值进行测量结果的一致性。采

用受试者工作特征曲线分析有统计学差异的参数的诊断效能，获得 ROC 曲线下面积、阈值、敏感性和特异性。
结果
PDAC 组 FA、Iso、VRA、T2-T 值明显小于 STPT 组，差异有统计学意义（P＜0.05）（表 1）。FA 的 AUC 为 0.826（敏感度 71%，特异度 83.6%，Cuto 值）≤0.43），Iso 的 AUC 为 0.669（灵敏度 40%，特异性 96.8%，Cuto 值≤261.90），VRA 的 AUC 为 0.796（灵敏度 86.7%，特异性 64.5%，Cuto 值≤0.22），T2-T 的 AUC 为 0.667（灵敏度 40%，特异性 96.8%，Cuto 值≤261.86）（表 2，图 3）。
结论
DTI 是一种鉴别 PDAC 和 SPTP 的有效方式。

# PU-156
# DWI 衍生序列鉴别胰腺实性假乳头状瘤和胰腺神经内分泌肿瘤

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目的
探讨 DTI 序列多个定量参数和 IVIM 定量参数对胰腺实性假乳头状瘤（SPTP）和胰腺神经内分泌肿瘤（PNET）的鉴别诊断价值。
方法
回顾性分析大连医科大学附属第一医院 2016-2020 年期间经 DWI 及衍生序列扫描检查的 SPTP 患者 15 例，PNET 患者 23 例.SPTP 患者中男性 3 例，女性 12 例，平均年龄为 36.13±12.26 岁，PNET 患者中男 9 例，女 12 例，平均年龄为 52.26±12.96 岁.SPTP 患者的平均病变大小为 4.65±2.37cm，PNET 患者的平均病变大小为 2.70±1.17cm。
采用 GE Signa HDxt 1.5T MR 超导型扫描仪，体部相控阵线圈.扫描顺序和参数详见表 1。
将各序列图像传输至 GE AW 4.6 工作站，经 Functool 软件处理，由 MRI 诊断经验分别为 5 年和 10 年的 2 名放射科医师（观察者 1，2），双盲法在工作站上完成病灶的测量：选择病灶轴位最大截面放置 3 个圆形 ROI，ROI 面积大约 25-100 $mm^2$，取其平均值，放置部位选择肿瘤实性部分（LAVA 序列对应的肿瘤明显强化区），并避开 T1WI、T2WI 及 LAVA 序列所显示的血管、出血及坏死囊变区，同时避开图像伪影区。
采用 SPSS 26.0 统计分析软件，采用 KolmogorovSmirov 检验各参数是否符合正态分布，符合者采用独立样本 t 检验，均值以±s 表示，P<0.05 为差异有统计学意义，不符合者采用 Mann-Whitney 秩和检验，用 M±s 四分位间距表示.采用组内相关系数检验，两名观察者对两组病灶 DTI 序列的参数值进行测量结果的一致性。ICC<0.40 为一致性差，0.40≤ICC<0.75 为一致性中等，ICC≥0.75 为一致性好.采用受试者工作特征曲线，分析有统计学差异参数的诊断效能，获得 ROC 曲线下面积、阈值、敏感性和特异性。
结果
两位观察员的结果一致性良好（表 2）.SPTP 中 IVIM 的 Alph 值显著高于 PENT（P＜0.05）。SPTP 组 DTI 的 FA 和 VRA 值显著高于 PENT 组（P＜0.05）。FA 的 AUC 为 0.771（敏感性 100%，特异性 47.8%，临界值≥0.33），VRA 的 AUC 为 0.762（敏感性 100%，特异性 47.8%，临界值≥0.12）（表 3，图 1，图 2）。
结论
DWI 衍生序列中 DTI 和 IVIM 的定量参数可作为鉴别 SPTP 和 PNET 的有效方式。

PU-157

# 磁共振评价尼古丁依赖者小脑-皮层间功能连接的研究

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目的 长期吸烟不但会导致大脑形态和功能的异常，小脑在成瘾过程中也起着重要作用。本研究采用静息态功能磁共振成像 resting-state functional magnetic resonance imaging (fMRI)的技术，分析尼古丁依赖者在静息状态下小脑-皮层间功能连接 functional connectivity (FC)的异常改变。
材料与方法 通过网络平台招募 117 例尼古丁依赖者和 52 名年龄和教育程度相匹配的不吸烟志愿者并采集静息状态功能磁共振成像数据。选取双侧小脑 CrusI 为感兴趣区 region of interest (ROI)，计算 ROI 与全脑的功能连接，比较两组小脑-皮层间功能连接的差异。
结果 与健康对照组相比，尼古丁依赖者左侧小脑 CrusI 与默认网络 default mode network (DMN)、运动协调和感觉相关的脑区之间的功能连接显著增高（GRF 校正，P<0.005，团块水平 P<0.05）。尼古丁依赖者右侧小脑 CrusI 与皮层的功能连接较健康对照组无显著差异。
结论 与健康对照组相比，尼古丁依赖者存在多个小脑-皮层间功能连接的异常，强调了小脑的非运动功能，说明小脑参与尼古丁依赖的神经生物学机制并发挥了作用，并在一定程度上解释了尼古丁依赖者自动吸烟行为和认知、注意的缺陷。

PU-158

# DKI 序列对术前卵巢癌 Ki-67 表达的预测

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目的：评估 DKI 衍生参数在卵巢癌患者 Ki-67 表达术前评估中的有效性。材料与方法：回顾性收集 2015-2020 年共 20 例病例（年龄：24-76 岁，均值 55.75± 13.12 岁）经手术病理证实的卵巢癌 21 个病灶。所有患者均行腹部 MR 检查，包括 T2WI 和 DKI。将 DKI 序列的原始轴向数字图像传输到 GE-SDC-adw4.6 工作站（Sun Microsystems，Santa Clara，Calif），并用 Functool 软件进行后处理。根据 T2 加权成像获得的病变解剖位置，自动构建 FA、MD 和 MK 图，并由两名分别具有 10 年和 15 年盆腔成像经验的、对临床信息和组织病理学结果不知情的观察者进行回顾。根据脂肪抑制 T2WI 和 T1WI，在实体面积最大的切片上沿肿瘤边缘绘制手动感兴趣区（roi）。重复测量三次，计算三次测量的平均值。记录 FA、MD 和 MK 值。术后病理标本行 Ki-67 免疫组化染色，采用 Pearson 相关系数检验分析 Ki-67 在卵巢癌组织中的表达与上述指标的相关性。
结果：癌组织中 Ki-67 的表达与 MD 值呈负相关（r=-0.508，P=0.016）。癌组织中 Ki-67 的表达与癌症 MK 值呈正相关（r=0.553，P=0.008）。而 Ki-67 的表达与卵巢癌的 FA 值无关
结论：DKI 的 MD 和 MK 可以预测卵巢癌的 Ki-67 状态，有望成为评价卵巢癌良恶性更加有效的手段。

PU-159

# MRI 结合腔内充盈耦合剂对直肠癌术前评估的应用研究

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目的：探讨直肠 MRI 结合腔内充盈耦合剂对直肠癌术前评估的价值。方法：整理 2017 年 3 月至 2018 年 12 月在我院诊治的直肠癌 76 例，所有患者均行直肠 MRI 检查及腔内充盈耦合剂后 MRI 检查，分别评估肿瘤的 T 分期、N 分期、系膜血管受侵、环周切缘情况，并与术后病理结果进行对比分析。结果：直肠 MRI 对于直肠癌 T 分期、N 分期诊断的总准确率为 76.3%、72.3%，与病理结果的一致性为中等（kappa 值=0.593,0.572），系膜血管受侵、环周切缘分析的总准确率为 72.3%、89.5%，与病理结果分别为中等、较高一致（kappa 值=0.564,0.754）。腔内充盈耦合剂后直肠 MRI 后对于直肠癌 T 分期、N 分期诊断的总准确率为 86.8%、72.3%，与病理结果分别为较高、中度一致（kappa 值=0.736,0.569），系膜血管受侵、环周切缘诊断的总准确率为 77.4%、85.1%，与病理结果为较高一致（kappa 值=0.612,0.713）。结论：结肠 MRI 结合腔内耦合剂可提高直肠癌术前 T 分期、系膜血管受侵的病理结果符合率，对于 N 分期、环周切缘情况的总体病理结果符合率无明显影响。

## PU-160

# 胃肠道间质瘤的 MRI 表现及对临床治疗的参考价值

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目的：分析胃肠道间质瘤（GIST）的 MRI 影像表现，制定后续的临床治疗方案。方法：回顾性分析 2014 年 1 月~2018 年 10 月期间 136 例原发 GIST 患者的 MRI 图像及相关临床病理资料。结果：136 例 GIST 患者，男性 78 例（57.4%），女性 58 例（42.6%），均行常规 MRI 检查及强化扫描，影像分型瘤体位于粘膜下 51 例（37.5%），壁间 39 例（28.7%），浆膜下 46 例（33.8%）；行胃肠镜下切除 23 例（16.9%），外科手术治疗 113 例（83.1%），伊马替尼辅助治疗 75 例（55.1%）。
病变 MRI 表现为类圆形或不规则分叶状软组织信号影，49 例病变 T1WI 上呈均匀低信号，T2WI 上呈均匀高信号（图 1），87 例病变 T1WI 上呈不均匀低信号，T2WI 上呈不均匀高信号（图 2）。病变内出现囊变、坏死 71 例（52.2%），其中 61 例发生于直径＞5cm 的瘤体。病变内出血 16 例（11.8%），瘤体内钙化 4 例（2.9%）。影像分型瘤体位于粘膜下 51 例（37.5%），壁间 39 例（28.7%），浆膜下 46 例（33.8%）。边缘清晰者 59 例（43.4%），边缘模糊者 77 例（56.6%），相邻脏器受侵 9 例（图 3），12 例与周围组织发生黏连（图 4）。136 例 GIST 在 DWI 序列上均表现为高信号，其中高危险度组 ADC 均值为 1.236±0.259 x10-3mm2/s，中危险度组 ADC 均值为 1.416±0.312 x10-3mm2/s，低危险度组 ADC 均值为 1.521±0.236 x10-3mm2/s。MRI 动态增强扫描，病灶呈不均匀强化，瘤体实性部分呈轻、中度强化 76 例（55.9%），明显强化 60 例（44.1%），瘤体静脉期强化程度高于动脉期 116 例,瘤体静脉期强化程度稍低于动脉期 20 例。发生远处转移 21 例（15.4%），包括肝脏 14 例，腹膜 7 例，转移瘤均表现为动脉期明显强化，门脉期及延迟期强化程度缓慢下降，转移瘤内出现坏死、出血 18 例。
结论：通过 GIST 的 MRI 形态学及功能性检查，可以对其后续治疗方法及疗效评估提供重要参考。

## PU-161

# ESWAN 序列多定量参数鉴别胰腺实性假乳头状瘤和胰腺神经内分泌瘤

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目的
评价 ESWAN 序列多个定量参数在胰腺实性假乳头状瘤（SPTP）和胰腺神经内分泌瘤（PNET）鉴别诊断中的价值。
方法
15 例 SPTP 和 23 例 PENT，采用带相控阵线圈的 1.5T MR 扫描仪（Ge signa hdxt）。扫描序列和参数用 T1WI 描述：TR/TE，620ms/90ms，矩阵，320×192，NEX，1，层厚/层距，6.0mm/1.5mm，FOV，38cm×38cm，扫描时间，17s；T2WI：TR/TE，6000ms/102ms，矩阵 288×224，next3，层厚/层距，6.0mm/1.5mm，FOV，38cm×38cm，扫描时间，17s。ESWAN：TR/TE，16.4ms/2.1ms，角度，20°，矩阵，256×192，FOV，38cm×38cm，层厚，2mm。通过函数软件获得相位、幅度、R2*和 T2*图像。两名放射科医生分别在工作站上使用双盲法测量幅度值、相位值、R2*值和 T2*值。将三个圆形 ROI 放置在病灶的坚实部分，面积约为 25-100mm$^2$。所有数据均采用 SPSS26.0 进行统计分析。使用类内相关系数（ICC）对两名观察者的测量结果进行一致性测试。采用 Kolmogorov-smirov 试验测试正态分布，两组之间的差异通过独立样本 T 测试或曼惠特尼 U 测试进行分析。应用受体操作器特征曲线（ROC 曲线）分析诊断疗效，获得曲线下面积（AUC）、阈值、敏感性和特异性。
结果
两名观察员的结果一致性良好。SPTP 组 R2*值明显大于 PENT 组，T2*值明显小于 PENT 组，有统计学意义（P<0.05）。曲线下面积 R2*为 0.707（敏感性 91.3%，特异性 46.7%，阈值 ≥22.44），T2*为 0.829（敏感性 73.9%，特异性 86.7%，阈值≤48.4）。
结论
ESWAN 序列的 R2*和 T2*是鉴别 SPTP 和 PNET 的有效方法，对临床术前诊断和预后判断具有重要意义。

# PU-162

## 常规磁共振成像对子宫肉瘤与子宫内膜癌的鉴别诊断价值

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目的 探讨常规磁共振成像对子宫肉瘤（uterine sarcoma,US）与子宫内膜癌（endometrial carcinoma，EC）的鉴别诊断价值。 资料与方法 本回顾性研究共纳入经手术病理证实的 41 例 US 患者及 59 例 EC 患者。由两位放射科医生评估患者下列 MRI 指标：肿瘤大小、肿瘤上下径(vertical diameter,Ve)与前后径（anteroposterior diameter,Ap）之比(Ve/ Ap)、肿瘤边界、结合带是否完整、T1WI 及 T2WI 信号强度和肿瘤强化特点、肿瘤内出血、血管流空影以及囊变/坏死。比较各参数的诊断效能并建立联合诊断模型。结果 US 与 EC 患者在肿瘤大小（横径、上下径以及前后径）、Ve/Ap、T1WI 及 T2WI 信号特点、强化程度、出血、血管流空影以及囊变/坏死等方面均有显著差异（P<0.05）。根据受试者工作特征曲线，由肿瘤前后径、出血和肿瘤强化程度构成的联合诊断模型具有最高的诊断效能，曲线下面积（area under the cueve,AUC）为 0.844。结论 常规 MRI 影像的肿瘤大小与信号特征的联合应用有助于 US 与 EC 的鉴别诊断。

# PU-163

# Locus coeruleus degeneration correlated with levodopa resistance in Parkinson's Disease: a retrospective analysis

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**Objectives:**

Widely divergent responsiveness of levodopa in Parkinson's disease (PD) patients is a vital and intractable clinical issue because of its relation with the quality of daily life and disease prognosis (1). The mechanisms responsible for the variability of treatment responses are still unclear. A preliminary animal experiment suggested that locus coeruleus (LC) degeneration attenuated the efficacy of levodopa treatment (2), while this relationship has not been confirmed in PD patients yet. Therefore, we aimed to explore the relationship between LC degeneration and levodopa responsiveness in PD patients in vivo.

In this study, levodopa responsiveness was represent using the improvement of motor performance and functional synchronization of somatomotor network. LC degeneration was assessed using the neuromelanin sensitive magnetic resonance imaging (NM-MRI). In addition, substantia nigra (SN) degeneration might be a necessary covariate because of the close relationship between SN degeneration and motor manifestations of PD (3). The relationship between SN degeneration and levodopa responsiveness was also assessed.

**Methods:**

Fifty-seven PD patients and 65 healthy controls (HC) were enrolled in this study.

1. LC and SN integrity measurement

NM-MRI data were obtained during OFF state only. LC and SN were manually measured by one author twice with a time interval of one month (intra-rater agreement were 0.873 for LC and 0.875 for SN). Round like regions of interest were placed at the bilateral LC, SN, mid portions of the pontine (PT, reference region for LC), and cerebral peduncles (CP, reference region for SN) (4). The $CNR_{LC}$ was calculated using the following equation: $CNRLC = (SI_{LC} - SI_{PT}) / SD_{PT}$. The CNRSN was calculated as $CNR_{SN} = (SI_{SN} – SI_{CP}) / SD_{CP}$. Detailed methods of LC and SN measurements could be found in **Fig. 1** and **Fig. 2**.

2. Levodopa responsiveness assessment

The severity of motor symptom was assessed using the Unified Parkinson's Disease Rating Scale (UPDRS). Levodopa challenge test was conducted to evaluate the responsiveness of levodopa treatment: the UPDRS-III score and functional MRI data were obtained during the OFF state (at least 12 hours after withholding PD medications) and repeated one hour after administration of 200 mg levodopa and 50 mg benserazide (5). The improvement of motor performance was calculated using the formula: $(UPDRS\text{-}III_{OFF} – UPDRS\text{-}III_{ON}) / UPDRS\text{-}UIII_{OFF}$; and the improvement of somatomotor network's synchronization was calculated using the formula: $(Synchronization_{OFF} - Synchronization_{ON}) / Synchronization_{OFF}$.

In this study, we applied a phase-based synchronization analysis (**Fig .3**) to characterize the organization of somatomotor network, which is good at depicting the extent of network-level synchrony, and avoiding the curse of dimensionality and underrating the synchronicity of functional connectivity (6, 7).

3. Statistical analysis

The relationship among $CNR_{LC}$ and $CNR_{SN}$ with the change rate of UPDRS-III and somatomotor network's synchronization were calculated. Age, duration of dopaminergic drug administration, and levodopa equivalents daily dose (LEDD) was regressed as covariate of no interest.

Multiple linear regression analysis was conducted to ruled out the potential influences of SN degeneration and other clinical factors on levodopa responsiveness. Potential factors including $CNR_{LC}$, $CNR_{SN}$, age, duration of dopaminergic drug administration, and LEDD were enrolled.

Results:
1. Demographics
Significantly reduced $CNR_{LC}$ (P = 0.003) and $CNR_{SN}$ (P <0.001) was found in PD patients when compared with HCs, which were highly consistent with previous studies (8, 9). Detailed demographic, clinical characteristics, and $CNR_{LC}$, $CNR_{SN}$ of HC and PD groups were shown in Table 1.
2. The relationships among $CNR_{LC}$, $CNR_{SN}$, and L-dopa responsiveness
The $CNR_{LC}$ was positively associated with the change rate of UPDRS-III score (R = 0.421, P = 0.004, **Fig. 4A**). The change rate of UPDRS-III was correlated with the synchronization of somatomotor network (R = -0.370, P = 0.011, *Fig. 4B*). This finding indicated that the improvement of somatomotor network's synchronization was a suitable indicator for levodopa responsiveness in the level of functional network. And we found that the $CNR_{LC}$ was negatively associated with the change rate of somatomotor network's synchronization (R = -0.323, P = 0.029, **Fig. 4C**). Above evidences demonstrated the significance of LC-norepinephrine deficiency on levodopa resistance from the perspective of both clinic and brain network organization.
PD patients showed decreased synchronization of the somatomotor network (**Fig. 4D**, P = 0.002) during the OFF state when comparing with HCs. No significant difference was found in the synchronization of the somatomotor network during the ON state when comparing with HCs (**Fig. 4D**, P = 0.159). In PD patients, the synchronization of the somatomotor network was significantly increased after levodopa administration (*Fig. 4D*, P = 0.027). These findings suggested that the synchronization of somatomotor network was modulated by levodopa.
In addition, no significant correlation was found between the change rate of UPDRS-III score and the change rate of somatomotor network's synchronization with $CNR_{SN}$.
3. Multiple linear regression analysis
Multiple linear regression analysis demonstrated that only CNRLC (β = 0.423, P = 0.002), but not CNRSN, age, duration of dopaminergic drug administration, and LEDD could affect the change rate of UPDRS-III. This finding suggested that LC degeneration was an independent factor of levodopa resistance.

Conclusions:
LC degeneration, rather than SN degeneration, might be an essential factor for levodopa resistance in PD patients. LC evaluation using NM-MRI might be an alternative tool in predicting levodopa responsiveness and help stratifying patients into clinical trials for improving the efficacy of levodopa.

# PU-164

# 肥厚型心肌病扩张相与扩张性心肌病临床特征比较

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目的 探讨肥厚型心肌病扩张相（D-HCM）与扩张相心肌病（DCM）的临床特征比较 方法 回顾性分析 2016 年 1 月-2021 年 5 月于云南省第一人民医院住院治疗的肥厚型心肌病扩张相及扩张相心肌病患者的临床资料，分析两组病人的在临床资料、磁共振检查结果、治疗以及预后的差异。结果 本研究共收集到近 5 年 4 个月内入住且具有完整临床资料的肥厚型心肌病扩张相（D-HCM）患者 23 例，扩张性心肌病（DCM）患者 85 例，其中 D-HCM 患者男性 18 例，女性 5 例，年龄 46.2±13.5 岁，DCM 患者男性 72 例，女性 13 例，年龄 56.4±17.9 岁。（1）从病史上看，D-HCM 患者较 DCM 患者病史更长，临床症状更多，NYHA Ⅲ-Ⅳ级居多，房颤发生率更高。D-HCM 患者确诊肥厚型心肌病时间在 7.5±2.4 年，有 5 例（21.7%）患者有家族史，有呼吸困难、胸痛、心悸、晕厥病史较多（p＜0.01），心功能 NYHA Ⅲ-Ⅳ级患者 20 例（87%）（p＜0.01），BNP 较

大［9760（1 503.4，25 783）ng/L 比 7561（852，16905）ng/L，P=0.002]，发生房颤患者 15 例（65%）（p＜0.01），发生阵发性室上速患者 12 例（52%）（p＞0.01），发生植入式心律转复除颤器（ICD）和心脏再同步化治疗（CRT）各 2 例（8%）、3 例（13%）。（2）从影像结果分析，D-HCM 患者较 DCM 患者心房左右径更大［（7.21±1.65mm）比 6.43±0.85mm），p=0.003]，左心室前后径与左右径比值更大［（1.32±0.14）比（1.03±0.13），p=0.01]，DCM 左心室舒张末期容积更大［（290±54）比（237±29）,p＜0.01]ml，D-HCM 室间隔更厚［（14.2±3.1）比（8.5±1.2）,p=0.005]mm，钆对比剂增强延迟强化出现的概率更大[19（82.6%），55（65.9%），p=0.02]，钆对比剂增强延迟强化范围（LGE%）更大［（35.5±12.4%）比（18.6±11.9%）,p=0.004]，D-HCM 钆对比剂增强（LGE）分布区域多在室间隔、右室插入部以及左心室前壁，呈斑片状、絮状分布，DCM 患者多在室间隔、游离壁心肌中层或者心内膜下，呈条状、斑片状分布。（3）随访 5 年 4 个月内发生 D-HCM 患者发生心源性猝死 9 例（39%），DCM 患者发生心源性猝死 4 例（4.7%），p＜0.01，因 D-HCM 患者心力衰竭再住院率 20 例（87%），DCM 患者心力衰竭再住院率（89%），p＞0.05。结论 肥厚型心肌病扩张相（D-HCM）较扩张性心肌病（DCM）临床症状更多，房颤发生率更高，心源性猝死发生率更高，整体预后更差。

## PU-165

# 瘤内联合瘤周影像组学特征对在诊断三阴型乳腺癌中的价值

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【摘要】 目的 探讨乳腺动态增强 MRI（DCE-MRI）瘤内与瘤周影像组学特征对三阴型乳腺癌（TNBC）的诊断价值。方法 本研究已经通过我院伦理委员会审查批准并免除知情同意书。回顾性分析 140 例乳腺癌患者（TNBC 21 例，non-TNBC 119 例），均经手术病理证实，并在术前行乳腺 DCE-MRI 扫描。采用 3D Slicer 软件在动态增强第二期上标注病灶，瘤周区域选择瘤体向外扩 5mm 进行自动勾画，然后手动调整确认标注范围。按照 7:3 的比例随机分为训练集与验证集，使用 Analysis Kit（AK）分析软件对训练集提取 396 个影像组学特征，用 mRMR 算法及 LASSO 回归分析对影像组学特征进行降维，用优化的特征集建立模型，并对模型性能进行 Hosmer-Lemeshow（H-L）检验。结果 经过特征降维，瘤内、瘤周及瘤内加瘤周分别剩余 6 个影像组学特征被用来建立模型。在验证集中，瘤内及瘤内加瘤周的模型 ROC 曲线下面积分别为 0.73、0.82；敏感性分别为 0.82、0.83；特异性分别为 0.63、0.82。H-L 检验的结果也表明三个模型与实际结果有较好的一致性（P>0.05）。结论 联合瘤内及瘤周影像组学特征有助于提高三阴型乳腺癌的诊断能力。

## PU-166

# 3.0T MRI 1H MRS 在椎体良恶性压缩性骨折鉴别诊断中的应用

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摘要：目的：探讨椎体骨质疏松和恶性肿瘤所致的压缩骨折的 3.0T MRI 1H MRS 不同特征，为鉴别椎体良恶性压缩性骨折提供科学的依据。
方法：收集 2018 年 2 月-2020 年 12 月在西安市红会医院就诊的研究对象共 209 例，其中骨量正常组 46 例，骨量减少组 63 例，骨质疏松压缩骨折组 53 例，肿瘤压缩性骨折组 47 例。收集患者的年龄、性别和 BMI 等指标，所有研究对象均进行脂肪分数和脂水比值等指标的测量。本次研究

采用 3.0 T 西门子超导 MR 机及体部线圈进行波谱的采集。采用 SPSS20.0 进行数据分析，对于年龄、MRS FF%、LWR 等定量资料的统计描述采用均数±标准差进行，对于性别等分类资料的统计描述采用频数和频率进行；对于多组定量指标之间的比较采用方差分析进行，两两比较采用 Bonferroni 法进行。对于定量指标之间的相关分析采用 Pearson 相关分析。

结果：分析不同组别的年龄和 BMI，通过方差分析发现，不同组之间的年龄存在差异，正常组的年龄是最小的，为 52.07±11.24 岁，其次是骨量减少组，为 58.91±6.43 岁；骨质疏松组的年龄是最大的，为 65.67±5.46 岁。分析不同组别之间的性别，发现性别在不同组别之间存在差异，P<0.001,女性的骨量减少和骨质疏松所占的比例，远高于男性中的比例。对于肿瘤组来说，男性所占比例高于女性。在四个组之间的脂肪分数和脂水比值之间存在显著差异。对于 MRS FF%而言，肿瘤组的 MRS FF%最低，为 16. 8±7.7，骨质疏松组最高为 66.3±5.43，通过 Bonferroni 法进行不同组别之间的两两比较，发现任意两组之间均存在统计学差异，P<0.001。MRS FF%和脂水比 (lipid water ratio，LWR)具有高度相关性，r=0.834,P<0.001。

结论：3.0T MRI 1H MRS 在骨质疏松和肿瘤导致的压缩骨质中的 MRS FF%和 LWR 之间具有显著的统计学差异，可以有效的进行椎体良恶性压缩性骨折的鉴别诊断。

PU-167

# Application of 3.0T 1H MRS in differential diagnosis of benign and malignant compression fracture of spine

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Objective: To investigate the characteristics of 3.0T 1H MRS in benign and malignant spinal compression fractures due to osteoporosis and malignant tumors of the spine and to provide scientific basis for differentiating benign or malignant compression fractures of the spine.
Methods: A total of 209 subjects were collected from Feb 2018 to March 2020 in Xi'an Red Hospital, including 46 patients in the normal group, 63 in the bone loss reduction group, 53 in the osteoporosis compression fracture group, and 47 in the tumor compression fracture group. The patient's age, sex, and BMI were collected and all subjects were measured for fat fraction and lipid water ratio. In this study, 3.0 T Siemens superconducting MR machines and body coils were used to acquire the spectrum. SPSS20.0 was used for data analysis, mean ± standard deviation was used for statistical description of quantitative data such as age, MRS FF % and LWR, and frequency and frequency were used for statistical description of classified data such as gender. The variance analysis was used for the comparison among multiple groups of quantitative indicators, and the Bonferroni method was used for the pantwise comparison. Pearson correlation analysis was used for correlation analysis among quantitative indicators.
Results: By analyzing the age and BMI of different groups, variance analysis showed that there were differences in age among different groups. The age of the normal group was the smallest (52.07±11.24 years old), followed by that of the bone mass reduction group (58.91±6.43 years old). The age of the osteoporosis group was the largest at 65.67±5.46 years. After analyzing the sex between different groups, it was found that there were differences between different groups. P<0.001, the proportion of bone mass loss and osteoporosis in women was much higher than that in men. For the tumor group, the proportion of males was higher than that of females.There was a significant difference between the fat fraction and the lipid water ratio between the four groups. For MRS FF%, the MRS FF% in tumor group was the lowest, 16. 8±7.7, and the highest in osteoporosis group was 66.3±5.43. The two groups were compared by Bonferroni method and found between any two groups. There was a statistical difference, P<0.001. There was a high correlation between MRS FF% and LWR, r=0.834, P<0.001.
Conclusion: 3.0T 1H MRS has significant statistical differences between MRS FF% and LWR in osteoporosis and tumor-induced benign and malignant compressed bone and can be used for the differential diagnosis of benign and malignant compression fractures of the spine.

PU-168

# Percentage fat fraction in magnetic resonance imaging: Upgrading the osteoporosis-detecting parameter

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bstract
Purpose Osteoporosis (OP) is a common metabolic bone disorder and orthopedic imaging approaches were commonly used with some limitations. The aim of this study was to explore the diagnostic value of magnetic resonance 1-H MRS and m-Dixon-Quant in the evaluation of osteoporosis.
Methods We enrolled 76 subjects and used a quantitative computed tomography (QCT) technique to determine the subjects' bone mineral density (BMD). Those with a BMD >120 mg/cm3 were categorized as the normal control; those with a BMD ranging from 80–120 mg/cm3 were classified as having osteopenia; and those with a BMD <80 mg/cm3 were diagnosed as having OP. The following parameters were recorded for each patient: sex, age, body height, body weight, waist circumference, and hip circumference. Simultaneously, the FF% values from 1-H MRS examinations and m-Dixon-Quant scans were acquired.
Results In both 1-H MRS and m-Dixon-Quant MRI, the FF% exhibited a negative correlation with BMD. Among the different groups, the OP patients had a significantly higher FF% compared to healthy subjects. In addition, the FF% in the m-Dixon scans exhibited a positive correlation with age, while BMD showed a negative linear relationship with age. Further, females had a higher FF% compared to males, and body height was correlated with BMD but not with FF%.
Conclusion MRI investigations (especially FF% in the m-Dixon-Quant imaging system) are useful in OP assessments. Also, parameters such as sex, age, and height are important factors for predicting and diagnosing OP.

PU-169

# 体素内不相干运动成像及扩散峰度成像在宫颈癌淋巴结转移中的应用研究

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目的 探讨体素内不相干运动成像、扩散峰度成像等多种扩散加权成像模型在诊断宫颈癌转移性淋巴结中的价值。资料与方法 对 102 例女性宫颈癌患者进行术前磁共振成像，根据术后病理淋巴结诊断分为阴性组和阳性组，使用 IVIM、DKI 和 DWI 模型计算原发肿瘤和 LNs 的扩散参数并在两组间进行比较。结果 本研究共纳入 102 例病例，其中 38 例经病理确诊为有淋巴结转移，共收集到 63 例转移性淋巴结和 126 例非转移性淋巴结进行分析。转移组淋巴结的 ADC 值、MD 值及 f 值低于非转移组；转移组淋巴结的长径、短径大于非转移组，长短径比值小于非转移组；转移组原发灶的短径、CEA 及 CA15-3 均大于非转移组。其中淋巴结短径的诊断效能最高，AUC 为 0.848。结论 由于 IVIM 及 DKI 有限的诊断效能和较长的扫描时间，不推荐在临床中广泛使用，我们推荐使用淋巴结及原发灶的短径结合肿瘤标志物区分转移性和非转移性淋巴结。

PU-170

# mpMRI 联合 NLR 及 PLR 在宫颈癌淋巴结转移中的诊断价值

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目的 探讨多参数磁共振成像(mpMRI)联合白细胞/淋巴细胞（NLR）及血小板/淋巴细胞（PLR）在宫颈癌淋巴结转移中的诊断价值。材料与方法 回顾性收集 93 例经病理证实的宫颈癌患者临床资料，术前均行 MRI 及血清 NLR 及 PLR 检查，结合病理结果，依据 FIGO 2018 版宫颈癌分期，将有无腹盆腔淋巴结是否转移，分为转移组(n=30)和非转移组(n=63)，肿瘤直径和宫颈侵犯深度均在小 FOV、 斜轴位 T2WI 序列上测量。排除：高热病人，锥切术后病人，体内同时患有其他部位恶性肿瘤及机体急性发作病症患者，除外宫颈腺癌及腺鳞癌患者。采用日 Sysmex XN-9000 血球分析仪，获取中性粒细胞及淋巴细胞计数、平均血小板体积，并计算 NLR、PLR。行单因素分析，比较两组的 MRI 诊断、肿瘤直径、NLR、PLR、有无绝经、宫颈侵犯深度之间是否有统计学差异，通过受试者工作特征曲线(ROC)，评估其 MRI 及 NLR、PLR 及其联合方案的诊断效能。结果 MRI 诊断、肿瘤直径、NLR、PLR、肌层侵犯深度对有无淋巴结转移有较好的诊断价值。ROC 曲线显示，MRI 诊断、NLR、PLR 曲线下面积（AUC）值分别为 0.829、0.691、0.668， MRI 联合 NLR（并联）诊断宫颈癌淋巴结转移的效能最高。结论 MRI 诊断、肿瘤直径、NLR、PLR、肌层侵犯深度对宫颈癌淋巴结转移有较好诊断效能，MRI 联合 NLR（并联）诊断宫颈癌淋巴结转移的效能最高，能指导临床治疗和术前精准分期。

PU-171

# 基于 ESWAN 的肿瘤内磁敏感信号鉴别前列腺癌与前列腺增生的价值

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目的：通过评估基于增强 T2*加权血管造影（ESWAN）的肿瘤内磁敏感信号（ITSS），来鉴别诊断前列腺癌（PCa）和良性前列腺增生（BPH）。
方法：收集我院部分患有前列腺疾患的患者，所有病例均有病理证实，根据病理分为两组：PCa 组（n=38, (74.05±8.85)岁），BPH 组(n=39, (69.59±8.80)岁）。所有患者均术前行盆腔 3.0T MR 检查(Signa HDxt，GE 医学系统, USA)，扫描序列包括 T1WI，T2WI，DWI 和 ESWAN。MR 扫描参数具体细节见表 1。所有 ESWAN 序列图像传输到 GE AW 4.6 工作站进行后处理。在相位图中产生了带状伪影，见图 1a。去伪影具体流程如图 1。前列腺癌，参考 T2WI 和 DWI 图像，在相位图上勾画肿瘤的感兴趣区域(ROIs)；良性前列腺增生，参考 T2WI 图像，在轴位上显示前列腺中央腺体最大面积的层面沿中央腺体边缘勾画 ROIs，见图 2。利用 AS 软件的插值标注工具，无需逐层标注即可获得容积 ROIs。AS 软件可以自动计算出相位图的 ITSS 比值。ITSS 比值定义为肿瘤 ITSS 信号占肿瘤容积的比值。采用 SPSS 25.0 软件进行数据分析。正态分布采用 Shapiro-Wilks 检验。利用组间相关系数(ICC)评价 2 名放射科医师测量 ITSS 值的一致性。组间 ITSS 值差异用 Mann-Whitney U 检验进行比较。采用受试者工作特征曲线(ROC)评估诊断效能。
结果：两名放射科医师测量的数据一致性良好(ICC>0.75，表 2)。PCa 组 ITSS 值显著高于 BPH 组（p<0.001）, 表 3)。AUC 值为 0.897(见图 3)。阈值为 0.069 时，诊断灵敏度和特异性为 0.895 和 0.846。

结论：定量 ITSS 对前列腺癌和前列腺增生有良好的诊断效果。我们提出 ITSS 可能是一个很有前途的成像模式，能够自动定量地鉴别出前列腺癌和前列腺增生。

## PU-172
# 基于 ESWAN 的肿瘤内磁敏感信号鉴别临床显著性和非显著性前列腺癌

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目的：评价基于增强 T2*加权血管造影(ESWAN)的肿瘤内磁敏感信号强度(ITSS)在鉴别临床显著性前列腺癌（Cs PCa）和临床非显著性前列腺癌（Ci PCa）中的价值。
方法：收集我院 62 例经病理证实的前列腺癌患者，根据 Gleason 评分分组：评分为 4+3=7 及>7 分的为 Cs PCa 组（n=37, (75.21±8.67)岁），评分为 3+4=7 及<7 分的为 Ci PCa 组(n=25, (72.19 ± 8. 42)岁）。所有患者均在术前行盆腔 3.0T MR 检查(Signa HDxt，GE 医学系统)，序列包括 T1WI，T2WI，DWI，ESWAN。MR 扫描参数的具体细节见表 1。ESWAN 序列图像上传至 GE AW 4.6 工作站后处理。相位图中产生了带状伪影，见图 1a。而去伪影具体流程如图 1。前列腺癌参考 T2WI 和 DWI 图像，在相位图上沿肿瘤边缘勾画感兴趣区域(ROIs)，见图 2。利用 AS 软件的插值标注工具，无需逐层勾画即可获得容积 ROIs。AS 软件能自动计算出相位图的 ITSS 比值。ITSS 比值定义是肿瘤 ITSS 信号占肿瘤容积的比值。利用 SPSS 25.0 软件进行数据分析。正态分布用 Shapiro-Wilks 检验。组间相关系数(ICC)评价 2 名放射科医师测量 ITSS 值的一致性。组间 ITSS 值差异用 Mann-Whitney U 检验进行比较。受试者工作特征曲线(ROC)评估诊断效能。
结果：两名放射科医师的数据结果一致性良好(ICC>0.75，表 2)。Cs PCa 组 ITSS 值显著高于 Ci PCa 组（p<0.01）（见表 3）。AUC 值为 0.715(见图 3)。阈值为 0.1137 时，诊断灵敏度和特异性分别为 0.622、0.76。
结论：定量 ITSS 对鉴别临床显著与非显著性前列腺癌有一定的诊断效果。

## PU-173
# 基于 QSM 功能成像对帕金森患者脑铁含量的定量评价研究

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摘要：目的：探讨 MR 功能序列-定量磁敏感加权成像(Quantitative susceptibility weighted imaging，QSM)获得的脑深部核团的定量磁敏感值是否可以作为鉴别原发性帕金森及健康对照的影像学诊断指标，进一步研究帕金森患者基底节与中脑水平上组织内局部铁代谢变化与帕金森疾病发病机制及病情严重程度之间的相互影响。材料与分析方法：通过对本研究 29 例经临床确诊的 PD 患者（其中男 17 例，女 12 例）以及 15 名年龄[平均(60.80±8.76)岁、性别(其中男 7 例，女 8 例)]与 PD 组匹配的健康志愿者(HC 组)进行常规 MRI 序列及 QSM 序列扫描，在 MATALAB 软件处理后的 QSM 参数图上测得基底节水平及中脑水平灰质核团定量磁敏感值。将 PD 组根据 Hoenh-Yahr 分期分为早期 PD 组（PD-1）[平均(59.79±9.89)岁、性别(其中男 8 例，女 6 例)]和中晚期 PD 组（PD-2）[平均(61.80±9.60)岁、性别(其中男 9 例，女 6 例)]。单因素方差分析及 LSD 法被用来比较 PD 各组及健康对照组之间的差异，而铁沉积量与 PD 临床分级的相关性分析采用 Sperman 相关系数。结果：通过对比发现，帕金森患者黑质、红核、及苍白球的定量磁敏感值显著高于早期

组及对照组(P＜0.05)，其中早期组与对照组无统计学意义(P＞0.05)，而丘脑及尾状核各组间比较均无统计学差异（P＞0.05），且黑质、壳核、苍白球及红核铁沉积量异常与临床帕金森病严重程度具有显著的相关性（r=0.586，0.419，0.497，0.497）结论：早期 PD 患者锥体外系的多个灰质核团铁代谢异常改变不显著，而中晚期 PD 患者多个核团存在铁代谢异常造成的过度沉积，其中黑质、壳核、苍白球及红核的铁过度沉积与 PD 病情发生发展具有一定的关联性。

## PU-174

# 磁共振引导肿瘤冷冻消融现状与进展

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影像引导的经皮冷冻消融是指在影像设备的监视下应用极低温来灭活肿瘤。它是微创的，安全的，可重复的，并且不会中断或影响其他肿瘤治疗。本文就冷冻消融治疗肿瘤的机制、介入性磁共振技术的发展以及磁共振成像技术在肿瘤冷冻消融治疗过程中的优势等方面应用做出概述。

## PU-175

# Real-time MR-guided brain biopsy using 1.0-T open MRI scanner

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Objectives：Toevaluate the safety, feasibility and diagnostic performance of real-timeMR-guided brain biopsy using a 1.0-T open MRI scanner. Methods：Medical records of 86 consecutive participants who underwent brain biopsy under the guidance of a 1.0-T open MRI scanner with real-time and MR fluoroscopy techniques were evaluated retrospectively. All procedures were performed under local anaesthesia and intravenous conscious sedation. Diagnostic yield, diagnostic accuracy, complication rate and procedure duration were assessed. The lesions were divided into two groups according to maximum diameters: ≤ 1.5 cm (n = 16) and > 1.5 cm (n = 70). The two groups were compared using Fisher’s exact test.Results：• Diagnostic yield and diagnostic accuracy were 95.3% and 94.2%, respectively. The diagnostic yield of lesions≤1.5 cm and > 1.5 cm were 93.8% and 95.7%, respectively. There was no significant difference in diagnostic yield between the two groups (p > 0.05). Mean procedure duration was 41 ± 5 min (range 33–49 min). All biopsy needles were placed with one pass. Complication rate was 3.5% (3/86). Minor complications included three cases of a small amount of haemorrhage. No serious complications were observed.Conclusions：Real-timeMR-guided brain biopsy using a 1.0-T open MRI scanner is a safe, feasible andaccurate diagnostic technique for pathological diagnosis of brain lesions. Theprocedure duration is shortened and biopsy workflow issimplified. It could be considered as an alternative for brain biopsy.

## PU-176

# MRI 在诊断眼眶神经鞘瘤中的应用研究

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【摘要】目的：探讨眼眶神经鞘瘤患者选用 CT、MRI 诊断的价值。方法：选 2018.01~2020.01 区间收治 50 例眼眶神经鞘瘤患者研究，均实施 CT 检查（对照组）、MRI 检查（观察组），以病理检查为金标准，统计两组检出率、准确率。结果：观察组定性检出率（94.00%）高于对照组（80.00%），统计值=4.3324，P<0.05。观察组定位检出率（98.00%）高于对照组（86.00%），统计值=4.8913，P<0.05。观察组定性准确率（94.00%）高于对照组（80.00%），漏诊率（4.00%）、误诊率（2.00%）低于对照组 12.00%、8.00%，统计值=4.3324，P<0.05。观察组定位准确率（98.00%）高于对照组（86.00%），漏诊率（2.00%）、误诊率（0.00%）低于对照组 10.00%、4.00%，统计值=4.8913，P<0.05。结论：MRI 在眼眶神经鞘瘤患者诊断中效果确切，可为临床诊断、治疗提供参考，值得借鉴。

PU-177

# MR 弥散加权成像联合增强 MR 诊断大龄儿童视网膜母细胞瘤 1 例

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摘要：视网膜母细胞瘤（RB）以婴幼儿占绝大多数，其中约 95%发生在 5 岁之前，单侧性视网膜母细胞瘤约占 75%，双侧性视网膜母细胞瘤发病年龄更早[1-3]。我院收治 1 例 8 岁儿童，并且 CT 影像表现不典型(球内无钙化斑)，最终由 MR 诊断视网膜母细胞瘤及侵袭范围，临床根据 MR 结果确定手术及治疗方式。

PU-178

# 弥散张量成像定量参数纹理分析鉴别胰腺神经内分泌肿瘤和胰腺实性假乳头状瘤

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目的：探讨基于 DTI 定量参数纹理分析鉴别胰腺神经内分泌肿瘤和胰腺实性假乳头状瘤的可行性。材料与方法：回顾 15 例胰腺实性假乳头状瘤（SPN）和 17 例胰腺神经内分泌瘤（PNET），包括常规扫描序列和 DTI 序列（b 值=0，600s/mm2，6 个方向）。GE AW4.6 工作站上的 Functool 软件导出 ADC 和 FA 图，通过 Omni-Kynamics 软件在 ADC 和 FA 图上手动勾画各层的 ROI，在覆盖整个肿瘤的 3D ROI 后自动生成纹理特征。获得了能量、熵、峰度、最大值、平均值、中值、最小值、偏度、均匀度、群集显著性、群集阴影、相关性、长期游程突出、游程长度不均匀性归一化、短游程突出、大面积突出和小面积突出等。采用 SPSS26.0 分析，Mann-Whitney U 试验用于纹理特征。

结果：SPN 组与 PNET 组的 ADC 能量值差异有统计学意义，（AUC：0.722，阈值≥6.25×1010，敏感性：86.7%，特异性：52.9%）。两组 FA 的最大值、长期游程突出、游程长度不均匀性归一化、短游程突出、大面积突出和小面积突出有显著差异（P<0.05），其余参数无统计学差异；最大值（AUC：0.712，阈值≥3.22×104，敏感性：82.4%，特异性：60%）；长期游程突出（AUC：0.725，阈值≥1.01，敏感性：64.7%，特异性：60%）；游程长度不均匀性归一化（AUC：0.722，阈值≤0.994，敏感性：88.2%，特异性：53.3%）；短游程突出（AUC：0.725，阈值≤0.994，敏感性：35.3%，特异性：86.7%）；大面积突出（AUC：0.737，阈值≥1.10，敏感性：64.7%，特异性：80%）；小面积突出（AUC：0.706，阈值≤0.978，敏感性：70.6%，特异性：73.3%）。

结论：DTI 纹理分析可拥有术前鉴别 SPN 和 PNET，且 FA 纹理分析比 ADC 纹理分析更有价值。

## PU-179

# 交界性和恶性卵巢肿瘤的 MRI 鉴别诊断

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目的 探讨交界性卵巢肿瘤（BEOT）的常规 MRI 表现，明确 MRI 鉴别 BEOT 与恶性卵巢上皮性卵巢肿瘤（MEOT）的价值。
材料与方法 回顾性分析经手术和病理证实的 67 例 BEOT 患者的临床及 MRI 资料，观察征象包括肿瘤的部位、大小、构型、乳头或结节、信号、强化程度、同侧卵巢显示、腹膜种植灶及腹水，结果与 69 例 MEOT 的征象比较。
结果 67 例 BEOT 共 86 个肿瘤，其中 19 例（28%）累及双侧卵巢；69 例 MEOT 共 98 个病灶，29 例（42%）累及双侧卵巢，双侧卵巢发生率差异无统计学差异（p=0.095）。完全囊性（9/86 [10%] vs 1 /98 [1%]，p=0.007）、囊性为主伴赘生物（31/86 [36%] vs 11/98 [11%]，p＜0.001）、外生型乳头或结节（23/86 [27%] vs 7/98 [7%]，p＜0.001）、分支状乳头（28/86 [33%] vs 0/98 [0]，p＜0.001）、同侧卵巢显示（29/86 [34%] vs 0/98 [0]，p＜0.001）五个征象在 BEOT 较 MEOT 多见。混合型乳头或结节、腹膜种植灶及大量腹水三个征象在 MEOT（41/98 [42%] vs 6/86 [7%]；44/69 [64%] vs 7/67 [10%]；18/69 [26%] vs 5/67 [7%]）较 BEOT 多见（p 值分别为＜0.001，＜0.001 和 0.010）。
结论 MRI 可显示 BEOT 和 MEOT 不同的征象，有助于两者的鉴别。

## PU-180

# EphA2 联合 DKI 直方图在脑胶质瘤分级中的价值

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目的 探讨 EphA2 联合扩散峰度成像(diffusion kurtosis imaging, DKI)直方图在胶质瘤分级中的价值。
方法 回顾性分析 2015 至 2019 年东部战区总医院经病理证实胶质瘤患者 183 例，其中低级别胶质瘤（low grade glioma，LGG）63 例，高级别胶质瘤（high grade glioma，HGG）120 例。采用 MRIcon 软件包将 DICOM 格式文件转换为 Nifti_1 格式图像，利用 DKE 软件对 DKI 图像进行后处理获取包括部分各向异性（FA）、平均扩散率（MD）、峰度分数各向异性（KFA）、平均峰度（MK）、平均峰度张量（MKT）。通过 MRIcron 软件在 3D T1WI 增强图像上手动勾画肿瘤全域，运用 SPM12 软件将每个患者的 3DT1WI 增强图像、肿瘤 VOI 分别与其 FA、MD、KFA、

MK、MKT 图像进行匹配。基于 Matlab 2014a 软件开发的《磁共振高信号区域分割及信息提取软件 V1.0》软件计算获取最小值、最大值、平均值、方差、中位数、1/4 位数、3/4 位数、峰度、偏度。采用独立样本 t 检验（满足正态分布和方差齐性）或 Mann-Whitney U 检验（不满足正态分布及方差齐性）比较 DKI 直方图各参数在高、低级别胶质瘤分级的差异，组间比较以 P＜0.05 为差异有统计学意义，将具有统计学意义的指标纳入多因素 Logistic 回归分析，筛选分级独立预测因素，基于以上因素构建 2 个分级预测模型（模型 1：DKI,模型 2：EphA2+DKI），分别通过绘制 ROC 曲线评估模型效能。
结果 两组间年龄具有统计学差异(P=0.000)，HGG 组 MD 方差、偏度、FA 方差、3/4 位数、MK 及 MKT 平均值、方差、中位数、1/4 位数、3/4 位数均大于 LGG 组，差异具有统计学差异（P＜0.05），FA 偏度、MK 及 MKT 偏度小于 LGG 组，差异具有统计学差异（P＜0.05），多因素 Logistic 回归分析表明，MD 方差、FA 偏度、MKT3/4 位数是分级的最优预测变量，其中 MKT3/4 位数具有最高 OR 值（odds ratio），OR=3.415。EphA2 联合 DKI 预测模型的准确性（AUC=0.904）优于单一的 DKI 模型（AUC=0.862）。
结论 基于脑胶质瘤 DKI 直方图分析，构建 EphA2 联合 DKI 的预测模型，可有效提高脑胶质瘤的分级诊断效能

## PU-181

# 肺部超短回波时间(UTE) MRI 在 COVID-19 长期随访中的价值研究

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【摘要】目的 探讨肺部超短回波时间(UTE) MRI 在 COVID-19 长期随访中的价值。方法 前瞻性纳入河南省人民医院 2020 年 01 月至 2020 年 03 月收治的 COVID-19 患者中符合研究标准的 21 人，根据 COVID-19 临床分型标准分为重症组（10 人）和非重症组（11 人），应用肺部 UTE-MRI 和 HRCT 对患者出院 6 个月以上的肺部情况进行评估，由三名经验丰富的影像诊断医师对两种成像方式的图像质量及肺部情况进行评分。采用组内相关系数(ICC)和 Kappa 一致性检验分析两种成像方式评估肺部情况的一致性。Mann-Whitney U 检验比较重症组与非重症组之间影像学评分差异。结果 21 名患者随访时间为出院后 180-225 天，两种成像方式对 COVID-19 患者肺部情况的量化评估结果具有高度的一致性(ICC:0.914, 95%ICC:0.820-0.960, P＜0.05)； Kappa 一致性检验显示：肺部 UTE-MRI 与 HRCT 检出磨玻璃影 Kappa 值为 0.713，(P＜0.05)，检出小叶间隔增厚 Kappa 值为 0.838，（P＜0.05）。肺部 UTE-MRI 和 HRCT 病变评分显示重症组均高于非重症组(P=0.045，P=0.036)。HRCT、UTE-MRI 病变评分与患者年龄和患病时长分别呈显著正相关，HRCT(r=0.414， P=0.025；r=0.421，P=0.029)，UTE-MRI(r=0.443，P=0.021；r=0.37，P=0.048)，与患者肺一氧化碳弥散量实测值与预测值的百分比(TLCO%pred)负相关，HRCT(r=-0.543，P=0.003)，UTE-MRI(r=-0.384，P=0.048)。结论 肺部 UTE-MRI 对 COVID-19 患者长期随访中肺部情况的评估能够达到和 HRCT 相似的效果，具备评估 COVID-19 复查患者胸部情况的潜能。

## PU-182

# ADC 值联合 T2WI 纹理分析术前预测子宫内膜癌 Ki-67 表达水平的初步研究

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[摘要]： 目的：探讨 ADC 值联合 $T_2$WI 纹理分析术前预测子宫内膜癌 Ki-67 表达水平的价值。方法：回顾性分析 137 例经手术病理证实的子宫内膜癌患者，所有患者术前均行常规 1.5 T MRI 及扩散加权成像（DWI）（b 值 0 、1 000 $mm^2/s$）扫描，并测量 ADC 值。在轴位 $T_2$WI 图像上逐层勾画子宫内膜癌全病灶感兴趣区， 导入 GE Analysis Kit（AK）软件获取病变的三维纹理特征。根据术后病理结果，将 Ki-67 增殖指数<50%分为低表达组、≥50%为高表达组。结果：137 例病理证实的子宫内膜癌中，Ki-67 低表达组 63 例，高表达组 74 例。Ki-67 高表达组的 ADC 值低于低表达组（$P$<0.05）。 AK 软件共提取 1316 个纹理参数，经独立样本 t 检验或 Mann-Whitney U 检验和 Logistic 回归分析对上述纹理参数进行筛选，得到 5 个有鉴别意义的纹理参数：firstorder_90Percentile、firstorder_Minimum、glcm_InverseVariance、firstorder_Skewness 和 gldm_DependenceVariance。Ki-67 高表达组的纹理参数 firstorder_90Percentile、firstorder_Minimum、glcm_InverseVariance 和 gldm_DependenceVariance 值明显高于 Ki-67 低表达组 ($P$ < 0.05)；firstorder_Skewness 值明显低于 Ki-67 低表达组（$P$ < 0.05）。单一 ADC 值鉴别 Ki-67 高低表达组的 ROC 曲线下面积（AUC）为 0.799。在 ADC 值联合纹理参数预测子宫内膜癌 Ki-67 表达中经多因素 Logistic 回归分析得到 3 个纹理参数表现出具有独立诊断效能，分别为 firstorder_90Percentile、firstorder_Minimum 和 firstorder_Skewness。上述 3 个纹理参数在鉴别 Ki-67 高低表达组的 ROC 曲线下面积（AUC）分别为 0.624、0.599、0.615。ADC 值联合纹理参数预测子宫内膜癌增殖抗原 Ki-67 的效能（AUC = 0.854）高于各参数单独预测效能，敏感性和特异性分别为 70.27%和 87.30%。 结论：ADC 值联合 $T_2$WI 纹理分析有助于术前评估子宫内膜癌 Ki-67 表达水平，为临床精准的个性化治疗提供一定帮助。

PU-183

# 集成磁共振弛豫时间定量技术在前列腺癌诊断及侵袭性评估中的应用研究

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目的 探讨从集成磁共振成像中获得的弛豫时间定量在前列腺癌诊断及侵袭性评估中的应用价值。材料与方法 回顾性搜集宁夏医科大学总医院行前列腺 MRI 常规序列和 MAGiC 序列扫描的患者 160 例，其中经病理证实 45 例为前列腺外周带癌，35 例为前列腺中央腺体癌，经随访和部分病理证实 45 例为非癌患者的外周带，35 例为良性前列腺增生。PCa 病灶分为低危(GS≤6)和中/高危(GS≥7)。前列腺癌组和正常对照组 MAGiC 图像经过后处理后得到 T1、T2、PD、R1、R2 值，同时用相关软件进行后处理生成 ADC 值，并采用独立样本 t 检验、U 检验、ROC 曲线进行统计分析，P＜0.05 具有统计学差异。结果 前列腺外周带癌组的 T1 值（1202.66±124.59）ms 和 T2 值（78.62±7.11）ms 均明显低于外周带非癌组的 T1 值（2221.47±761.67）ms 和 T2 值（160.58±54.90）ms,（Z=-6.839,P＜0.01; Z=-7.562, P＜0.01）。前列腺中央腺体癌组的 T1 值（1081.66±100.81）ms 和 T2 值（77.12±6.73）ms 均低于良性前列腺增生组的 T1 值（1340.76±195.91）ms 和 T2 值（94.21±15.15）ms,（Z=-5.773, P＜0.01，Z=-5.281, P＜0.01）,PD 值均不具有统计学意义（Z=-0.908 和 Z=-0.981; 均 P＞0.05）。在 PZ 区分前列腺癌与非癌性病变时，T2 值显示出与 ADC 值相似的 AUC(0.963 和 0.991，P = 0.1045)，而在 TZ，T1

值则显示出与 ADC 值相似的 AUC(0.901 和 0.959，P = 0.1235)。在 PZ 和 TZ，ADC 值均与 Gleason 评分呈中度负相关（r=-0.649 和 r=-0.728,均 P＜0.01），T2 值与 Gleason 评分之间也呈负相关（r=-0.506 和 r=-0.639,均 P＜0.01）。T2 值和 ADC 值在区别低危和中高危前列腺癌的 AUC 分别为 0.812[0.710–0.914]和 0.885[0.795–0.976],（P=0.3404），两者具有相似的诊断效能。结论 集成磁共振成像（SyMRI）获得的定量 T1 和 T2 值能够鉴别前列腺癌和其他良性病变，且存在与 ADC 值诊断性能相当的参数，SyMRI 具有很高的临床应用价值，T2 值能够区分低危与中高危前列腺癌。

## PU-184
# 基于 pCASL 研究乳腺浸润性导管癌患者化疗后脑血流灌注

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目的：利用磁共振伪连续动脉自旋标记技术（pCASL）探究乳腺浸润性导管癌化疗后脑血流量（CBF）的变化及认知能力的关系。材料与方法：选择经手术后病理证实的乳腺浸润性导管癌患者 27 例，所有患者术后均行 EC-T（E：表柔比星，C：环磷酰胺，T：紫杉醇）化疗方案，同期纳入年龄、受教育年限相匹配的健康志愿者 29 例。所有受试者进行听觉词语记忆（AVLT-H）以及蒙特利尔认知评估量表（MoCA）测试，随后进行全脑 T1WI 结构像扫描及 pCASL 像扫描。利用 SPM8 软件包及 DPABI 软件包对两组受试者 CBF 图分析，利用 RESTplus 软件提取差异脑区 CBF 值；利用 SPSS19.0 软件对 AVLT-H、MoCA 量表进行双样本 t 检验，并对存在差异脑区的 CBF 值与化疗后时间进行相关性分析。结果：两组受试者 AVLT-H 及 MoCA 量表无明显统计学差异（p＞0.05）。与对照组相比，患者组双侧脑岛、左侧海马旁回血流量减低，左侧楔前叶血流量增高；左侧海马旁回 CBF 值与化疗后病程呈正相关（rs=0.388，p=0.046），双侧脑岛、左侧楔前叶与化疗后时间无明显相关。结论：乳腺浸润性导管癌长期幸存者虽无明显认知损失，但仍存在左侧海马旁回、双侧脑岛及左侧楔前叶的脑血流量异常，且左侧海马旁回脑血流量随化疗结束后时间推移逐渐恢复。

## PU-185
# 肝硬化患者门静脉 4D-flow MRI 定量参数与肝功能相关性分析

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目的：比较肝硬化患者门静脉 4D-flow MRI 定量参数与肝功能的相关性
材料方法：回顾性分析 2019 年 9 月至 2020 年 10 月于我院行上腹部 3.0T MRI 检查的肝硬化患者，收集肝功能相关化验指标，包括总胆红素、总胆汁酸、前白蛋白、白蛋白、γ 谷氨酰转肽酶、天冬氨酸转氨酶、丙氨酸转氨酶、碱性磷酸酶、凝血酶原时间。排除标准:a .肝功能相关化验指标不完整或化验日期与磁共振检查日期之间的差异超过 5 天；b .肝脏术后患者；c.肝内具有占位性病变患者。最终入组 14 例肝硬化患者(平均年龄 54.5±13.6 岁；7 名男性，7 名女性)。所有患者均在 3.0T MRI（Ingenia CX）行磁共振扫描。扫描序列包括常规 T1WI，T2WI，DWI，2D Q-flow 和 4D-flow 序列。其中扫描 2D Q-flow，以测量门静脉中的流速作为速度编码的参考。4D-flow 参数如下：TR/TE = 5.0/3.2 ms，FOV = 300×350 mm2，分辨率= 2.5×2.5×2.5 mm3，PC 方向= RL-AP-FH，CS=8，扫描时间= 4 分 37 秒。扫描完成后通过主机进行 4D flow 重建。将重建后的数据拷出，由临床诊断经验丰富的放射科医师（具有 5 年腹部 MRI 诊断工作经验）在 CVI 42 软件包上处

理图像，以获得 3D 血管图像。首先在门静脉起始位置放置参考平面，其次在门静脉的近端、中间部和远端分别放置一个测量平面用于血流定量分析。测量的定量参数包括目标血管段的流量、流速、壁切应力(WSS)和压力梯度。所测得数据分别取均值。采用 SPSS 22.0 统计学分析软件进行统计分析。Spearman 检验用于分析门静脉血流定量参数与肝功能化验指标之间的相关性。
结果：肝硬化患者门静脉流量与 TBIL、总胆汁酸呈正相关(r = 0.798 和 0.881，P<0.05)。门静脉流速与血小板呈负相关(r = 0.667，P<0.05)。门静脉流速与总胆汁酸呈正相关(r = 0.881，P<0.05)。肝硬化患者其余门静脉定量参数与肝功能化验指标没有统计学差异（P＞0.05）。
结论：肝硬化患者门静脉 4D-flow MRI 定量参数与肝功能化验指标具有相关性。流量和流速反映了肝脏的血液供应。肝硬化患者的肝功能可以通过 4D-flow MRI 进行初步评估。

# PU-186

# Diffusion kurtosis imaging for quantitatively evaluation of WT-1 expression in Ovarian Cancer

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Purpose

To explore the value of Diffusion kurtosis imaging (DKI) quantitative parameters for difference WT-1 positive and negative OC.

Introduction

Ovarian cancer (OC) behaves more aggressively and has a worse prognosis than any other cancer involving the female genital tract. Research suggest that a single WT-1 immunohistochemistry can be used to assess both the tumor cells and micro-vascular density in ovarian tumors[1]. WT-1 is expressed in both tumor and endothelial cells, the development of therapeutic agents to target WT-1 may provide an effective treatment option for ovarian cancer. Diffusion kurtosis imaging (DKI) is a special DWI model which treats water diffusion as non-Gaussian behavior. Compared with traditional DWI, this model has been shown to provide greater sensitivity to tissue microstructural complexity with an extender b-value range[2]. Therefore, the purpose of this study is to evaluate the efficacy of DKI-derived parameters in the preoperative evaluation of WT-1 expression in OC patients.

Methods

A total of 29 patients of ovarian cancer confirmed by surgery and pathology from 2015 to 2020 were retrospectively collected. including 15 WT-1 positive OC (age(51.71±11.08) years old) and 14 WT-1 negative OC (age, (61.27±9.15) years old). All patients underwent abdominal MR examinations (Signa HDxt, GE Medical Systems, USA)(Scan parameters show in table 1). The original axial digital images from the DKI sequence were transmitted to the GE SDC-ADW 4.6 workstation (Sun Microsystems, Santa Clara, Calif) and the post-processing was performed by Functool software. Referring to the anatomical location of lesion obtained on T2-weighted or DWI images, The FA, MD and MK maps were automatically constructed, and were reviewed by two observers who were blinded to clinical information and histopathologic results with 10 and 15 years of experience in pelvic imaging, respectively. The manual regions of interest (ROIs) were drawn along the edge of tumors on the slice with maximal solid area (we choose the solid in tumors), according to fatsuppression T2WI and T1WI (Fig. 1). The measurement was repeated for three times, and the averages of three measurements were calculated. The FA, MD and MK were recorded. Intra-group correlation coefficient (ICC) was used to test the measurement consistency between the two observers. Correlation between above values and the expression of WT-1 in OC was compared by Mann-Whitney U test. Receiver operating characteristic (ROC) analysis was performed to evaluate diagnostic performance.

Results
The MK value of WT-1 positive group was higher than WT-1 negative group, and P value=0.020(table 2). FA and MD were not significantly different between the two groups (P values, 0.345 and 0.240). (Table 1).The area under the curve (AUC) of MK for discriminating WT-1 positive group and WT-1 negative group was 0.759, the sensitivity was 69.32%, and the specificity was 80.00% (Figure 3).
Discussion 解读结果
WT-1 immunohistochemistry can be used to assess both the tumor cells and micro-vascular density in ovarian tumors1. Our findings suggest that a single WT-1 immunohistochemistry can be used to assess both the tumor cells and micro-vascular density in ovarian tumors1. MK is potentially the most specific parameter to reflect tumor biological behaviors. In the present study, we proposed that MK could be a promising imaging biomarker in evaluation of WT-1 expression.

Conclusion
MK of DKI image could be a promising imaging biomarker in evaluation of WT-1 expression in OE.

Reference[1] Hsiao YH, Siddiqui S, Man YG. Dual use of a single Wilms' tumor 1 immunohistochemistry in evaluation of ovarian tumors: a preliminary study of 20 cases .J Cancer. 2010 Jul 13;1:93-7. doi: 10.7150/jca.1.93.[2] Likun Cao,1 Jie Chen,1 Ting Duan,et al. Diffusion kurtosis imaging (DKI) of hepatocellular carcinoma: correlation with microvascular invasion and histologic grade. Quant Imaging Med Surg. 2019 Apr; 9(4): 590–602.
Figure 1 A 47-year-old woman with left side ovarian cancer. A T2WI shows a low signal lesion in left pelvis .B FA value is 0.199. C The MD value is 1.12μm2/ms. D The MK value is 0.898. E Microscopically, the tumor presents in pathology.. F The WT-1 is positive.

# PU-187

# 接受 EC-T 化疗后乳腺癌幸存者大脑自发神经活动异常的 rs-fMRI 研究

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目的 采用临床神经心理测试方法及基于静息态功能 MRI（rs-fMRI）的低频振幅(ALFF)算法探讨化疗后乳腺癌幸存者的认知功能损伤及大脑局部自发神经活动的异常改变，为该类患者及早进行干预、治疗提供理论依据。方法 选择经病理证实的乳腺浸润性导管癌患者 29 例，平均年龄 45.3±7.0 岁，均接受标准的 EC-T（E：表柔比星；C：环磷酰胺；T：紫杉醇）序贯化学治疗。同期选择年龄及受教育程度相匹配的女性健康志愿者 30 例。所有受试者首先行蒙特利尔认知评估（MoCA）及听觉词语测试（AVLT-H），然后行静息态功能磁共振（rs-fMRI）及 T1WI 结构像扫描。最后采用 RESTplus 软件包对静息态图像进行处理及统计分析，使用 SPSS 19.0 软件包对临床资料及量表进行统计学分析。结果 两组间 AVLT-H 各子项得分均无显著性差异（P＞0.05），乳腺癌患者组 MoCA 评分低于健康志愿者（P＜0.05）；乳腺癌患者组左侧背外侧额上回（Frontal_Sup_L）ALFF 值高于对照组(P＜0．05)，小脑蚓_6（Vermis_6）、左侧扣带和旁扣带脑回（Cingulum_Ant_L）ALFF 值低于对照组(P＜0．05)，且 Pearson 相关分析显示左侧扣带和旁扣带脑回 ALFF 值与 MoCA 评分呈正相关（r=0.79，p＜0.001）。结论 接受 EC-T 化疗后的乳腺浸润性导管癌长期幸存者虽无明显记忆功能损伤，但仍存在认知功能损伤，左侧背外侧额上回（Frontal_Sup_L）、小脑蚓_6（Vermis_6）、左侧扣带和旁扣带脑回（Cingulum_Ant_L）出现自发神经活动异常，且左侧扣带和旁扣带脑回自发神经活动异常与 MoCA 评分存在正相关。

PU-188

# MRI 纹理分析预测成人脑胶质瘤 IDH 分型的价值

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**目的** 探讨常规 MRI 图像纹理分析判别脑胶质瘤 IDH 分型的价值。
**材料与方法** 回顾性分析经手术病理证实，于术前 2 周内行头颅 MR 检查的脑胶质瘤患者 66 例的临床及影像学资料。IDH 突变型 23 例，IDH 野生型 43 例。MR 序列包括平扫 T1WI、T2WI、FLAIR 及延时增强 T1WI。在 MaZda 软件中手动勾画病灶 ROI，提取病变的纹理特征参数，选出最具有鉴别脑胶瘤 IDH 类型的纹理特征参数，并比较 IDH 突变型与 IDH 野生型两组患者的纹理特征参数值；利用 B11 软件对纹理特征参数的鉴别诊断效果进行评估。
**结果** IDH 突变型与野生型脑胶质瘤的纹理特征参数值主要在直方图、共生矩阵等方面具有统计学差异。常规 MR 序列中，鉴别脑胶质瘤 IDH 类型的纹理特征主要来自 T1WI 增强序列，误判率为 3.03%。纹理特征分类分析方法中，误判率较小的为非线性分类分析方法。
**结论** 常规 MRI 纹理分析利用不同种类的纹理特征参数在预测脑胶质瘤 IDH 分型方面具有较高的准确率，能为临床治疗及预后评估提供有效依据。

PU-189

# 高场强 MRI 联合血清 CYFRA21-1、CA72-4、CA125 鉴别食管癌 T 分期的价值分析

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目的 分析高场强 MRI 联合血清细胞角蛋白 19 片段(CYFRA21-1)、糖类抗原 72-4(CA72-4)、癌症抗原 125(CA125)鉴别食管癌 T 分期的价值。材料与方法 选取 2017 年 7 月~2021 年 4 月在湖州市中心医院、商丘市第一人民医院拟行手术治疗的食管癌患者为研究对象，自愿接受高场强 MRI、血清肿瘤标志物检查，并有明确术后病理诊断结果；分析高场强 MRI 的图像质量，高场强 MRI 及其联合血清 CYFRA21-1、CA72-4、CA125 鉴别食管癌 T 分期的价值。结果 高场强 MRI 图片质量 2 分 6 例、3 分 16 例、4 分 40 例、5 分 42 例；高场强 MRI 诊断食管癌 T 分期的准确率为 92.30%（96/104），诊断 T1、T2、T3、T4 分期的敏感度分别为 100.00%、100.00%、91.30%、66.67%，特异度 100.00%、93.58%、94.82%、100.00%，准确率 100.00%、95.19%、93.26%、97.11%，阳性预测值 100.00%、83.87%、93.33%、100.00%，阴性预测值 100.00%、100.00%、93.20%、96.93%，Kappa 值 1.000、0.879、0.863、0.785；不同 T 分期的食管癌患者血清 CYFRA21-1、CA72-4、CA125 阳性率差异有统计学意义（P＜0.05）；高场强 MRI 联合血清 CYFRA21-1、CA72-4、CA125 诊断食管癌 T 分期的准确率为 95.19%（99/104），与单一 MRI 诊断食管癌 T 分期的准确率差异无统计学意义（P＞0.05）；诊断 T1 分期的效能与单一 MRI 高场强 MRI 相当；但诊断 T2 分期的特异度、准确率、阳性预测值及 Kappa 值，诊断 T3 分期的敏感度、特异度、准确率、阳性预测值、阴性预测值及 Kappa 值，诊断 T4a 分期的敏感度、准确率、阴性预测值及 Kappa 值均较单一高场强 MRI 诊断上升。结论 单一高场强 MRI 或联合血清 CYFRA21-1、CA72-4、CA125 鉴别食管癌 T 分期均可获得良好效能，联合诊断效能有所提升。

PU-190

# MSCT 联合 MRI 多模态技术对透明血管型巨淋巴结增生症的诊断价值

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**目的**：探讨多层螺旋 CT(multi-slices spiral CT,MSCT)联合 MRI 多模态技术对透明血管型巨淋巴结增生症的诊断价值。**方 法**：回顾性分析我院 2015 年 1 月至 2021 年 5 月经手术切除后病理证实的 6 例透明血管型巨淋巴结增生症患者的临床资料和影像学 MSCT 及 MRI 表现，并复习相关文献，总结其相对特征性影像学表现。6 例均进行 CT 平扫及增强扫描，其中 4 例同时行 MRI 平扫及增强检查。**结果**：6 例透明血管型巨淋巴结增生症均为单中心型，男女各 3 例，位于颈部 1 例，胸部 3 例，肝门部及左侧髂窝各 1 例，年龄为 34～72 岁。6 例 MSCT 平扫+增强扫描病灶均呈圆形或卵圆形孤立性软组织肿块影，境界清楚，其中 3 例肿块内见斑点及分支样钙化，增强动脉期呈显著强化，延迟期缓慢减低，呈“快进慢出”模式，容积重建(volume rendering, VR)及最大密度投影(maximum intensity projection, MIP)显示 4 例肿块周边见粗大的供血动脉；MRI 显示肿块边缘见流空血管，肿块内裂隙状低信号区增强延迟强化。**结论**：MSCT 联合 MRI 多模态影像学技术，能精确显示肿块内分支状钙化、裂隙状纤维胶原延迟强化、边缘迂曲供血动脉及富血供强化等透明血管型巨淋巴结增生症相对特征性影像表现，对术前精准诊断具有重要的诊断价值。

PU-191

# Correlation between Ki67 expression and Intraventricular incoherent motion (VIM) in ovarian cancer

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Correlation between Ki67 expression and intravoxel incoherent motion (IVIM) in ovarian cancer
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Synopsis
Ki-67 is one of the prognostic marker which determines the growth fraction of a tumour and its over expression is associated with malignancy, tumour aggression, reserved prognosis and metastasis. This worked aimed at exploring the correlation of Intravoxel incoherent motion (IVIM) quantitative parameters with ki-67 expression level in ovarian cancer. The results proved that there are correlation between D value and Ki-67 gene expression in ovarian cancer, P value is 0.039 and the r value is -0.454.

Introduction
Ovarian cancer (OC) is one of the most common tumors in the female reproductive system. The incidence rate of ovarian cancer ranks third in the female reproductive system malignant tumors, and the mortality rate ranks first. Proliferating nuclear antigen Ki67 reflects the proliferative activity of tumors and is widely used to predict the prognosis of many tumors. IVIM can be used to evaluate the pure molecular diffusivity (performed by the parameters apparent diffusion coefficient [ADC] and diffusion coefficient value [D]) and perfusion-related diffusivity (performed

by parameters perfusion coefficient value [D*] and perfusion fraction value [f]). Therefore, the purpose of this study is to evaluate the efficacy of IVIM parameters in the preoperative evaluation of ki-67 expression in OC. Ki-67 is one of the prognostic marker which determines the growth fraction of a tumour and its over expression is associated with malignancy, tumour aggression, reserved prognosis and metastasis. This worked aimed at exploring the correlation of Intravoxel incoherent motion (IVIM) quantitative parameters with ki-67 expression level in ovarian cancer.

Methods
A total of 20 patients (age: 54.75±12.99 years range (24-76 years))with 21 lesions of ovarian cancer confirmed by surgery and pathology from 2015 to 2020 were retrospectively collected. This research Includes 10 serous cystadenocarcinoma with 11 lesions, 1 mucinous cystadenocarcinoma, 2 endometrioid adenocarcinoma, 3 clear cell carcinoma, 1 metastasis, 1 endometrial stromal sarcoma, 1 mixed germ cell tumor, and 1 adult granulosa cell tumor patients. All patients underwent abdominal MR examinations (Signa HDxt, GE Medical Systems, USA) included T2WI, IⅣVIM and LAVA(Scan parameters show in table 1). The original axial digital images from the IVIM sequence were transmitted to the GE SDC-ADW 4.6 workstation(Sun Microsystems, Santa Clara, Calif) and the post-processing was performed by Functool software. Referring to the anatomical location of lesion obtained on T2-weighted or DWI images, The stand ADC, D, D* and f maps were automatically constructed, and were reviewed by two observers who were blinded to clinical information and histopathologic results with 10 and 15 years of experience in pelvic imaging, respectively. The manual regions of interest (ROIs) were drawn along the edge of tumors on the slice with maximal solid area (we choose the solid in tumors), according to fat suppression T2WI and T1WI (Fig. 1). The measurement was repeated for three times, and the averages of three measurements were calculated. The stand ADC, D, D*and f were recorded. Correlation between above values and the expression of Ki-67 in gastric cancer was analyzed by Pearson correlation coefficient test.

Results
ICC for all parameters were more than 0.75(table2). The Ki-67 expressions in cancer tissue was negatively correlated with cancer D values(r=-0.454,P=0.039.while Ki-67 expression was not correlated with stand ADC,D*and fvalue of ovary cancer. table2)

Discussion and Conclusion
Many studies have investigated immunohistochemical expression of Ki-67 as a prognostic and predictive marker for cancer[1-3]. The D value reflects the diffusion state of water molecules in tissues. Because the degree of tumor differentiation is related to cell heteromorphism, the lower the degree of differentiation, the greater the cell heteromorphism; the active proliferation of tumor cells leads to the increase of microvessel density, which leads to the limitation of water molecule diffusion.
Conclusion So, our research show D value has a negative correlation with Ki67 value. The D value of IVIM can predict Ki-67 status of ovarian cancer.
So, our research show D value has a negative correlation with Ki67 value. The D value of IVIM can predict Ki-67 status of ovarian cancer.

# PU-192

## T1 mapping 对直肠癌淋巴结转移预测价值的初步研究

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目的

探讨 T1 mapping 对直肠癌患者是否淋巴结转移的预测价值。
材料与方法
回顾性收集 2019 年 11 月至 2020 年 7 月于我院行 3.0T 直肠 MRI 扫描的直肠癌患者 21 例（年龄范围：39-77 岁，平均年龄：63.57 ± 8.02；男性 11 例）。其中有淋巴结转移者 11 例（A 组），无淋巴结转移者 10 例（B 组）。MRI 扫描序列包括常规序列（如 T1WI、T2WI、DWI）和 T1 mapping。扫描参数见表 1。由两位观察者在 ISP（intellispace portal， Philips Healthcare）工作站上，参考 T1WI、T2WI、DWI 等图像手动将 ROI 放置在 T1 mapping 图像病灶最大层面上（图 1-2），测量病灶 T1 值。采用组间相关系数（Inter-class correlation coefficient，ICC）检验两位观察者所测数值的一致性。采用 Mann-Whitney U 检验比较两组 T1 值的差异。如果差异有统计学意义，则采用受试者工作特征曲线（receiver operating characteristic，ROC）分析参数的诊断效能。
结果
两位观察者所测数据一致性良好 (ICC > 0.75)。A 组 T1 值显著高于 B 组（1446.91±112.97 ms & 1271.94±294.27 ms， P=0.024）（图 3）.区分两组的曲线下面积（area under the curve， AUC) 值为 0.882，灵敏度和特异度分别为 81.8%和 90%，阈值为 1393.42ms（图 4）。
结论
有淋巴结转移的直肠癌病灶 T1 值显著高于无淋巴结转移者。T1 mapping 序列具有区分直肠癌有无淋巴结转移病灶的潜能，有望为术前预测直肠癌淋巴结转移提供非侵入性诊断手段。

PU-193

# 表观弥散系数定量评估膀胱癌新辅助化疗早期疗效的应用性研究：比较三种感兴趣区勾画方法的价值

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【目的】 探讨表观弥散系数(ADC)值在膀胱新辅助化疗早期疗效评价中的价值；比较 3 种感兴趣区（ROI）勾画方法对 ADC 值测量的影响。
【材料及方法】 对就诊于我院并进行新辅助化疗的膀胱癌患者分别于化疗前及化疗 2 周期后行膀胱 DW-MR 扫描。依据实体瘤疗效评价（RECIST）标准，24 例患者入组中缓解组 14 例，非缓解组 10 例。分别用 3 种感兴趣区（ROI）勾画方法（最大层面法，三个小 ROI 法和体积测量法）测量化疗前后的 ADC 值（pre-ADC 和 post-ADC 值），并计算化疗前后 ADC 值的差值及变化率（△ADC 和%△ADC 值）。pre-ADC 和 post-ADC 值的比较采用配对样本 t 检验。有效组和无效组间的 pre-ADC、post-ADC、△ADC 和%△ADC 的比较采用独立样本 t 检验。绘制受试者工作特征（ROC）曲线，评价有统计学差异的 ADC 值、差值及其变化率在膀胱癌新辅助化疗疗效评价中的价值。
【结果】 3 种 ROI 勾画方法所测得 post-ADC 均较 pre-ADC 明显增高，差异有统计学意义（P< 0.05）。最大单层面法和三个小 ROI 法测得的 post-ADC 和△ADC 及体积测量法测得的 post-ADC 在有效组及无效组间均有统计学差异（P< 0.05）；三种 ROI 方法所测得 pre-ADC 和%△ADC 及体积测量法测得的△ADC 在两组间差异均无统计学意义（P> 0.05）。ROC 曲线结果表明，体积测量法和最大单层面法测得的 post-ADC 在评价化疗有无疗效中的 ROC 曲线下面积（AUC）最高，分别为 0.91 和 0.90；三个小 ROI 法测得的 post-ADC 和△ADC 值及最大单层面法测得△ADC 的 AUC 分别为 0.81、0.80 和 0.79。
【结论】 post-ADC 和△ADC 值可作为监测膀胱新辅助化疗早期疗效的可靠指标。体积测量法和最大层面法测得的 ADC 值较三个小 ROI 法在评估新辅助化疗疗效方面具有更高的价值。

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# 动静态磁共振成像技术在正常青年男女盆底结构的对比研究分析

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目的：利用动静态盆底磁共振成像技术比较正常青年男女盆底解剖结构参数特征的差异性。
材料及方法：前瞻性收集无盆底功能障碍性疾病的青年人 60 例，其中男性 27 例，年龄 18～39 岁，平均（29.93±6.20）岁，女性 33 例，年龄 18～26 岁，平均（24.76±1.09）岁。使用 3.0T MRI 扫描仪在静息状态下进行盆腔常规矢状位和横轴位 T2WI 扫描，在应力状态下（Valsalva 动作）行动态盆底功能矢状位 HASTE 序列扫描。在矢状位和横轴位 T2WI 图像上测量 H 线（T2WI 正中矢状位上耻骨联合下缘到肛门直肠交界处后壁的距离）长度、M 线（肛直肠交界处到耻骨尾骨线（PCL）的垂直距离）长度、耻骨直肠肌（PRM）厚度、肛管直肠角度（ANA）和膀胱颈（BN）到耻骨尾骨线(PCL) 的垂直距离（BN-PCL）长度；在应力状态下 HASTE 矢状位 MRI 图像上测量 H 线、M 线和 ANA 变化情况以及 BN-PCL 下降程度。分别统计男女两组上述参数并比较两组间各参数差异，若数据符合正态分布、方差齐采用 t 检验；若数据符合正态分布、方差不齐采用 t'检验；数据符合非正态分布采用秩和检验（u 检验）。
结果：静息状态下正常青年男性 M 线长度显著大于女性（13.69±3.79mm vs 8.74±2.77mm）（P＜0.05）；女性 ANA 显著大于男性（110.42° IQR【105.00-116.88°】 vs 104.28° IQR【91.54-112.40°】）（P＜0.05）；男性 BN-PCL 长度显著大于女性（28.10±6.17mm vs 19.18±4.61mm）（P＜0.05）。应力状态下女性 BN-PCL 下降值显著大于男性（7.52mm IQR【4.68-12.35mm】 vs 4.43mm IQR【2.20-7.47mm】）（P＜0.05）。
结论：正常青年男女盆底 MRI 测量常用参数值存在一定差异，利用 MRI 技术评估盆底结构改变时需考虑性别差异，提高临床分析盆底功能障碍性疾病病因的准确性。

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# Combination study of spectral CT and DCE-MRI quantitatively predicting vascular invasion of rectal cancer preoperatively

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Purpose To explore the feasibility of spectral CT and DCE-MRI in quantitatively predicting vascular invasion of rectal cancer.
Materials and Methods
Data of 32 patients with rectal cancer ( age range from 44 to 89 years, mean age: 63.34 ± 10.18; 12 women) were retrospectively collected. The cases were divided into two groups (group A: 17 cases with vascular invasion, and group B: 15 cases without vascular invasion). All patients underwent pelvic MR scans (including DCE sequence and some routine scans) on a 3.0T MR scanner (GE Signa HDxt, America), and pelvic spectral CT scans. Scanning parameters for the DCE-MRI were as follows: using LAVA fast volume scan sequence, FOV=40mm×32mm, TR/TE=3.5/1.5ms, slice thick/gap=3.6/0mm, NEX=0.69, matrix=256×192, scanning time=4min, 40 periods are scanned totally. Scanning parameters for the spectral CT were as follows: using gemstone spectral imaging (GSI) mode, tube voltage=80kVp/140kVp, tube current=230-445mA,

slice thick/gap=5/5mm, detector width=80mm, tube rotation time =0.6s, pitch=0.992:1, FOV=50mm×50mm, the arterial, venous, and delayed images were obtained 30 s, 60 s, and 120 s after the contrast medium injection. Iodine concentration (IC) and quantitative parameter value of DCE-MRI (Ktrans, Kep and Ve) were measured by two radiologists. Three ROIs were placed at the largest level of the lesion and thier mean value were calculated as the value of the whole lesion (Figure 1). NIC = iodine concentration of lesion / iodine concentration of common iliac artery at the same level. The intra-class correlation coefficient was used to test the consistency between measurements by the two radiologists. The Mann Whitney U test was used to analyze the difference of each parameter value between the two groups. Logistic regression was used to combine significantly different parameter values, and got predicted probabilities. The ROC curve was used to test potency of the predictive value in distinguishing the two groups.

Results
Measurements by the two radiologists were in good agreement (ICC=0.885), and the average of them was taken for subsequent analysis. The value of arterial NIC (ANIC), intravenous NIC (VNIC), Ktrans and Kep were significantly higher in group A than group B (P<0.05, respectively) (Table 1). Ktrans combined with ANIC has the highest efficacy, with area under the curve (AUC) of 0.875, sensitivity of 86.7%, and specificity of 88.2% (Table 2), and the predicted probability was significantly lower in group A than group B (Figure 2).

Discussion and Conclusion
The advantage of spectral CT is that it can accurately reflect the IC of the tumor, and its evaluation of the substance composition is better than the conventional simple CT value measurement. The higher the malignant degree of the tumor, the higher the IC. Ktrans represents the capillary permeability-surface area product per unit volume, which depends on blood flow, vascular endothelial cell permeability and endothelial cell surface area. Kep is the flow rate of contrast medium from extracellular space to intravascular flow, which is closely related to vascular wall permeability. In our work, the ANIC-Ktrans combined value were significantly lower in the group of vascular invasion than the other. And the ROC curve indicated that the combined value can differentiate the them with a high accuracy. In summary, spectral CT combined with DCE-MRI may serve as a feasible and non-invasive way in predicting vascular invasion of rectal cancer preoperatively, that is of great significance for clinical diagnosis.

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# 磁共振纵向弛豫时间定量成像对 COVID-19 康复患者脾脏功能的评估价值

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**目的**探讨磁共振纵向弛豫时间定量成像（T1mapping）对 COVID-19 患者脾脏功能的评估价值；**方法** 选取 2020 年 1 月-3 月期间因 COVID-19 于本院住院治疗，康复 3 月后复查的患者 35 例（普通型 25 例，重症型 10 例）和正常健康者 18 例，两组均进行上腹部常规 MRI 平扫加增强检查，并行图像后处理。观察并在两组脾脏增强前、后相对固定兴趣区多点测量 T1 值（T1 前、T1 后），并计算出 T1 前/后、T1 前-后。采用方差分析比较正常组、普通组、重症组间 T1 前、T1 后、T1 前/后、T1 前-后，有统计学意义的参数值行受试者操作特征曲线（ROC），计算出曲线下面积（AUC），分析诊断最佳阈值、敏感度及特异度。**结果** 三组间 T1 前值比较差异无明显统计学意义（P＞0.05）；三组间 T1 后值比较差异有统计学意义（P＜0.05），其中普通型组小于对照组（P＜0.05），重症组均小于对照组及普通型组；三组间 T1 前/后值比较差异有统计学意义（P＜0.05），其中重症组均小于对照组及普通型组（P＜0.05）；三组间 T1 前-后值比较差异有统计学意义（P＜0.05），其中重症组均小于对照组及普通型组（P＜0.05）。T1 前/后的 AUC 分别为

0.66，诊断最佳阈值为 1.925、755.30，灵敏度和特异度为 95.90%、50.00%。**结论** COVID-19 患者引起的脾脏功能潜在受损，尤其是重症病例比例升高，MRI T1mapping 值有助于对其评估，其中增强前后 T1 值比率具有一定诊断效能。
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# MRI 联合 MSCT 在胰腺癌术前诊治中的应用

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目的 分析核磁共振成像（MRI）联合多层螺旋 CT（MSCT）在胰腺癌术前诊治中的应用价值。方法 回顾性分析 2017 年 1 月-2019 年 1 月本院收治的术前未行放化疗的 50 例经术后病理证实的胰腺癌患者临床资料，患者均在术前接受 MRI、MSCT 检查，结合术后病理结果进行对比分析，评估 MRI 联合 MSCT 在胰腺癌术前分期、术前淋巴结转移和术前血管浸润情况中的诊断价值。结果 MRI 联合 MSCT 诊断胰腺癌术前 T 分期、术前淋巴结转移、术前血管浸润与术后病理结果的总体符合率 96.00%（48/50）、96.88%（31/32）、94.12%（32/34）较 MRI（80.00%、81.25%、73.53%）、MSCT（78.00%、78.13%、70.59%）的明显高，差异有统计学意义（P＜0.05）。结论 MRI 联合 MSCT 能明显提高胰腺癌术前 T 分期、术前淋巴结转移、术前血管浸润检出率，可为胰腺癌患者治疗方案的制定提供重要参考信息。
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PU-198

# 胶质母细胞瘤 MR 诊断的应用价值及准确性分析

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【摘要】目的 探讨胶质母细胞瘤 MR 诊断的应用价值及准确性。方法 选取 2020 年 1 月-2020 年 12 月我中心检查的胶质母细胞瘤患者 65 例，均经临床病理检查确诊，同时所有患者均接受 MR 诊断与 CT 诊断。比较两种检查方法检出率、分析病灶部位情况、各疾病类型检出率、阳性率、准确性、符合率、影像学情况。结果 ①病理确诊 65 例患者，占比为 100.0%，CT 检出 44 例，占比为 67.7%，MR 检出 63 例，占比为 96.9%，MR 检出率高于 CT（P＜0.05）；②65 例患者中，少枝胶质细胞瘤 3 例，胶质母细胞瘤 15 例，星形母细胞瘤 47 例，CT 检出少枝胶质细胞瘤 1 例，胶质母细胞瘤 10 例，星形母细胞瘤 33 例，MR 检出少枝胶质细胞瘤 3 例，胶质母细胞瘤 14 例，星形母细胞瘤 46 例，MR 检出各疾病类型多于 CT（P＜0.05）；③CT：平扫显示等高密度，病灶内部为囊变坏死；2 例病灶内部大部分显示囊性密度，详细观察可以看见少量实性部分；19 例边界不清、形态不规则；2 例形态比较规则，为类圆形，边界比较清楚；20 例病灶周围存在明显的水肿；1 例显示大部分囊性密度病灶，但是周围没有明显的水肿现象。增强扫描显示 36 例为明显强化，为花环状或者是环状，薄厚不一，8 例为早期轻度强化，延迟扫描为中度强化。④MR：63 例患者平扫 T1WI 为等信号或者是稍低信号，中心囊变坏死部分的信号更低，T2WI 信号不均匀，中心囊变坏死部分为高信号，60 例外周存在明显水肿，3 例无明显水肿。增强扫描 55 例患者为花环状强

化或者是环状强化，薄厚不一，囊变坏死部分没有明显的强化，8 例为轻中度强化。结论 胶质母细胞瘤诊断中，MR 诊断结果较为准确，值得临床使用。

## PU-199

# 探讨滑膜肉瘤 MRI 影像学表现

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目的：探讨滑膜肉瘤 MRI 诊断与影像学表现。材料与方法：选择我院 2019 年 1 月至 2021 年 5 月入院收治的、经病理证实的 15 例滑膜肉瘤患者入组，分别行 MRI 检查，对其影像表现进行分析。结果：肿瘤位于四肢关节附近肌间隙内 7 例（46.67%），纵隔 3 例（20.00%），胸腔 2 例（13.33%），腹部 2 例（13.33%），头颈部 1 例（6.67%）。探究得出滑膜肉瘤 MRI 特征性影像表现：T2WI 以高信号为主的三重混杂信号，T2 压脂序列呈“铺路石征”，病灶内见不均匀低信号分隔，增强扫描呈不均匀强化，病灶邻近骨质呈外压性骨质吸收，部分呈侵袭性骨质破坏。结论:（1）滑膜肉瘤具有一定的 MRI 影像学特征，综合分析有助于诊断，MRI 软组织分辨率高，对于滑膜肉瘤诊断优势明显，值得临床进一步推广使用。（2）当肿瘤体积较小、生长缓慢或对周围骨质无明显破坏时，易造成良性肿瘤假象，影响诊断结果，应结合临床尽量避免漏误诊。

## PU-200

# 功能性便秘患者直肠感觉差异相关的静息态功能磁共振研究

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功能性便秘(Functional constipation，FCon)是一种常见的功能性胃肠病(Functional gastrointestinal disorder，FGID)；神经影像学研究显示 FGID 患者参与情绪唤醒调节、躯体、感觉和运动控制处理的主要脑区脑功能与结构异常。然而，FCon 患者基于不同直肠感觉（rectal sensitivity）分组的脑区改变的研究在很大程度上仍然是未知的。我们采用静息态功能磁共振成像及低频波动幅度(ALFF)研究 61 例 FCon 患者（23 例低敏、18 例正常感觉、20 例高敏）之间的脑功能差异。结果显示，低敏 FCon 患者在参与情绪唤醒处理脑区（海马旁回 HIPP、岛叶 INS、前扣带回 ACC、额叶眶回 OFC）的 ALFF 值较正常感觉 FCon 患者和高敏 FCon 患者明显增高，参与感觉、运动控制的脑区（辅助运动皮层 SMA、中央前回 PreCen）的 ALFF 值明显减低。事后检验及体素相关分析发现，INS 与 ACC 的 ALFF 值与焦虑抑郁评分等级呈负相关，表明功能性便秘症状导致情绪过程和躯体和内脏信息整合的基线脑功能异常。OFC 中 ALFF 增加，与排便不尽感之间呈正相关，表明对排便的更强期望导致感觉统合和情绪处理异常。而 SMA 及 PreCen 中 ALFF 的减低也提示感觉和行为反应的异常。这些结果首次深入了解了 FCon 患者直肠感觉相关差异，并强调相关脑区的调控受直肠感觉影响，扩展了我们目前对功能性便秘潜在神经机制的理解。

## PU-201

# Alterations of spontaneous brain activity in systematic lupus erythematosus (SLE) patients without neuropsychiatric symptoms: A Resting-fMRI study

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Purpose To explore the alterations of spontaneous neuronal activity using amplitude of low-frequency fluctuation (ALFF), fractional amplitude of low-frequency fluctuation (fALFF) and regional homogeneity (ReHo) in non-NPSLE patients and their relationship with the anxiety and depression rating scales.
Methods Twenty-three non-NPSLE patients and 28 healthy controls were enrolled in this study. Resting-state functional magnetic resonance imaging was firstly analyzed by ALFF, fALFF and ReHo. The relationships between ALFF/fALFF/ReHo values of abnormal regions and anxiety/depression rating scales, including SAS and SDS, were also analyzed.
Results Compared with HC, non-NPSLE had decreased ALFF values in the bilateral postcentral gyrus, while increased ALFF values in the bilateral inferior temporal gyrus, left putamen and bilateral precuneus. Non-NPSLE showed reduced fALFF values in the left lingual gyrus, left middle occipital gyrus, right postcentral gyrus and left superior parietal gyrus, while increased fALFF values were in the left inferior temporal gyrus, right hippocampus, bilateral precuneus and bilateral superior frontal gyrus. Reduced ReHo values were in the bilateral postcentral gyrus and higher ReHo values were in the left inferior temporal gyrus, left putamen and bilateral superior frontal gyrus. In the non-NPSLE group, the mean ALFF values of bilateral precuneus were positively correlated with the Self-Rating Anxiety (SAS) rating scales (R=0.5519, P=0.0176); either were the mean ALFF values of right inferior temporal gyrus and SAS rating scales (R=0.5380, P=0.0213). The mean fALFF values of left inferior temporal gyrus were positively correlated with SAS rating scales (R=0.5700, P=0.0135). And the mean ReHo values of left putamen were positively correlated with Self-Rating Depression (SDS) (R=0.5477, P=0.0186).
Conclusion Non-NPSLE exhibited abnormal spontaneous neural activity and coherence in several brain regions mainly associated with cognitive and emotional functions. The ALFF values of bilateral PCUN, the right ITG and the fALFF values of left ITG may be complementary biomarkers for assessing the psychiatric symptoms.

# PU-202

# 非对比增强定量 T1 Mapping 技术对肝血管瘤、肝细胞癌及肝转移瘤的诊断价值

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目的 探讨非对比增强磁共振纵向弛豫时间定量成像（Non-contrast-enchanced T1 Mapping）技术对肝血管瘤、肝细胞癌及肝转移瘤的诊断价值。材料和方法 回顾性分析 68 例经肝脏 T1 Mapping 技术及扩散加权成像（DWI）扫描的患者，共发现病灶 105 枚，其中血管瘤 25 枚、肝细胞癌 26 枚、肝转移瘤 54 枚，测量并统计三组病变的平均初始 T1 值(Native T1)与平均 ADC 值之间的差异。利用线性判别分析分别对单纯使用 T1 值作为变量、单纯使用 ADC 值作为变量及同时使用 T1 值与 ADC 值作为变量对上述三组病变分类准确率进行统计。结果 血管瘤、肝细胞癌及肝转移瘤的平均初始 T1 值及平均 ADC 值分别为：1788.63±261.91 ms 与 1.73±0.32×10-3 mm2/s、1221.84±173.83 ms 与 0.92±0.13×10-3 mm2/s、1538.86±189.04 ms 与 0.88±0.14×10-3 mm2/s。三组病变之间初始 T1 值差异均有统计学意义（P＜0.05、F=49.09）；三组病变之间 ADC 值差异有统计学意义（P＜0.05、F=172.09），肝细胞癌与肝转移瘤之间 ADC 值差异无统计学意义（P=0.36）。单纯使用 T1 值作为变量与单纯使用 ADC 值作为变量对三组病变的分类准确率分别为 64.8%与 62.9%，同时使用 T1 值与 ADC 值作为变量对三组病变分类准确率为 78.1%。结论 非对比增强 T1 Mapping 技术初始 T1 值在肝血管瘤、肝细胞癌及肝转移瘤的鉴别诊断中有较

好的鉴别诊断效能，且初始 T1 值对肝细胞癌及肝转移瘤的鉴别诊断效能高于 ADC 值；联合应用 T1 Mapping 与 DWI 技术，可以显著提高对肝血管瘤、肝细胞癌及肝转移瘤的诊断准确率。

## PU-203

# 3D-FLAIR 序列在致痫性脑皮层结构发育不良诊断的价值

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目的：通过比较常规 FLAIR 和 3D-FLAIR 序列显示的颅脑局灶性皮层结构发育不良（focal cortical dysplasia,FCD）异常高号的分布区域和病灶数量，评估 3D-FLAIR 序列对颅脑局灶性皮层结构发育不良的诊断价值。
方法：26 例经手术病理证实为脑皮层结构发育不良（FCD）的脑癫痫患者在 3.0T 磁共振扫描仪上进行常规 FLAIR 序列和 3D-FLAIR 序列扫描，请两位有经验丰富的放射科医生对比观察图像，判断病变的解剖位置并对显示病灶的能力进行分析并计数小病灶。
结果：与常规 FLAIR 比较，26 例 FCD 患者采用 3D-FLAIR 对脑室旁、紧贴额叶皮层、颞叶皮层脑检出的病灶数均有统计学意义(P＜0.05)，各序列检出的病径小于 5mm 的病灶总数均有统计学意义。与常规 FLAIR 比较，3D-FLAIR 序列对小于 5 毫米的病灶的检出率有统计学意义(P=0.012)，而对大于 1 厘米病灶的检出率无统计学意义。
结论：3D-FLAIR 序列较常规 FLAIR 序列对于发现 1 厘米以下致痫性 FCD 具有诊断意义的病灶更具有优势，有助于皮层下区局灶性皮层结构发育不良的准确诊断。

## PU-204

# 肾脏肿瘤小视野高分辨 DWI 成像研究

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目的：目的：对比研究肾脏肿瘤小视野高分辨 DWI 和常规 DWI 成像的图像质量和诊断信息。
方法： 运用 GE 3TMRI，对 24 例肾脏实性肿瘤患者分别行小视野高分辨 DWI 和常规视野 DWI 扫描，比较两种方法肾脏肿瘤的图像质量（空间分辨力、信噪比、对比信噪比）和诊断信息（肿瘤边界显示、成分显示、与胰管关系），进行统计学分析。
结果：小视野高分辨 DWI 的层厚为 3mm，层内分辨力为 0.68mm。常规 DWI 层厚为 5mm，层内分辨力为 1.18mm。对于肾脏实性肿瘤，小视野高分辨 DWI 获得肾脏肿瘤信噪比、对比信噪比分别为 25.43±1.33、15.66±6.80；常规 DWI 序列获得肾脏肿瘤信噪比、对比信噪比分别为 33.52±12.97、25.38±10.11，2 组差异有显著性。对于肿瘤边界显示、结构显示，小视野高分辨 DWI 评分分别为 2.92±1.5、3.92±0.29。常规 DWI 评分分别为 2.2±0.45、2.33±0.49、1.75±1.06，前两者差异有显著性。 结论： 小视野高分辨 DWI 空间分辨力及信噪比优于常规 DWI 序列，对于肾脏肿瘤能够提供更精细的诊断信息，提高诊断准确性。

## PU-205

# 体素内不相干运动扩散加权成像对前列腺良恶性病变的诊断价值

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【摘要】目的 探讨体素内不相干运动（IVIM）扩散加权成像对前列腺良恶性病变的鉴别诊断价值。方法：回顾性分析 52 例前列腺癌患者与 33 例前列腺良性增生患者的 IVIM 扩散加权成像影像资料（B=0,50,100,200,400,600,800,900,1000,1100,1200），利用 IVIM 双指数模型测量各相关参数的平均值，包括：灌注分数（perfusion fraction, f）、假性扩散系数（pseudo-diffusion - coefficient, D*）及单纯扩散系数（pure diffusion coefficient, D），并分析上述参数在前列腺良恶性病变差异，探讨其在良恶性病变诊断中的价值。结果：前列腺良性病变组： f=36.34 ± 22.91%，D*=6.11 ± 4.21μm2/ms， D=1.08 ± 0.47μm2/ms ADC=1.57 ± 0.26μm2/ms；前列腺癌组灌注分数 f=7.17 ±5.70%， D*=5.33 ± 4.36μm2/ms ， D=0.69 ± 0.10μm2/ms ， ADC=0.75 ± 0.13μm2/ms ，前列腺良恶性病变的 D 值及 D*差异无统计学意义。前列腺良恶性病变的 f 值及 ADC 值差异有统计学意义。结论：体素内不相干运动扩散运动成像在前列腺良恶性病变鉴别诊断方面可提供一定的补充信息，f 值在鉴别诊断中价值较大。

# PU-206

## 基于磁共振神经成像技术的正常成人骶神经解剖特征分析

车英玉、张静、王庆伟、贾智明、杨子涛、朱文、吴玥、赵志恒、单帅帅、程敬亮、文建国
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[摘要] 目的 利用磁共振神经成像技术探讨正常成人骶神经影像解剖特征，为骶神经调控手术治疗神经源性膀胱提供参考。方法 收集我院在 3T MRI 机器进行增强 3D-STIR- SPACE 序列扫描骶神经成像检查的成年患者，选取骶神经形态显示正常者共 92 例，男 43 例，平均年龄（47.33±16.34）岁，女性 49 例，平均年龄（52.12±16.31）岁。然后在 3D 骶神经后处理重建图像上对 S1-S4 每对骶神经进行观察，并分别测量每支骶神经连续走行的角度以及在骶前孔内的长度，比较两组间每对及每支骶神经各测量参数差异有无统计学意义。结果 92 例正常显示的磁共振骶神经图像中双侧 S1、S2 神经显示率均为 100%，双侧 S3 神经显示率均为 94.6%（87 例），双侧 S4 神经显示率分别为 33.7%（左 31 例）、29.4%（右 27 例）。双侧骶神经呈对称性向前外侧方走行。男性左侧 S1-S4 神经向外走行的角度为（26.9±3.2）°～（13.7±4.8）°,右侧为（26.1±3.6）°～（12.5±4.0）°；女性左侧 S1-S4 神经向外走行的角度为（27.0±3.5）°～（14.6±5.0）°,右侧为（26.3±3.5）°～（13.0±3.6）°。男性左侧 S1-S3 神经向前走行的角度为（6.7±2.9）°～（13.2±5.6）°，右侧为（7.3±3.2）°～（12.7±4.4）°；女性左侧 S1-S3 神经向前走行的角度为（6.0±2.5）°～（11.1±3.0）°，右侧为（5.6±2.2）°～（11.5±3.6）°。男性左侧 S1-S3 神经在骶前孔内走行的长度为（2.8±0.3）cm～（2.2±0.5）cm,右侧为（2.8±0.3）cm～（2.2±0.4）cm；女性左侧 S1-S3 神经在骶前孔内走行的长度为（2.5±0.3）cm～（1.8±0.3）cm，右侧为（2.5±0.3）cm～（1.8±0.3）cm。S1-S4 每对神经向外走行的角度及 S1-S3 在骶前孔内的长度逐渐减小，S1-S3 向前走行的角度逐渐增大，差异有统计学意义(P＜0.05）。每对骶神经左右侧走行的角度及在骶前孔的长度差异均无统计学意义(P＞0.05)。男性右侧 S1、左侧 S3 神经向前走行的角度及双侧 S1-S3 神经在骶前孔内走行的长度大于女性，差异有统计学意义(P＜0.05）；S1-S4 神经向外走行的角度男女之间无显著差异（P＞0.05）。结论 骶神经走行的角度和在骶前孔的长度及性别存在差异，磁共振神经成像技术可为临床骶神经调控手术的神经定位提供重要参考。

# PU-207

# DWI 联合 CT 对肺部病变良恶性鉴别及医师诊断信心的增益价值研究

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目的：探讨 DWI 联合 CT 对肺部病变良、恶性的鉴别诊断价值，评估在 DWI 辅助下不同年资放射科医师的诊断效能及诊断信心是否得到提升。
方法：搜集南通市第一人民医院 2015 年 8 月至 2021 年 3 月经病理或随访证实的肺结节/肿块 95 例，其中恶性 57 例，良性 38 例，所有患者在治疗或穿刺前行 CT 平扫+增强扫描及 DWI（b 值取 0，300，800s/mm2）检查。测量记录 b 值为 800s/mm2 时病灶/脊髓信号比（LSR）及病灶表观扩散系数（ADC 值），分析良恶性病变的 LSR 及 ADC 值差异，采用 ROC 曲线下面积（AUC）确定两者最佳阈值及鉴别诊断效能。由 3 位不同年资医师对全部病例 CT 图像进行随机独立阅片，分别给出诊断信心评分（1 分：良性；2 分：可能良性；3 分：良恶性不确定；4 分：可能恶性，5 分：恶性），两周后结合 DWI 图像及 CT 图像再行阅片并给出评分，采用 ROC 曲线比较不同阅片者诊断效能。将联合 DWI 评估提高恶性病变评分或降低良性病变评分定义为“正确”更改，反之亦然。
结果：肺良、恶性病变的 LSR 分别为 0.56±0.27、1.47±0.83，良恶性病变的平均 LSR 差异有统计学意义（P＜0.05）；肺良、恶性病变的 ADC 值分别为 1.702±0.459×10-3mm 2 /s、1.058±0.227×10-3mm 2 /s，良恶性病变的平均 ADC 值差异有统计学意义（P＜0.05）。以 LSR=0.871、ADC=1.308×10-3mm 2 /s 时，鉴别肺良恶性病变的 AUC 分为 0.888、0.922，敏感度分别为 77.2%、89.5%，特异度分别为 89.5%、93.0%。在结合 DWI 后，3 位阅片者对良恶性病变鉴别的平均 AUC 由 0.826 提升至 0.931（P＜0.05），3 位阅片者平均做出了 36 次正确更改和 6.3 次错误更改。
结论：DWI 联合 CT 能提高放射科医师对肺部病变良恶性的鉴别诊断效能，有助于提高诊断信心。

题目：DWI 联合 CT 对肺部病变良恶性鉴别及医师诊断信心的增益价值研究
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PU-208

# IVIM-DWI 与 3D-ASL 定量参数评估 METTL14 调控人结直肠癌裸鼠皮下移植瘤细胞增殖和血管生成的实验研究

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目的 探讨定量参数体素内不相干运动扩散加权成像（IVIM-DWI） 和三维自旋动脉标记法（3D-ASL）灌注成像技术动态评价 METTL14 调控人结直肠癌裸鼠皮下移植瘤细胞增殖和血管生成的可行性。方法 20 只 5 周龄裸鼠建立皮下移植瘤模型，每组 10 只，分为实验组（METTL14 敲低组）和对照组。两组裸鼠皮下成瘤后分别进行 MRI 平扫、IVIM-DWI 与 3D-ASL 检查。测量的 IVIM-DWI 参数有表观扩散系数（ADC）、真性扩散系数（D）、灌注相关的扩散系数（D*）、灌注分数（f）和 3D-ASL 参数血流量（BF）值，并将其与皮下瘤体积、质量、Ki-67 和 CD34 的免疫组化染色结果进行相关性分析。结果 实验组皮下移植瘤的体积和质量均大于对照组，差异存在统计学意义（t 值分别为 5.312、5.535，P 值均<0.05）。实验组的 ADC 值、D 值均低于对照组，而 D*值、

f 值以及 BF 值均高于对照组，差异均有统计学意义（t 值分别为-2.802、-4.311、4.992、4.141 和 6.498，P 值均<0.05）。实验组皮下移植瘤的 Ki-67 增殖指数和 MVD 计数明显高于对照组，均存在统计学差异（t 值为 9.387 和 7.3，P 值<0.05）。通过 Pearson 相关性分析，实验组的 D*值、BF 值 与 MVD 计数及皮下移植瘤体积、重量之间均呈正相关性（P<0.05），ADC 值、D 值与 Ki-67 增殖指数及皮下瘤体积、重量之间均呈负相关性（P<0.05）。结论 IVIM-DWI 与 3D-ASL 技术能够定量评价裸鼠皮下移植瘤的水分子扩散运动与微循环的信息，无创性反映肿瘤组织内微血管生成与细胞密集度的状况，可以用于监测 METTL14 调控人结直肠癌皮下移植瘤生长的状况，是裸鼠移植瘤实验研究的有益工具。

关键词：裸鼠；结直肠癌；皮下移植瘤；体素内不相干运动扩散加权成像；三维自旋动脉标记法灌注成像

PU-209

## 基于 DTI 对先天性甲状腺功能减低症儿童的神经影像学研究

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目的 运用磁共振扩散张量成像（DTI）技术探讨先天性甲状腺功能减低症儿童脑白质微观结构的改变。方法 收集 20 例先天性甲状腺功能减低症儿童（患儿组）和 20 例年龄、性别相匹配的正常儿童（对照组）行常规颅脑 MR 平扫及 DTI 扫描。采用德国 Siemens Avanto 1.5T MR 扫描系统和头颅 8 通道相控阵线圈。患儿组与对照组儿童均口服 10%水合氯醛（0.5ml/kg）镇静后行 MR 检查。头颅常规 MR 平扫包括轴位 T1WI、T2WI/FLAIR，DTI 扫描采用单次激发自旋回波序列（SE-EPI），扫描参数：TR=10000ms，TE=90ms，B=0、1000s/mm2，30 个梯度方向，层厚 2mm，层间距 0mm。FOV=256mm×256mm，Averages=4，成像矩阵 128x128,全脑扫描。将采集的 DTI 数据导入 MR 工作站 3D-Neuro 菜单，自动生成彩色编码方向(directional encoded color，DEC)图,部分各向异性(fractional anisotropy，FA)图，结合 DEC 图在 FA 图上选取双侧额叶皮层下白质、内囊前肢、内囊后肢、胼胝体膝部、胼胝体压部、半卵圆中心各放置 2～3 个感兴趣区，固定大小（2mm×2mm），软件自动生成 FA 值，各感兴趣区的 FA 值均测量 3 次，取平均值。由于 FA 图图像灰白质对比良好，因此感兴趣区的放置主要以 FA 图为主，同时参考 DEC 图以求在白质纤维束最密集的层面放置感兴趣区，以提高测量结果的准确性。采用 SPSS13.0 统计分析软件处理数据，采用独立样本 t 检验对患儿组与对照组各部位的 FA 值进行分析。结果 患儿组额叶皮层下白质、内囊前肢、胼胝体膝部、胼胝体压部、半卵圆中心 FA 值较对照组减低（P<0.05），患儿组内囊后肢 FA 值较对照组无明显统计学差异（P>0.05）。结论 DTI 能反映先天性甲状腺功能减低症儿童脑白质微观结构的损伤，为定量评估此类患儿脑发育情况提供一定的客观依据。

PU-210

## MRI 对附睾结核的诊断价值

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目的 探讨 MRI 对附睾结核的诊断价值。
方法 回顾性分析 10 附睾结核的 MRI 表现。
结果 10 例患者中，单侧发病 9 例，双侧发病 1 例；病变位于附睾尾、体部 6 例，弥漫累及整个附睾 4 例。其中 5 例累及睾丸，5 例累及阴囊壁（其中 4 例形成皮下脓肿、3 例伴流脓），6 例合并

前列腺结核，9 例伴有精囊腺结核（其中 2 例同侧输精管结核）。本组病变均为增生性结节伴不同程度坏死。其中 6 例表现为增生性病变为主，增强呈厚壁环形强化伴分隔样强化，T1WI 等稍高信号、T2WI 稍高信号为主，病灶内可见 T2WI 高信号液化坏死区及 T2WI 低信号干酪坏死区。另 4 例表现为坏死性病变为主，增强呈圆形、类圆形或不规则环形强化，当以干酪坏死为主时，T1WI 呈等低信号，T2WI 呈低信号或以低信号为主的混杂信号，当以液化坏死为主甚至形成脓肿时，T1WI 呈低信号，T2WI 呈高信号为主的混杂信号。增生性病变及脓肿区弥散受限，DWI 呈高信号、ADC 值减低，干酪坏死区和液化坏死区弥散不受限。本组 10 例病变周围均可见完整或不完整的 T2WI 低信号环。
结论 附睾结核的 MRI 表现具有一定特征性，并且能够清晰显示病变周围邻近组织的情况，对附睾结核的诊断有一定的价值。

## PU-211

# MRI T2*mapping 序列定量评估膝关节前交叉韧带黏液样变性与撕裂的临床价值

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目的：前交叉韧带黏液样变性（anterior cruciate ligament mucoid degeneration，ACL-MD）常因少见及临床医师缺乏认识而被忽视，在普通磁共振上常被误诊为部分韧带撕裂及其他韧带损伤。本研究的研究目的是利用功能 MRI T2*mapping 序列定量分析 ACL-MD 与撕裂的弛豫时间的特点及不同病变级别间的弛豫时间的差异。

材料与方法：
前瞻性收集昆明医科大学第一附属医院接受膝关节镜检查和拟行前交叉韧带重建术的患者，术中关节镜下 ACL 形态学特征提示变性或损伤者则取胫骨端外侧缘前交叉韧带组织送病检，共收集患者 91 例，根据关节镜表现及病理结果，共纳入患者 75 名，其中变性组 22 例（变性+：16 例，变性++：6 例），损伤组 42 例（一度损伤：7 例，二度损伤：15 例，三度损伤：20 例）。所有研究对象术前均于美国 GE Discovery MR 750W 3.0 T MR 扫描仪上行膝关节矢状位 PD，3D-FIESTA、T2* mapping 扫描。扫描图像经美国 GE ADW4.6 工作站后处理，获得 ACL 胫骨端 T2*值。使用 SPSS26.0 统计软件包分析数据。连续变量表示为均值±标准差(SD)，分类变量用数字和百分比表示。组间比较采用两独立样本 t 检验，分类变量的卡方检验。关于方差分析，在方差不齐的情况下使用 Welch 检验。

结果：变性组 22 例，损伤组 42 例，两组间年龄、性别、侧别、身高、体重、体质指数差异均无统计学意义（P＞0.05）。变性组胫骨端 T2*值明显高于损伤组，且差异有统计学意义。变性组内，变性程度越重，T2*值越大，且差异具有统计学意义（P＜0.05）。损伤组中，损伤级别越高，T2*值越大，但是差异无统计学意义。

结论：MRI 定量参数 T2*值为膝关节 ACL-MD 和撕裂提供了有价值的定量评估，T2mapping 序列可能成为未来评估韧带变性和损伤的一种实用的定量成像手段，并有望用于识别 ACL 不同程度的黏液样变性。

## PU-212

# 轻微型肝性脑病患者认知功能障碍与认知控制网络改变的相关性研究

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目的：探究轻微型肝性脑病患者局部一致性（ReHo）异常脑区与认知功能障碍的关系。
方法：搜集 23 例乙肝肝硬化伴 MHE 患者（MHE 组）、25 例无 MHE 的乙肝肝硬化患者（NMHE 组）和 30 例性别、年龄、受教育程度相匹配的健康对照者（HC）组。所有受试者均行头颅静息态 BOLD-fMRI 扫描。将原始图像经过处理后得到 ReHo 脑图。采用单因素方差分析方法分析 3 组受试者间 ReHo 值存在差异的脑区，然后采用 spearman 相关分析方法分析 3 组受试者间 ReHo 值存在差异的脑区与 MoCA 量表评分、NCT-A 及 DST 量表评分是否存在相关性。
结果：与健康对照组相比，轻微型肝性脑病患者左侧中央后回、右侧枕中回、左侧额中回 ReHo 值均明显减低，内侧额叶脑回、右侧梭状回 ReHo 值均明显增高，差异均有统计学意义(P<0.05)。与健康对照组相比，乙肝肝硬化患者左侧中央前回，左侧额上回 ReHo 明显降低，差异均有统计学意义(P<0.05)。与乙肝肝硬化患者相比，轻微型肝性脑病患者左侧中央后回、左侧额中回 ReHo 明显身高，差异均有统计学意义(P<0.05)。与健康对照组及乙肝肝硬化患者相比，轻微型肝性脑病患者的 MoCA 评分明显减低，差异有统计学意义(P<0.01)。相关性分析显示轻微型肝性脑病患者异常 ReHo 脑区与 MoCA 评分呈明显相关关系(P<0.05)。与健康对照组相比，轻微型肝性脑病患者左侧中央后回与 NCT-A 量表评分呈明显负相关关系(P<0.01)，与 DST 量表评分呈明显正相关关系(P<0.01)，右侧梭状回与 NCT-A 量表评分呈正相关关系(P<0.01)，与 DST 量表评分呈明显负相关关系(P<0.01)。
结论：轻微型肝性脑病患者 ReHo 值增高或降低脑区与患者认知功能障碍的发生有关。

PU-213

# 两种不同超高 b 值扩散加权成像序列在前列腺癌和前列腺增生中的临床应用

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目的　探讨分段读出扩散加权成像序列（Rs-EPI）与单次激发平面回波成像（SS-EPI）超高 b 值在前列腺癌和前列腺增生诊断中的应用。方法　纳入 37 例经外科手术或穿刺、病理证实的前列腺疾病患者，其中前列腺癌 15 例，前列腺增生 22 例，所有患者于手术或穿刺前行 MR 扩散加权成像，b 值选择 0、1000、2000、3000s/mm$^2$，由两名高年资医师用双盲法观察两种不同扩散加权成像不同 b 值时的扩散加权图像，对两名观察者的判断结果进行 Kappa 一致性检验，并比较两种不同 b 值对前列腺癌及前列腺增生的定性诊断准确率。结果　两名观察者的判断结果存在一致性，Kappa 值为 0.80。当 b 值分别为 1000s/mm$^2$、2000s/mm$^2$、3000s/mm$^2$时，RS-EPI 诊断前列腺癌和前列腺增生的灵敏度及特异度分别为 66.7%和 81.8% 、80.0%和 90.9% 、93.3%和 95.5%。SS-EPI 诊断前列腺癌和前列腺增生的灵敏度及特异度分别为 66.7%和 77.3% 、73.3%和 81.8% 、80.0%和 86.4%。RS-EPI 的诊断符合率分别为 75.7%、86.5%、94.6%，而 SS-EPI 的诊断符合率分别为 73.0%、78.4%、83.8%。RS-EPI 在超高 b 值诊断前列腺癌和前列腺增生的灵敏度及特异度明显高于 SS-EPI。结论　选择超高 b 值（1000、2000、3000s/mm$^2$）对前列腺癌和前列腺增生的鉴别具有较高的灵敏度和特异度，在鉴别前列腺癌和前列腺增生时，RS-EPI 较 SS-EPI 可能成为一种更好的辅助方法。

PU-214

# 人口统计学和血管危险因素对淋巴系统功能的影响

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背景：大脑内的类淋巴系统在维持大脑正常运转的过程中起着至关重要的作用。类淋巴系统循环功能可以帮助清除大脑产生的一系列代谢废物和病理性的物质，例如，abeta 淀粉样蛋白和 tau 蛋白，从而维持内环境的稳态，保护神经元的结构和功能的完整性。当类淋巴系统功能出现障碍时，脑内代谢废物和病理性物质容易沉积于细胞内外，从而导致神经元结构和功能障碍，大脑正常生理功能出现紊乱。因此，类淋巴系统的功能异常是一系列神经退行性疾病的发生发展的重要原因之一。了解影响大脑类淋巴系统功能的潜在的影响因素，对于认识和了解神经性疾病的发生发展的过程有着非常重要的意义。
目的：我们旨在验证血管风险因素，人口统计学因素与可以间接反映脑类淋巴循环功能的一种指标-ALPS index 之间的关系。
方法：我们通过利用弥散张量成像的方式测量血管周围间隙内水分子弥散参数，从而了解大脑类淋巴循环功能。我们一共招募了 142 名社区老年人进行多模态磁共振扫描。对计算出来的 ALPS-index，血管风险因素，人口统计学因素进行了回归分析。
结果：ALPS-index 与年龄成显著的负相关（β= -0.284,ρ< 0.001）；相比于男性，女性 ALPS 指数更高（β= -0.243, ρ= 0.001）；患有高血压的人相比于非高血压人群的 ALPS 更低（β = -0.189, ρ= 0.013）。除此之外，髓静脉评分低的人该指标的得分同样也越低（β = -0.215, ρ= 0.003）。
结论：我们的结果与之前理论与动物研究中得出的有关因素影响类淋巴功能的结论基本一致，表明了类淋巴循环功能与一系列的人口学因素与血管性的风险因素有关，同时提示了 ALPS-index 是一种体内可以间接反应类淋巴循环的一种实用性的方法。日后对于类淋巴循环功能的有关研究，可以考虑将上述讨论的因素考虑在内。

PU-215

# 面肌痉挛患者皮质-纹状体网络静息态功能连接改变

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目的：面肌痉挛是一种面部肌肉运动障碍性疾病，而纹状体在运动功能中发挥重要作用。本研究旨在应用静息状态功能磁共振成像(functional magnetic resonance imaging, fMRI)技术，研究原发性单侧面肌痉挛患者组纹状体的功能连接(functional connectivity, FC)的变化，探索纹状体亚区功能连接异常在面肌痉挛中的作用，阐明皮质-纹状体环路功能连接改变在面肌痉挛中的神经病理学机制，为面肌痉挛早期诊断和疗效评估提供科学依据。
方法：用 3.0T 磁共振成像仪采集 30 例成人原发性单侧面肌痉挛患者组(左 15 例，右 15 例)和 30 例健康对照组的 fMRI 数据。为了统一患病侧，我们将左侧面肌痉挛患者组和相应对照组(15 例)的数据进行左向右翻转。翻转后，右侧定义为患侧，左侧定义为对侧。采用静息态脑功能数据辅助处理(data processing assistant for resting-state fMRI, DPARSF)软件对静息态 fMRI 数据进行预处理。选取纹状体亚区共 12 个种子点（左右侧各 6 个），进行基于体素水平的全脑 FC 分析和基于种子点水平的种子点间 FC 分析。采用单样本 t 检验对患者组和对照组进行组内 FC 分析。采用双样本 t 检验比较患者组与对照组间 FC 的差异（GRF 校正，体素 $P<0.005$，团块 $P<0.05$）。采用 Cohen 痉挛程度分级评分法评估面肌痉挛程度，所有受试者评估抑郁自评量表，应用 Spearman 相关分析评估面肌痉挛患者异常 FC 与痉挛严重程度及抑郁自评量表得分的相关性。

结果：基于体素水平的全脑 FC 分析结果显示面肌痉挛患者组的腹侧纹状体、壳核种子点与运动皮层、情绪相关脑区之间的 FC 较对照组显著增强，壳核、尾状核种子点与患侧运动区、小脑之间的 FC 在面肌痉挛组较对照组显著减低。患侧下腹侧纹状体与运动皮质之间的 FC 与患者 Cohen 痉挛程度呈正比。
结论：面肌痉挛患者组的纹状体亚区与运动皮层、情绪相关脑区间的 FC 存在异常。不同纹状体亚区可能通过皮质-纹状体环路参与面肌痉挛的发病及恢复过程。

PU-216

# Reversal of neurovascular coupling and cognition in end-stage renal disease patients after a single hemodialysis session

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Objective:
The neurovascular (NV) coupling mechanism describes the tight temporal and regional linkage between neural activity and CBF response, which can reflect the coordination between requirement of oxygen and the blood supply in the brain. Our recent neuroimaging finding has revealed that NV decoupling may be a potential neuropathologic mechanism of cognitive impairment in end-stage renal disease (ESRD) patients undergoing maintenance HD treatment. However, ESRD patients show improvement in cognitive impairment at 24 hours after a hemodialysis (HD) session. Evaluating the NV coupling changes that accompanying cognition reversibility during a single HD treatment can provide us with a greater understanding regarding the potential neuropathologic mechanisms underlying the protective effect of HD on cognitive function. We aim to investigate the reversal of neurovascular (NV) coupling associated with cognition improvement after a HD session. We further investigated the relationship among the NV coupling alteration, cognitive performance, and clinical indicators during a HD session. We hypothesized that a single HD treatment has a positive effect on NV coupling, which may be associated with the cognition reversibility in patients with ESRD.
Materials and methods
Using resting-state functional MR and arterial spin labelling, 39 ESRD patients and 50 healthy controls (HC) were scanned before HD (T1pre-dialysis), and all ESRD patients were scanned again after 24 hours (T2post-dialysis). A battery of neuropsychological tests and blood biochemical tests was performed before the MR scans. To quantitatively evaluate the NV coupling for each individual, gray matter (GM)-based correlations were performed between images of BOLD signals [amplitude of low-frequency fluctuation (ALFF), fractional ALFF (fALFF), regional homogeneity (ReHo), and degree centrality (DC) maps) and cerebral perfusion (CBF maps) at two time points: before HD (T1pre-dialysis) and after 24 hours (T2post-dialysis). For each individual, four types of voxel-wise NV coupling patterns (ALFF-CBF, fALFF-CBF, ReHo-CBF and DC-CBF correlation coefficients) were reflected NV coupling at T1pre-dialysis and T2post-dialysis, respectively. The relationships between the changed blood biochemistry tests and altered cognitive variables were assessed by canonical correlation analysis (T2post-dialysis versus T1pre-dialysis). The relationships between the changed NV coupling patterns and altered cognitive variables, the changed NVC patterns and altered blood biochemistry tests, and the changed NV coupling patterns and indicators of dialysis treatment were assessed by stepwise regression analysis (T2post-dialysis versus T1pre-dialysis).
Results:

ESRD patients showed improvement of memory and executive function at T2post-dialysis than at T1pre-dialysis. Compared with HC, ESRD patients at T1pre-dialysis and T2post-dialysis showed a significantly lower ALFF-CBF coupling (rHC = 0.579, rT1pre-dialysis = 0.260, rT2post-dialysis = 0.386, pT1pre-dialysis versus HC<0.001, pT2post-dialysis versus HC = 0.001). Compared with those at T1pre-dialysis, ESRD patients at T2post-dialysis showed a significantly higher ALFF-CBF coupling (p = 0.025). Increased ALFF-CBF coupling (T2post-dialysis versus T1pre-dialysis) was positively correlated with improvement of executive function and long-term memory. Increased hemoglobin and red blood cell count, lower total plasma homocysteine, lower systolic blood pressure (SBP) variability, and lower ultrafiltration volume during a HD session were associated with higher ALFF-CBF coupling.
Conclusion
Our study provides a significant insight into understanding the protective effect of HD treatment on cognitive function with respect to the NV coupling function. Partial correction of anemia and hyperhomocysteine, stable SBP, and fluid restrictions may be closely involved in the reversal of NV coupling and cognition in ESRD patients. More studies are needed to explore innovations in HD and ESRD treatment strategies and to mitigate these abnormalities.

PU-217

# Readout segmented diffusion weighted imaging sequence of clinical application in prostate cancer and benign prostatic hyperplasia in high b value

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Objective： To investigate the readout segmented diffusion weighted imaging sequence (Rs-EPI) ultra high b value used in the diagnosis of prostate cancer and benign prostatic hyperplasia. Methods: in 37 cases by surgery or biopsy, pathology of prostate disease patients, including 15 cases of prostate cancer, 22 cases of prostate hyperplasia, on MR diffusion weighted imaging in all patients in operation or puncture, b = 0、1000、2000、3000s/mm2, analyzed by two experienced radiologists with double blind observation method and different b values of diffusion weighted images, the signal strength measurement in DWI high signal region and background region, different b values was calculated the rate of accurate diagnosis of prostate cancer and benign prostatic hyperplasia. Results： the value of B DWI respectively 1000s/$mm^2$、2000s/$mm^2$、3000s/$mm^2$, DWI diagnostic sensitivity and specificity of prostate cancer and benign prostatic hyperplasia were 80% and 63.6%, 93.3% and 68.2%, 93.3% and 72.7%.b=1000s/$mm^2$、2000S/$mm^2$, the sensitivity of diagnosis of prostate cancer and benign prostatic hyperplasia and the specificity was lower than the b value of high b value for 3000s/$mm^2$. Conclusion： high b value (1000、2000、3000s/$mm^2$) with high sensitivity for the identification of prostate cancer and benign prostatic hyperplasia and specificity, can be used as an important auxiliary method in the diagnosis of prostate cancer and prostate hyperplasia.

PU-218

# MUSE 技术在颅底肿瘤弥散图像中的应用

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题目：MUSE 技术在颅底肿瘤弥散图像中的应用

摘要：
目的 探讨在颅脑磁共振检查中 MUSE 技术在改善颅底肿瘤成像中变形及伪影的应用价值。
方法 选择首都医科大学宣武医院颅底肿瘤接受磁共振扫描的患者 40 例，扫描序列为单次激发回波平面成像（ss-EPI）DWI 及 MUSE DWI，对两组序列所得到的图像质量进行主观分析和客观分析。主观评分 5 级，对每组图像进行评分。客观评价根据信噪比（SNR）的公式 SNR=SI 组织/SD 背景，测量两组图像在同一层面的 SNR、ADC 做配对比较。
结果 相较于 ss-EPI DWI 序列图像，MUSE DWI 序列图像评分高于前者，图像 SNR 明显增加，两种序列之间 ADC 值无明显差异。
结论 MUSE DWI 在改善颅底肿瘤弥散成像的变形及伪影方面明显优于 ss-EPI DWI，能够清晰显示颅内病变而不改变 ADC 值，可在常规扫描中应用 MUSE 技术提高图像质量。
关键词：高分辨扩散加权成像；磁敏感伪影；信噪比；磁共振成像

PU-219

# Fatty Liver Characteristics in Acute Pancreatitis: Evaluation by Magnetic Resonance Imaging

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Aims: The objective of this research was to investigate the characteristics of fatty liver in acute pancreatitis (AP) in two-dimensional in-phase (IP) / out-of-phase (OP) magnetic resonance imaging (MRI).
Method: Fifty patients with AP (23 men, 27 women; mean age: 44 ±12 years [range: 16-73 years]) were included in this single-centre retrospective study. Patients' informed consent was waived. All of them performed abdominal MRI within 72 hours of symptom onset and MRI follow-up. The severity of the AP was graded according to the magnetic resonance severity index (MRSI). The MRSI cut-off value was 7.0 points between the mild and the severe AP. Fatty liver in MRI was determined by the hepatic signal intensity difference between OP and IP images. Correlations between the severity of fatty liver and MRSI or serum triglyceride levels were analyzed.
Results: Of the 50 patients with AP, fatty liver was found in 66% of patients' MRIs. A close correlation can be seen between the difference of liver signal intensities on IP/OP images and the MRSI ($r= 0.83$, $P< 0.001$). Close correlations were also found between fatty liver appearance on MRI and serum triglyceride levels in both mild ($r=0.93$, $P< 0.001$) and severe AP ($r= 0.95$, $P< 0.001$). During follow-up MRI, the appearance of fatty liver diminished following the decrease of MRSI scores and serum triglyceride levels in both mild and severe AP patients.
Conclusion: Fatty liver in AP is frequently observed via MRI. The fatty liver characteristics on MRI could reflect the AP severity. The appearance of fatty liver in MRI may resume following recovery of AP patients.

PU-220

# 慢性原发性失眠患者海马静息态功能连接研究

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目的：评估海马功能连接情况以分析原发性失眠的发病机制。
方法：前瞻性收集 58 例慢性原发性失眠患者（失眠组）及 58 例健康对照者（对照组）的资料，所有受试者行 MRI 常规检查及静息态功能磁共振检查，以左侧海马、右侧海马和双侧海马作为种子点计算功能连接情况。同时采集失眠严重程度指数及睡眠效率。
结果：两组年龄及性别差异无统计学（P<0.05），失眠严重程度指数及睡眠效率差异有统计学意义（P>0.05）。与对照组相比，慢性原发性失眠患者的双侧海马与左侧额中回之间功能连接增加（P=0.035，Zmax=4.22）（P<0.05）。海马-左侧额中回连接强度与失眠严重程度指数正相关（r=0.371，P=0.001），与睡眠效率负相关（r=-0.307，P=0.009）。
结论：双侧海马与左侧额中回之间的连接性增加，可能与清醒状态与沉思状态有关，并且连接强度越强，患者的失眠程度更严重，睡眠质量更差。

## PU-221

# A deformation-based shape study of the corpus callosum in first episode schizophrenia

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Purpose: To reveal the pathogenesis of first-episode schizophrenia (FES). Corpus callosum (CC) shape has rarely been analyzed in FES.

Methods: We investigated FES-related CC shape abnormalities using 198 participants (92 FES patients and 106 healthy controls (HCs)). We conducted statistical shape analysis of the mid-sagittal CC curve in a large deformation diffeomorphic metric mapping framework. The CC was divided into the genu, body, and splenium (gCC, bCC, and sCC) to target the key CC sub-regions affected by the FES pathology. Gender effects have been investigated.

Results: There were significant area differences between FES and HC in the entire CC and gCC but not in bCC nor sCC. In terms of the localized shape morphometrics, significant region-specific shape inward-deformations were detected in the superior portion of gCC and the anterosuperior portion of bCC in FES. These global area and local shape morphometric abnormalities were restricted to female FES but not male FES.

Conclusions: gCC was significantly affected in the neuropathology of FES and this finding was specific to female FES. This study suggests that gCC may be a key sub-region that is vulnerable to the neuropathology of FES, specifically in female patients. The morphometrics of gCC may serve as novel and efficient biomarkers for screening female FES patients.

## PU-222

# Prognostic Value of Cardiac Magnetic Resonance Imaging Parameters in Left Ventricular Noncompaction with Left Ventricular Dysfunction

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BACKGROUND: Cardiac magnetic resonance (CMR) has been used to diagnose and risk stratify patients with left ventricular noncompaction (LVNC). Prognostic value of CMR parameters for LVNC is not well known, especially feature tracking (FT). The present study aimed to investigate

the prognostic role of CMR-FT in a LVNC patient cohort with left ventricular dysfunction and whether CMR-FT combined with traditional CMR parameters can increase the prognostic value of CMR for LVNC.
METHODS: There were 123 candidates retrospectively included in this multi-center study and 55 LVNC patients (mean age, 45.7±16.2 years; 61.8% men) was remained after exclusion criteria. Clinical features, left ventricular function parameters, global and segment myocardial strain and late gadolinium enhancement (LGE) were evaluated. Outcome was the composite events of cardiovascular death, heart transplantation, hospitalization for heart failure, thromboembolic events, and ventricular arrhythmias.
RESULTS: After a median follow-up of 5.17 years (interquartile range: 0.17 to 10.58 years), 24 (36.8%) patients experienced at least one the major adverse cardiovascular event (MACE). The myocardial strain parameters of patients with events were lower compared with patients without events. For the univariable Cox analysis, left ventricular ejection fraction (LVEF) (HR: 0.964; 95% CI: 0.929 to 0.999; p=0.046), global longitudinal peak strain (GLS) (HR: 1.238; 95% CI: 1.018 to 1.506 p=0.033) and the presence of LGE (HR: 2.768; 95% CI: 1.033 to 7.419; p=0.043) were univariate predictors of MACEs. The longitudinal strain at apical level and radial and circumferential strain at basal levels were also univariate predictors of MACEs. In the multivariate analysis, LGE was a strong predictor of MACEs. The presence of LGE significantly improved the model fit in comparison with the model including age, body mass index (BMI) and LVEF (global chi-square test: 7.51 vs. 13.47; p=0.015). However, myocardial strain parameters were no statistically significant for prediction of MACEs after adjusted for age, BMI, LVEF and the presence of LGE and cannot increase prognostic value (chi-square after adding GLS: 13.47 vs 14.14, p=0.411) in the multivariate model. The addition of segmental strain parameters, the longitudinal strain at apical level and radial and circumferential strain at basal level, also did not improve the model fit.
CONCLUSIONS: LV strain parameters from CMR-FT have no significant incremental prognostic value in LVNC patients with reduced LVEF while the presence of LGE was a strong independent predictor of MACEs.

# PU-223

# 应用多参数心脏磁共振评价心律失常性扩张型心肌病

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背景及目的
探讨多参数心脏磁共振在伴有室性心律失常及同时合并房性心律失常的扩张型心肌病患者中的应用价值。
材料及方法
搜集 2018 年 8 月到 2021 年 5 月在哈医大一院就诊所有扩张型心肌病患者，经过筛选，除外弥漫性强化及统计分析存在异常值患者，共计 24 例，其中房性伴室性心律失常患者 9 例，单纯室性心律失常患者 8 例，窦性心律患者 7 例。患者平均年龄 50.25±6.96 岁，最大年龄 74 岁，最小年龄 38 岁，三组数据间比较年龄无统计学差异，其中女性 13 名，男性 11 名。全部受试者进行了包括 24 小时动态心电图，冠状动脉造影或 CTA，超声心动图和心脏磁共振成像（CMR）检查，获取了全面的检查资料。使用 1.5T 西门子磁共振扫描仪（Siemens Amira，德国）对所有的受检者进行标准检查，采用 8 通道心脏专用线圈，主要扫描图像包括：多幅电影图像、心肌灌注及延迟增强图像、打药前后的 T1mapping 图像。

所有采集的原始数据由 CVI42（加拿大）专业心脏后处理软件进行处理。由 2 名放射线高级医师分别进行对图像进行独立测量。得到左右室心功能参数，及 nativeT1、postT1 值，径向、环向、纵向三个方向上的总体心肌应变参数，
比较室性心律失常组、房性及室性心律失常组及窦性心律组之间多种磁共振参数否存在差异，寻找评价敏感性的重要参数。
研究结果
所有数据统计学分析均采用 SAS9.4 国际标准统计学编程软件进行统计分析，采用单因素方差分析，配以两两比较，P<0.05 视为差异有统计学意义。
三组之间进行方差分析比较，LESV，LVEF 及总体心肌应变 GPSR、GPSC 及 GPSL 均有统计学差异，而右室各功能参数、nativeT1 值及 postT1 值均无统计学差异。组间比较，室性心律失常组与室性合并房性心律失常组间，LESV 值（P=0.0131）、EF 值（P=0.0687）及 GPSL（P=0.0449）之间有统计学差异；室性和无心律失常组比较，LESV 值（P=0.0131）、LVEF 值（P=0.0055）、GPSR（P=0.0158）、GPSC（P=0.0104）、GPSL（P=0.0114）均匀有统计学差异。
结论
DCM 患者中存在无或不同种类心律失常，CMR 能良好评价之间的差异性。尤其值得注意的是在 DCM 患者中 T1mapping 值不能良好的评价心律失常间的差异性，心肌应变参数更加敏感、有意义，能更好的区分心律之间的差异性，无需单独增加扫描序列，更具有临床应用价值。

## PU-224
## MRI 在鼻腔内翻性乳头状瘤与非霍奇金淋巴瘤鉴别诊断中的价值

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目的： 探讨 MRI 在鼻腔内翻性乳头状瘤(IP)和非霍奇金淋巴瘤(NHL)鉴别诊断中的价值。方法: 收集经手术和病理证实的 24 例鼻腔 IP、30 例 NHL 的术前 MRI 平扫及增强资料，对其 MRI 表现进行回顾性分析。比较两者在病变部位、生长方式、侵及范围、边缘乳头状改变、信号强度及强化情况方面的差异。结果： IP 患者中 MRI 表现为沿鼻腔长轴方向生长、边缘呈乳头状、T2WI 及 T1 增强上呈层状、裂隙状或卷曲脑回样改变的例数多于 NHL 患者； NHL 患者 MRI 表现为沿鼻腔黏膜方向弥漫浸润性生长、累及鼻翼、鼻背及颜面部皮下软组织的例数多于 IP 患者，T1 信号多高于 IP，T2 信号多低于 IP，两组比较差异有统计学意义(P<0.05)。 结论: 鼻腔 IP 和 NHL 有不同的 MRI 影像学特点，对于临床早诊断、早治疗具有重要意义。

## PU-225
## 利用 CTA 的侧支循环评分预测大脑中动脉 M1 体积及分布情况

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目的：探讨大脑中动脉 M1 段闭塞患者 CTA 的侧支循环评分与各脑血管危险因素、脑梗死体积及分布的相关性。方法：回顾性分析 60 例大脑中动脉 M1 段闭塞的患者，利用 CTA 评估侧支循环，根据侧支代偿优劣分为 2 组，按多田公式测量 48h 后的最终梗死体积，利用二元逻辑回归分析，判定侧支循环评分与各脑血管危险因素及最终脑梗死体积的关系。根据 MRI(DWI)记录各患者梗死部位及数目，2 组间以单多发、有无 PAI、有无 PI 及有无 BZ 进行比较。结果：60 例患者中，侧支循环不良组 21 例，侧支循环良好组 39 例。2 组间患者症状及 DWI 梗死体积评分比较，差异有统计

学意义(Z=18.266，t=-5.682，均为 P=0.000)。2 组患者年龄、性别、发病侧、高血压、糖尿病、高脂血症、吸烟史及既往脑卒中史比较，差异无统计学意义(P>0.05)。二元逻辑回归分析显示 DWI 梗死体积在 2 组间差异有统计学意义(P=0.01，<0.05)，而症状在 2 组间差异无统计学意义。2 组患者脑梗死多发较单发者多见，组间以单多发、有无 PAI 及有无 PI 比较差异无统计学意义(P>0．05)，以有无 BZ 比较差异有统计学意义(c2=12.493，P=0.000，P<0．05)。结论：大脑中动脉 M1 段闭塞后可运用 CTA 侧支循环评分对最终梗死体积进行简单量化评估，并对了解梗死分布有一定帮助，对临床治疗及预后有参考价值。

## PU-226

# 伴有轻度认知障碍的高血压患者脑内铁沉积的定量磁共振研究

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目的

利用定量磁敏感图（QSM）研究伴有轻度认知障碍（MCI）的高血压患者脑内铁沉积的分布，探究脑内各区域磁敏感值与神经认知表现的关系。

材料与方法

收集 2019 年 9 月至 2020 年 1 月诊断为原发高血压病 92 例，对照组 40 例。筛选为三组：高血压 MCI 组(n=54)，无 MCI 高血压组(n=25)，对照组（n=25），采集临床、认知测试及影像资料。

利用 3T 磁共振对受试者扫描常规序列和 QSM 序列。QSM 序列包含两组回波梯度序列，参数为 TR 25ms，$TE_1$ 7.5ms（第一组），$TE_2$ 8.75ms（第二组），FOV 256×192mm，64 层，层厚 2mm。

测量后处理得到的 QSM 图像中感兴趣区（ROI）磁敏感值，包括：双侧尾状核、丘脑、壳核、苍白球、黑质、红核、齿状核及额叶白质。比较三组间各 ROI 磁敏感值差异；统计高血压 MCI 组的蒙特利尔认知评估量表（MOCA），以年龄和教育水平为控制变量，分析 MOCA 结果与各 ROI 磁敏感值的偏相关关系。

结果

受试者在年龄、性别、教育水平上没有差异。

三组受试者双侧壳核、尾状核、丘脑及右侧苍白球之间磁敏感值差异显著 (p<0.05)，相比对照组，无 MCI 高血压组左侧壳核的磁敏感值显著增加，高血压 MCI 组双侧壳核、尾状核及右侧苍白球的磁敏感值显著增加。对照组双侧丘脑的磁敏感值较另外两组增加。

高血压 MCI 组左侧壳核、右侧尾状核的磁敏感值与认知测试结果密切相关，MOCA 分数与其磁敏感值呈负相关（r=-0.317 to -0.397 ，p＜0.05）。

结论

目前认为萎缩、梗死和出血引起的脑损伤是高血压认知损害的重要因素，但对脑铁沉积在高血压认知障碍中的作用仍不清楚。

本研究表明，高血压 MCI 组在双侧壳核、右侧苍白球及左侧尾状核中有显著增高的磁敏感值，发现其中左侧壳核、右侧尾状核的磁敏感值增加与认知障碍有关。本研究为高血压与脑铁沉积存在的关系提供了证据；揭示脑铁异常沉积在高血压患者认知障碍中发挥了重要作用，提示脑铁代谢异常可能是其认知障碍发生发展的关键因素；QSM 是检测脑铁沉积的有用工具。

## PU-227

# 基于骨髓水肿的多模态 MRI 对 RA 疗效的评估

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目的 探讨基于骨髓水肿的多模态 MR 成像在 RA 疗效评估中的价值。
方法 利用西门子 3.0 T MR 扫描仪对 RA 患者的单侧腕关节进行基线及随访复查，扫描序列包括 FS-TSE-T2WI、T1mapping 及 T2mapping 序列。48 例患者参与随访复查（男性 10 例，女性 38 例），中位年龄 50 岁（20～70 岁），右腕 30 例，左腕 18 例。其中复查 2 次者 38 例，复查 3 次者 27 例，复查 4 次者 18 例。按目标骨范围为单侧腕关节 15 块骨（尺桡骨远端、各腕骨及各掌骨基底部）、8 块（舟骨、月骨、三角骨、头状骨、钩状骨、桡骨远端及第 2、3 掌骨基底部）和 3 块（月骨、三角骨及头状骨）分别收集各次 MRI 测量数据。利用类风湿关节炎磁共振评分（rheumatoid arthritis magnetic resonance image scoring，RAMRIS）对各次单侧腕关节骨髓水肿进行半定量评分，同时收集自基线至各次复查时的 DAS28-ESR 评分。分析 DAS28-ESR 值与 T1、T2 值及 RAMRIS 评分在随访过程中的相关性，比较第 1 疗程末 MRI 定量值变化率在不同疗效中的差异性。
结果 各疗程末 T1 值变化值均与 DAS28-ESR 变化值呈正相关（P＜0.05），而 T2 值变化值与 DAS28-ESR 变化值均无相关性（P＞0.05）。第 1 疗程末 31 例患者治疗有效果，17 例治疗无效果。第 1 疗程末 T1 值变化率于治疗有、无效果病例间有显著差异（P＜0.05），且以月骨、三角骨及头状骨为目标范围的测量值可靠性最高，其 ROC 曲线的 AUC 为 0.763，最佳界值的敏感度为 0.871，特异度为 0.588。RAMRIS 评分在随访过程中无显著改变且与 DAS28-ESR 变化无相关性。
结论 T1mapping 成像能够有效定量评估 RA 患者初期的疗效，随着临床评分的下降，T1 值亦呈相应下降。T2mapping 骨髓成像在 RA 疗效监测中的意义不明显，其临床应用有待探索。腕关节骨髓水肿骨 T1 值在第 1 疗程末的变化率可以为 RA 疗效的判断提供帮助。月骨、三角骨及头状骨可以作为 RA 临床疗效评估新的观测点。

PU-228

# The value of IVIM-DWI combined with DTI in prediction of lymphovascular space invasion for early cervical squamous cell carcinoma

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Purpose This study aims to investigate the prediction of lymphovascular space invasion (LVSI) through a combination of intravoxel incoherent motion diffusion-weighted (IVIM-DWI) with diffusion tensor imaging (DTI) in patients with early cervical squamous cell carcinoma.
Methods Eighty patients with pathologically confirmed early cervical squamous cell carcinoma underwent conventional MRI, IVIM-DWI and DTI pretreatment. The patients were divided into LVSI positive and LVSI negative groups according to surgical pathology findings. The parameters of IVIM-DWI (ADC, D, D* and f value) and DTI (DCavg and FA) were measured. One-way analysis of variance was performed to compare the differences of preoperative parameters between the two groups, and optimal cut-off values and predictive performance of parameters with statistical significance were estimated by drawing the receiver operator characteristic (ROC) curve.

Results There were 45 patients in LVSI positive and 35 in negative group. The positive group showed a lower D and FA value (all p<0.05). The area under the ROC curve (AUC) of D and FA was 0.852 and 0.731, respectively, and the combination of D and FA improved the AUC to 0.929, with a sensitivity and specificity of 82.5% and 98.0%, respectively.
Conclusions Both D and FA value showed promising results for diagnosing LVSI in early cervical squamous cell carcinoma. A combination of D and FA might improve the predictive value.

## PU-229

# 定量脑磁共振灌注技术对颞叶癫痫患者海马灌注情况的研究

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目的：研究定量磁共振灌注技术对海马的检查方法，评估颞叶癫痫海马硬化患者海马灌注血流量的变化情况以及预测颞叶癫痫海马 CBF 临界值。
方法：收集我院 2018 年 3 月-2019 年 3 月因癫痫行头颅海马 MRI 检查，并通过磁共振波谱成像证实存在海马硬化的 30 例癫痫患者作为实验组，海马正常的另外 30 例患者作为常规组。采用西门子公司 Aera 1.5T 超导型磁共振扫描仪，使用头部相控阵线圈，患者取仰卧位，平静呼吸。实验组和常规组的 30 例患者均先行常规头颅 MRI 常规检查，再行常规海马斜轴位、斜冠状位 T2_Flair 扫描，之后行海马磁共振波普检查，最后行海马斜轴位定量磁共振灌注检查，自动生成 CBF 灌注函数图像。扫描结束后首先做波普后处理，再结合常规海马斜轴位、斜冠状位 T2_Flair 图像定位海马异常部位，最后在定量磁共振灌注 CBF 函数图像上测量海马异常部位的 CBF 灌注函数值。如果为海马正常的常规组患者，其定量磁共振灌注 CBF 函数图像的测量部位为最易发生海马硬化的海马头部。分析比较实验组和常规组海马的血流量变化情况，并通过 ROC 曲线预测 CBF 临界值。
结果：分别测量实验组、常规组全定量磁共振灌注 CBF 函数值。统计分析实验组、常规组海马 CBF 灌注函数值。实验组 CBF 灌注函数平均值为 15.15±3.17ml/(100g.min)，常规组 CBF 灌注函数平均值为 25.48±8.46ml/(100g.min)，实验组海马 CBF 灌注函数平均值低于常规组海马 CBF 灌注函数平均值。运用 ROC 曲线计算 CBF 最佳临界值为 19.60。
结论：定量磁共振灌注技术能够很好的应用于海马 CBF 的定量检测。硬化海马血流量相对于正常海马血流量有明显下降。颞叶癫痫患者海马灌注量的变化要先于影像学的改变，定量灌注定量测量海马 CBF 有助于颞叶癫痫的早期诊治。

## PU-230

# The value of IVIM-DWI in early prediction of efficacy of neoadjuvant chemotherapy for breast cancer

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Objective: To investigate the early predictive value of IVIM-DWI in neoadjuvant chemotherapy for breast cancer.
Methods: 43 cases of breast cancer confirmed by pathological puncture biopsy in our hospital were collected. Four courses of neoadjuvant chemotherapy were used to evaluate the efficacy. IVIM-DWI was performed after each chemotherapy. IVIM-DWI parameters included standard apparent diffusion coefficient (ADC), slow apparent diffusion coefficient (D), fast apparent diffusion coefficient (D*) and perfusion fraction (f). Referring to RECIST criteria, the study cases

were divided into two groups: (1) effective group: complete remission (CR) and partial remission (PR); (2) ineffective group: progress disease (PD) and stable disease (SD). Multivariate analysis of variance was used to compare IVIM-DWI parameters before and after treatment, between effective and ineffective groups. The ROC curve was used to calculate the optimal diagnostic threshold for the effective group and the ineffective group.
RESULTS: A total of 49 lesions were studied, including 33 in the effective group (CR: 7, PR: 26) and 16 in the ineffective group (SD: 11, PD: 5). There was significant difference in the volume of tumors in the effective group of pretherapy and the third treatment course, but there was no significant difference in the ineffective group. There were significant differences in D value, D* value and F value of IVIM-DWI parameters among three groups of pretherapy, 1st treatment and 3rd treatment in the effective group (F value was 30.487, 6.752 and 8.983, respectively, $P < 0.05$), but there was no significant difference in ADC value ($P > 0.05$). There was no significant difference in parameters in the three groups before and after treatment in the ineffective group. There were significant differences in D value, D* value and F value of IVIM-DWI parameters between effective group and ineffective group before treatment (F value was 30.487, 6.752 and 8.983 respectively, $P < 0.05$), but there was no significant difference in ADC value ($P > 0.05$). The area under curve (AUC) of D value, D* value and F value were 0.889, 0.910 and 0.879 respectively. The diagnostic thresholds were 0.716 mm2/s (specificity and sensitivity were 75.1% and 95.2%, respectively), 37.85 mm2/s (specificity and sensitivity were 71.2% and 98.3%, respectively) and 0.292 (specificity and sensitivity were 89.4% and 81.5%, respectively). (Table 1, Figure 1-2)
Conclusion: IVIM-DWI can predict the early curative effect of neoadjuvant chemotherapy for breast cancer and evaluate its effectiveness. It can assist conventional MRI to evaluate the curative effect.

## PU-231

# 基于 MR 灌注成像的血浆容积分数鉴别肿瘤患者脊柱病变良恶性的价值

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目的 探讨血浆容积分数（Vp）鉴别肿瘤患者脊柱病变良、恶性的价值。材料与方法 本研究为回顾性研究。纳入 2016 年 1 月至 2019 年 12 月期间在我院行脊柱动态增强 MR 灌注成像及病灶活检的 72 名肿瘤患者。MR 检查后 7 天行活检。共 111 个病灶据病理结果分为恶性组（n=63）和良性组（n=48），计算它们的 Vp，比较两组间差异。进行独立样本 t 检验和受试者工作特征分析来验证这 2 组间 Vp 的差异。结果 共有 72 名患者（年龄 63±12 岁），男性 44 名，女性 28 名。良性组 Vp 明显低于恶性组（P＜0.001）。受试者工作特性曲线下的面积（AUC）为 0.87（95% CI：0.807，0.934），受试者工作特性曲线的 Vp 最佳截断值为 2.45，以其为诊断阈值的敏感度为 77.4%，特异度为 77.6%，Youden 指数为 0.55。结论 Vp 可用于鉴别肿瘤患者脊柱病变的良恶性。

## PU-232

# PI-RADS v2 和 PI-RADS v2.1 对移行带前列腺癌诊断价值的对比研究

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目的：对比研究 PI-RADS v2 和 PI-RADS v2.1（第 2 版和 2.1 版前列腺影像报告与数据系统）在移行带前列腺癌诊断中的价值。资料与方法：回顾性分析 108 例（病理证实：前列腺癌 53 例、前列腺增生和（或）炎 55 例）病变位于移行带患者的临床与影像资料。2 名医师在未知病理结果与前列腺特异性抗原（T-PSA）的情况下，根据 PI-RADS v2 和 PI-RADS v2.1 评分标准独立对病灶评分。使用 Kappa 检验评估 2 名医师间 PI-RADS v2 和 PI-RADS v2.1 评分结果的一致性；使用 ROC 曲线评估并计算 PI-RADS v2 和 PI-RADS v2.1 对 PCa、csPCa 的诊断效能；使用 Spearman 相关分析分析评分结果与 Gleason 评分的相关性。结果：PI-RADS v2.1 的一致性较 PI-RADS v2 有所提高（Kappa 值全部病变为分别为 0.794、0.724，csPCa 病变分别为 0.826、0.758，PCa 病变分别为 0.734、0.678）；PI-RADS v2.1 诊断 PCa、csPCa 的敏感性、准确性和 AUC 值及 PCa 的特异性均稍高于 PI-RADS v2，（敏感性：PCa 分别为 0.981、0.943，csPCa 分别为 0.978、0.956；准确性：PCa 分别为 0.870、0.843，csPCa 分别为 0.796、0.787；AUC 值：PCa 分别为 0.945、0.921，csPCa 分别为 0.946、0.929；特异性：PCa 分别为 0.764、0.745；P 均>0.05）；诊断 PCa、csPCa 的阳性预测值和阴性预测值均稍高于 PI-RADS v2；PI-RADS v2.1 和 PI-RADS v2 评分结果均与 Gleason 评分呈中度正相关，（r 值分别为 0.552、0.507，均 P <0.05）。结论：PI-RADS v2.1 医师间的一致性更好，诊断效能不低于 PI-RADS v2；PI-RADS 评分可以指导穿刺，评估肿瘤的侵袭性，有助于临床诊疗决策

# PU-233

## 终末期肾病患者脑灰质体积异常与执行功能的相关性分析

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目的 利用基于体素的形态学分析（voxel-based morphometry ,VBM）方法观察终末期肾病（end stage renal disease ,ESRD）患者脑灰质体积变化情况，探讨 ESRD 患者脑灰质体积异常与执行功能障碍的关系。 方法 41 名 ESRD 患者（ESRD 患者组）及年龄、性别、教育水平相匹配的 41 名健康志愿者（正常对照组）均接受头颅 MR 高分辨 T1-3D 结构像扫描、数字连线测试 A 部分（TMT-A）及数字符号转换测试（DSST），利用 VBM 方法测量两组被试脑灰质体积，采用两独立样本 *t* 检验比较两组被试脑灰质体积差异，并将 ESRD 患者差异脑区体积与 TMT-A 及 DSST 评分进行 *Pearson* 相关分析。 结果 与正常对照组相比，ESRD 患者双侧前扣带回、双侧中扣带回、双侧岛叶、左侧额中回、左侧颞横回、左侧海马及左侧尾状核脑灰质体积变小（*P* <0.05，FWE 校正，蔟块数>50）；无显著增加脑区。双侧前扣带回、左侧中扣带回及左侧岛叶脑灰质体积与 TMT-A 评分存在显著负相关（*P* <0.05），双侧前扣带回、双侧岛叶、左侧额中回、左侧颞横回及左侧海马灰质体积与 DSST 评分存在正相关（*P* <0.05）。结论 ESRD 患者脑灰质结构存在异常，扣带回、前额叶及内侧颞叶脑灰质萎缩可能参与执行功能障碍的脑神经机制。

# PU-234

## 应用心脏磁共振组织追踪技术检测艾滋病(HIV)患者早期心肌损伤的诊断价值

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**目的** 初步探讨心脏磁共振组织追踪技术(CMR-TT)检测 HIV 患者早期心血管改变的可行性情况。

**材料与方法** 本次前瞻性研究共纳入 114 名受试者。其中包括 HIV 实验组 69 例及健康对照组 45 例，进行包括 SSFP 序列在内的 CMR 检查。应用 Circle Cardiovascular Imaging 42 软件测量左、右室整体应变参数，得到 CMR-TT 径向、周向和纵向三维应变参数。使用 SPSS 23 统计软件分析实验组及对照组间的应变差异性。

**结果** 对于所有获得的应变参数中，左室 LS 的 ROC 曲线下面积最大，为 0.829，右室 CS 的 ROC 曲线下面积最大，为 0.854，提示 LS、CS 在提示 HIV 患者早期心肌损伤中具有较高的应用价值。同时，左心室 LS(P<0.001)、RS(P<0.001)及右心室 CS(P<0.001)在 HIV 患者及健康对照组之间存在显著差异性。

**结论** 心脏磁共振组织追踪技术(CMR-TT)对检测 HIV 患者早期心肌损伤具有较高的敏感度及特异性，值得临床推广应用。

## PU-235

# CS-MATRIX 技术在脑转移瘤检出的临床应用

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目的 探讨压缩感知（CS）技术加速的三维快速自旋回波序列调制反转角成像技术(MATRIX)的脑转移瘤检出能力。方法 收集疑似有脑转移瘤的 59 例患者，同时基于 3.0T 磁共振行常规二维快速自旋回波(2D FSE)序列(增强 5mm-T1FLAIR 和增强 1mm-T1FLAIR）与 MATRIX 序列扫描(增强黑血 1mm-MATRIX）。经治疗后随访 3-6 个月临床证实为脑转移瘤的 28 例患者。按照病灶直径分为 3 组（≤3mm、3-10mm、≥10mm），比较各序列诊断脑转移瘤的检出数目与按病灶直径检出率。结果 （1）28 例患者共 752 个脑转移瘤病灶，增强 5mm-T1FLAIR、增强 1mm-T1FLAIR 和增强黑血 1mm-MATRIX 脑转移瘤的总检出数分别为 604 个、656 个和 752 个，其中直径≤3mm、3-10mm、≥10mm 分别为 258 个、263 个、347 个，291 个、337 个、349 个，55 个、56 个、56 个。（2）增强 5mm-T1FLAIR、增强 1mm-T1FLAIR 和增强黑血 1mm-MATRIX 的检出数目两两比较，$p < 0.05$，差异有统计学意义。（3）三种序列病灶直径≤3mm、3-10mm、≥10mm 的检出率做卡方检验，$p > 0.05$，差异无统计学意义；病灶直径≤3mm、3-10mm、≥10mm 的检出率的线性趋势比较，$p < 0.05$，差异有统计学意义。结论 增强黑血 1mm-MATRIX 对序列脑转移瘤检出率高于增强 5mm-T1FLAIR、1mm-T1FLAIR，特别是对直径≤3mm 的脑转移瘤的检出更有优势，推荐临床常规应用。

## PU-236

# 基于 HRMR-VWI 对大脑中动脉粥样硬化血管壁改变与脑梗死类型的关系研究

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目的：本研究主要应用高分辨磁共振血管壁成像（high resolution magnetic resonance vessel wall imaging，HRMR-VWI）探索大脑中动脉粥样硬化斑块所致脑梗死患者血管壁特征与卒中梗死机制的相关性。
材料与方法：参照中国缺血性卒中亚型（Chinese Ischemic Stroke Subclassification，CISS）分型标准回顾性收录大脑中动脉粥样硬化斑块所致脑梗死患者作为研究对象，并依据颅脑 DWI 表现将患者分为穿支动脉受累组及非穿支动脉受累组（包括动脉-动脉栓塞模式、低灌注模式及两者混合模式)。所有入组患者均行 3D 全脑血管 HRMR-VWI 扫描，比较两组患者之间责任动脉管壁特征的差异。
结果：共有 37 例穿支动脉受累患者及 54 例非穿支动脉受累患者纳入本研究。与穿支动脉受累组相比，非穿支动脉受累组的最狭窄层面管腔面积较小，而管壁面积、斑块面积、斑块负荷及管腔狭窄程度、血管重构指数均较大，且斑块内出血的发生率更高，差异有统计学意义(P<0.05)。经 Logistic 多元回归分析，结果显示, 最狭窄层面管壁面积及管腔狭窄程度是区分该两种不同卒中机制的独立预测因子(P<0.05)。
结论：HRMR-VWI 可用于分析不同机制大动脉粥样硬化型卒中患者的管壁特征，穿支动脉受累组与非穿支动脉受累组在管壁特征方面存在差异；HRMR-VWI 有助于进一步理解不同卒中亚型的病理生理机制。

PU-237

# The Value of Whole-lesion Histogram Analysis of MR images in Differentiating Cellular Uterine Leiomyoma from Uterine Leiomyoma with Degeneration

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Objectives：The purpose of this study is to assess the utility of whole-lesion histogram of multiple MRI sequences for differentiating cellular uterine leiomyoma(CUL) from uterine leiomyoma with degeneration（UL-D）. Methods：Fourty eight patients with CUL and fourty four patients with UL-D from March 2016 to April 2021，who underwent preoperative routine pelvic MRI sequences and DWI，were retrospectively evaluated．Two experienced radiologists manually delineated the volume of interest (VOI) by MaZda package in T2WI and ADC images, and the values derived from whole-lesion histogram analysis ( including mean、variance、skewness、perc01%、perc10%、perc50%、perc90%、perc99%) were measured for each VOI. The consistency of assessment between the two radiologists was evaluated by using intra-class correlation coefficients (ICC) , the MR variables were selected to build logistic regression model. Receiver operating characteristic (ROC) curve analysis were performed to evaluate the diagnostic performance of single variable and logistic regression model to differentiate CUL from UL-D. Results:The intra-class correlation coefficients (ICC) between radiologists was 0.844, the features of mean、variance、skewness、perc01%、perc10%、perc50%、perc90%、perc99% extracted from ADC maps and features of variance、kurtosis、perc01% extracted from T2WI images showed statistically significant (P＜0.05).The area under the curve(AUC) were 0.833、0.677、0.674、0.736、0.777、0.824、0.848、0.822 and 0.705、0.660、0.640 for each feature respectively. The T2WI、ADC、T2WI combined ADC logistic regression models were built to differentiate CUL from UL-D，created AUCs of 0.790、0.848、0.881 respectively，with corresponding Youden’s index were 0.4830、0.6250、0.6288. Pairwise comparison of ROC curves of each model, the P values were 0.3425、0.0394、0.2348 for T2WI/ADC、(T2WI+ADC)/T2WI、(T2WI+ADC)/ADC respectively. Conclusion：Whole-lesion histogram

analysis of T2WI and ADC gray-level images may assist in differentitating between CUL and UL-D patients．The combined model of ADC and T2WI create larger AUC than other models，but is not superior to ADC variables．

## PU-238

# T2-mappin 联合体素内不相关运动对前列腺癌与前列腺增生的鉴别诊断效能

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目的：探讨 T2-mapping 联合体素内不相关运动在鉴别前列腺癌与前列腺增生中的应用价值。方法：这项研究得到了当地 IRB 的批准。回顾性收集经病理证实，且术前行前列腺 3.0 T MR 扫描的前列腺癌患者 28 例（A 组，平均年龄：69.46±8.81 岁；范围：54-94 岁），前列腺增生患者 33 例（B 组，平均年龄：67.97±7.76 岁；范围：49-84 岁；）。扫描序列包括：T2WI、DWI、T2-mapping 和 IVIM，。由两位放射诊断医师采用双盲法进行参数测量：在 T2-mapping 与 DWI 的融合图上进行 T2 值的测量，选择病灶显示最大层面，感兴趣区（region of interest，ROI）覆盖整个病灶，IVIM 选择相同层面进行测量。采用组间相关系数（ICC）检验两位医师所测得数据的一致性；T2 值与 IVIM 定量参数值的相关性采用 Spearman 检验。结果：2 名观察者测得两组各参数值一致性良好(ICC 均>0.75)。 T2 值与 IVIM 的 Standard ADC 、Fraction of fast ADC-mono 及 Slow ADC bi、Fraction of Fast ADC bi 值正相关。结论： T2 Mapping 和 IVIM 对前列腺癌和前列腺增生有鉴别诊断价值。

## PU-239

# 肿瘤坏死因子-α 拮抗剂治疗 SpA 疗效监测-基于 T1-mapping 技术的初步研究

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【摘要】目的：探讨运用 T1-mapping 技术监测肿瘤坏死因子-α（tumor necrosis factor-α，TNF-α）拮抗剂治疗中轴型脊柱关节病(axial spondyloarthritis,SpA)疗效，以期对 SpA 炎症活动性和疗效监测提供有效的定量指标。资料与方法：纳入 114 例研究对象，对照组 15 例，病例组 99 例，病例组中 20 例患者经过系统的 TNF-α 拮抗剂治疗为治疗组。病例组分为活动组和非活动组，活动组分为中度活动组、活动度提高组、活动度非常高组三个亚组，治疗组根据治疗的不同周期分为治疗前组、治疗 3 周组、治疗 6 周组和治疗 12 周组。所有对象均行 T1-mapping 序列检查，比较对照组、病例组以及病例组各亚组之间骶髂关节软骨下骨髓区域 T1-mapping 值的差异，ROC 曲线分析诊断效能，并运用治疗组不同治疗周期 T1-mapping 值下降率对疗效进行监测。结果：1、各组骶髂关节骶侧、髂侧关节软骨下骨髓区域 T1-mapping 值的差异均无明显统计学差异，P>0.05；2、与对照组相比，病例组骶髂关节软骨下骨髓区域 T1-mapping 值表现为不同程度的上升，T1-mapping 值对活动度提高组和活动度非常高组具有很好的诊断效能；3、治疗组中不同治疗周期骶髂关节软骨下骨髓区域 T1-mapping 值的下降率能够有效监测疗效。结论：T1-mapping 技术可以量化评估 SpA 炎症活动性，并有效监测疗效，有益于临床个体化治疗、及时调整治疗方案。

PU-240

# DCE-MRI 量化指标评估中轴型脊柱关节炎骶髂关节改变的初步研究

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【摘要】目的：探讨运用动态增强磁共振（DCE-MRI）技术对中轴型脊柱关节炎(axial spondyloarthritis,SpA)骶髂关节改变进行量化评估，以期对 SpA 骶髂关节炎症活动性评估提供量化指标。资料与方法：纳入 65 例经临床确诊的 SpA 患者为病例组，18 例排除 SpA 诊断的健康志愿者为对照组。依据强直性脊柱炎疾病活动度评分将病例组分为活动组和非活动组。所有对象均行骶髂关节常规 MRI 及 DCE-MRI 扫描，利用 Omni-Kinetics 后处理软件测量骶髂关节感兴趣区域定量渗透参数、定量灌注参数和半定量参数，比较不同参数在病例组和对照组、活动组和非活动组之间差异性，寻找具有统计意义的量化指标。结果：1、病例组中定量参数 Ktrans、Kep、Ve 及半定量参数 TTP 值均显著高于对照组，差异具有显著的统计学意义（P 值均＜0.05）；2、活动组中定量参数 Ktrans、Kep、Ve 及半定量参数 TTP 值均高于非活动组，差异具有显著的统计学意义（P 值均＜0.05）；3、Ktrans 与 ASDAS 高度相关，相关性优于 Kep、Ve。结论：DCE-MRI 技术可以直观反映骶髂关节微循环灌注状态，可对 SpA 骶髂关节炎症活动性评估提供有效量化指标。

PU-241

# 症状性大脑中动脉粥样硬化性狭窄 HRMR-VWI 特征分析： 青年与中老年患者的比较

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目的：基于高分辨磁共振血管壁成像（high resolution magnetic resonance vessel wall imaging HRMR-VWI）探讨青年和中老年症状性大脑中动脉粥样硬化性狭窄（symptomatic middle cerebral atherosclerotic stenosis, sMCAS）患者责任血管管壁特征的差异。
材料与方法：选择 2019 年 8 月-2021 年 4 月 103 例因 sMCAS 导致缺血性卒中或短暂性缺血发作的患者，根据年龄分为青年组（≤45 岁）和中老年组(>45 岁)，行 HRMR-VWI 检查后，分析两组患者的责任血管在 HRMR-VWI 管壁特征的差异，包括斑块面积、负荷、长度、强化模式、斑块内出血、斑块分布模式及责任血管的狭窄率、重构指数、重构模式。
结果：纳入 sMCAS 患者 103 例，其中青年患者 30 例，中老年患者 73 例，两组患者在高血压和冠心病方面差异有统计学意义（P<0.05）；中老年组的斑块面积、斑块负荷及责任血管重构指数均大于青年组，差异有统计学意义（P<0.05）；两组之间在斑块长度、斑块强化模式、斑块内出血、斑块分布及血管狭窄率、重构模式上差异无统计学意义（P>0.05）。
结论：青年和中老年 sMCAS 患者在责任斑块面积、负荷及血管重构指数均存在明显差异，提示青年 sMCAS 的病理生理学改变有所不同，其干预策略可能有别于中老年患者。

PU-242

# The correlation between type 2 diabetes and fat fraction in liver and pancreas: a study using MR Dixon technique

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Background: The increased obesity results in ectopic fat deposits in liver and pancreas.Ectopic fat deposits affect insulin resistance and blood sugar content with Type 2 Diabetes.To assess the relationship between obesity and ectopic fat deposits and diabetes,this study used MR Dixon method for the quantification of liver and pancreas fat fraction (FF) in T2DM patients and healthy controls.
Methods: The FF of liver and pancreas, the maximum diameters of the pancreas, SAT, VAT and TAT were measured for 167 subjects using the MR Dixon data.Four groups were established on the basis of BMI value.For statistics, intra-and inter-group comparison was done by employing Independent Sample t Test.
Results: ① The average fat content in liver and pancreas, the fat content in pancreas body and tail, and VAT in Group 1 were higher than those in Group 3 (P＜0.05). ② The average fat content in liver and pancreas, the adipose fraction of the pancreas head, and VAT in the Group 2 were higher than those in Group 4 (P＜0.05). ③ The average fat content of liver and pancreas, the adipose content of the body and the tail of the pancreas, the abdominal subcutaneous adipose area (SAT), the visceral adipose tissue area (VAT), and the total abdominal adipose tissue area (TAT) in Group 2 were higher than those in the Group 1 (P＜0.05). ④ The FF of pancreas tail, SAT and TAT in Group 4 were higher than those in Group 3 (P＜0.05).
Conclusion:The tissue FF,which has a close relationship with T2DM,can be assessed by MR Dixon technique.The results showed that all T2DM patients should pay attention to tissue fat content regardless of BMI values.

## PU-243

# MRI 对腰骶段椎管内黏液乳头型室管膜瘤及神经鞘瘤的鉴别价值

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目的 比较并分析腰骶段椎管内黏液乳头型室管膜瘤(MPEs)和神经鞘瘤(SCHs)的临床资料及影像（MRI）表现，探讨 MRI 对腰骶段椎管内 MPEs 及 SCHs 的鉴别诊断价值，为临床手术方式的选择及预后评估提供更有价值的信息。
方法 回顾分析本院 2010 年-2018 年发生于腰骶段椎管内经手术病理证实且影像资料及手术记录完整的 5 例粘液乳头型室管膜瘤及 29 例神经鞘瘤的临床资料及影像表现，比较 MPEs 和 SCHs 的临床和影像学差异。
结果 MPEs 与 SCHs 在年龄、肿瘤纵向长度、与脊髓圆锥/马尾神经分界、T2WI 信号均匀性、坏死及囊变、T1WI 及 T2WI 信号强度、T2WI 高信号区域在 T1WI 增强表现特点上的差异具有统计学意义（P＜0.05）。而肿瘤在性别、形态、轴向位置、边界、出血、强化方式、强化程度及邻近骨质改变情况之间的差异均无统计学意义（P＞0.05）。
结论 腰骶段椎管内粘液乳头型室管膜瘤（MPEs）和神经鞘瘤（SCHs）在临床特点及影像学表现上存在一定的差异，MRI 对两种肿瘤的鉴别诊断有较大的价值。

## PU-244

# Alterations of cerebral cortical thickness and its association with mild cognitive impairment in patients with type 2 diabetes mellitus

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Objective: To investigate cerebral cortical thickness alterations in patients with type 2 diabetes mellitus (T2DM) and their association with mild cognitive impairment.
Methods: Sixty patients diagnosed with T2DM were recruited for this study. According to neuropsychological test results, they were divided into either the T2DM group without mild cognitive impairment (30 cases) or the group with mild cognitive impairment (MCI) (30 cases). Thirty volunteers were included as healthy controls. All subjects underwent high-resolution sagittal T1-weighted structural imaging using a three-dimensional magnetization prepared rapid acquisition gradient echo (MPRAGE) sequence. MRI data processing was performed using FreeSurfer software. The cortical thicknesses of the whole brain of the three groups were analyzed and compared using analysis of variance (ANOVA) test. Partial correlations between the cortical thicknesses of each brain region and standard laboratory testing data were analyzed for the T2DM without MCI group. Partial correlations between the cortical thicknesses of each region and the neuropsychological scale scores were analyzed for the T2DM with MCI group.
Results: Compared with the healthy controls, the T2DM without MCI group showed statistically significant cortical thickness reduction in the left posterior cingulate gyrus, right isthmus cingulate gyrus, middle temporal gyrus, paracentral lobule and transverse temporal gyrus. No close correlation was found between the standard laboratory testing data and the cortical thicknesses of these cerebral regions. Compared to the T2DM without MCI group, the cortical thickness alterations of the T2DM with MCI group were bidirectional. Increased cortical thickness was found in the left parahippocampal gyrus and right isthmus cingulate gyrus. Decreased cortical thickness was observed in left pars triangularis and right pars opercularis. A close correlation was found between the cortical thickness of the right pars opercularis and the CFT-delayed recall scores ($r = 0.464$, $p = 0.015$), TMT-A scores ($r = -0.454$, $p = 0.017$) and MoCA scores ($r = 0.51$, $p = 0.007$).
Conclusions: T2DM could influence the cerebral cortical thickness of several brain regions. The cortical thickness reduction of the right pars opercularis may be a biomarker of cognitive impairment and play an important role in its pathophysiological mechanism.

PU-245

# SWAN 联合 3D ASL 在单侧大脑中动脉 M1 段慢性闭塞后临床预后评估中的应用价值

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目的 探讨磁共振 T2*加权血管成像（SWAN）联合三维动脉自旋标记（3D ASL）序列在单侧大脑中动脉 M1 段慢性闭塞后临床预后评估方面的应用价值。方法 回顾性收集我院 2018 年 1 月-2021 年 4 月于脑病科、神经康复科以及老年病科收治的单侧 MCA M1 段慢性闭塞患者 42 例，均行磁共振 SWAN 及 3D ASL 序列检查，分析闭塞侧 MCA 供血区突出血管征（PVS）、脑血流量（CBF）值与患者 3 个月内缺血性脑血管病发生率之间的相关性。结果 PVS 阳性组 MCA M1 闭塞侧额叶、顶叶、颞叶及侧脑室旁白质区 CBF 值均低于 PVS 阴性组，差异有统计学意义（P<0.05）；PVS 阳性组 3 个月内缺血性脑血管病事件发生率为 47.06%，亦高于 PVS 阴性组，差异有统计学意义（P<0.05）。结论 单侧 MCA M1 段慢性闭塞后，PVS 阳性提示脑实质缺血缺氧状态，而 PVS 阴性显示提示良好的侧支循环建立及脑灌注状态。SWAN 及 3D ASL 能够客观反映脑灌注状态，并在评估患者近期临床预后方面具有重要应用价值。

PU-246

# 亚急性期缺血性脑卒中 FVH 与侧支循环及 PVS 相关性研究

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目的 探讨亚急性期缺血性脑卒中液体衰减反转恢复（FLAIR）序列血管高信号征（FVH）与侧支循环建立及突出血管征（PVS）之间的相关性。方法 收集 2018 年 1 月至 2021 年 4 月经三维时间飞跃法磁共振血管成像（3D-TOF MRA）提示单侧 MCA M1 段闭塞且 FVH 阳性显示的急性期（<72h）缺血性脑卒中患者 50 例。依据入组患者亚急性期（72h-10d）FLAIR 序列显示分为 FVH 阳性组及 FVH 阴性组，利用 DWI 序列测量并分别比较两组急性期及亚急性期梗死核心面积差异，并分析两组患者急性期及亚急性期于 T2*加权血管成像（SWAN）显示 PVS 差异。结果 两组患者急性期梗死核心面积无统计学差异（P>0.05）,亚急性期 FVH 阳性组梗死核心面积为（582.17±175.64）mm2，明显大于 FVH 阴性组，差异有统计学意义（P<0.05）。亚急性期 FVH 阳性组 PVS 显示率为 76.92%（10/13），亦明显高于 FVH 阴性组，差异有统计学意义（P<0.05）。结论 单侧大脑中动脉 M1 段闭塞后，亚急性期缺血性脑卒中 FVH 提示不完善的软脑膜侧支循环建立，并与患者不良预后相关。

PU-247

# 大脑中动脉 M1 段闭塞后动脉偏侧优势与 PVS 相关性研究

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目的 分析大脑中动脉（MCA）M1 段闭塞后，动脉偏侧优势与突出血管征（PVS）之间的相关性，并评估 PVS 与患者入院当日及两周 NIHSS 评分相关性。方法 收集 2017 年 1 月~2020 年 12 月单侧 MCA M1 段闭塞的急性缺血性脑血管病患者 55 例，依据磁共振血管成像（MRA）提示有无同侧 ACA、PCA 偏侧优势分为偏侧优势组和对照组，通过观察 T2*加权血管成像（SWAN）序列，显示两组梗死核心区周围 PVS 差异。同时依据 SWAN 序列将入组患者分为 PVS 阳性及 PVS 阴性组，分别于入院当日及两周依据美国国立卫生研究院脑卒中评分量表（NIHSS）进行评分，并比较两组患者评分差异。结果 55 例患者中，偏侧优势组出现 PVS 为 54.17%（13/24），对照组患者出现 PVS 为 80.65%（25/31）。PVS 阳性与阴性组入院当日 NIHSS 评分无明显统计学差异，两周后 PVS 阴性组 NIHSS 评分为（4.36±1.74）分 ，低于 PVS 阳性组，两组差异有统计学意义（P<0.05）。结论 MCA M1 段闭塞后，大脑动脉偏侧优势及 PVS 阴性显示提示侧支循环建立状态，同时与患者良好的近期预后相关。

PU-248

# 大脑中动脉 M1 段狭窄程度与 FVH 相关性研究

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目的 探讨单侧大脑中动脉（MCA）M1 段狭窄程度与磁共振液体衰减反转恢复序列(FLAIR)高信号血管征(FVH)之间的相关性。方法 收集 2017 年 1 月至 2019 年 12 月经三维时间飞跃法磁共振血管成像（3D-TOF MRA）提示单侧 MCA M1 段不同程度狭窄患者 120 例，依据管腔不同狭窄程度分为轻度狭窄组、中度狭窄组、重度狭窄组以及闭塞组，每组患者均为 30 例，FVH 评估采用 Olindo

评分法，分别进行四组 FVH 评分，并比较 MCA M1 段管腔狭窄程度与 FVH 评分之间的相关性。结果 单侧 MCA M1 段重度狭窄组 FVH 显示率最高 70 %（21/30），Olindo 评分为 91 分，其次为中度狭窄组 30 %（9/30）、慢性闭塞组 23.33%（7/30）和轻度狭窄组 6.7 %（2/30）。结论 FVH 显示率与管腔内血液流速缓慢相关，MCA M1 段重度狭窄组具有较高的 FVH 显示率，这也提示慢速血流是 FVH 形成的主要机制,且与血管狭窄程度密切相关。单侧 MCA M1 段闭塞者，FVH 显示率明显低于重度狭窄者，FVH 的出现提示流速缓慢的逆向软脑膜吻合侧支血流，同时侧支循环快速血流亦可表现为 FVH 阴性，无论是正向还是逆向血流，当血液流速缓慢至一定程度导致血液流空效应缺失时，FLAIR 序列即可出现 FVH。

## PU-249

# 中国绝经前妇女乳腺 DCE-MRI 中背景实质增强与月经周期及年龄的关系

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研究目的：探讨在中国绝经前妇女中月经周期及年龄对乳腺 DCE-MRI 中背景实质增强（BPE）定量评估的影响。
方法：收集 2017 年 1 月至 2020 年 12 月于温州医科大学附属第一医院接受双侧乳腺 MRI 扫描且于本院行乳腺手术，并经病理证实的 141 例女性患者 MRI、病理资料及临床资料。病灶均位于一侧乳房，其中 92 例病灶经病理证实为恶性，49 例病灶经病理证实为良性。采用 3D-slicer 软件在健侧乳房腺体面积最大层面勾画感兴趣区（ROI），再采用 ITK 软件测量该层腺体的共 6 期信号值，选取 1 期图像(SI1)和腺体强化最明显期相图像(SI2)，计算 BPE 比值，即(SI2-SI1)/SI1。运用 SPSS 25.0 统计软件中 Mann-Whitney U 检验和 Kruskal-Wallis 检验进行分析，$P<0.05$ 认为差异有统计学意义。

结果：总共对 142 例患者进行乳腺 MRI 检查。MRI 检查按月经周期的周分为 4 组：第 1 周（月经周期的第 1-4 天）为 9.93% (n=14)，第 2 周（第 5-12 天）为 28.39%（n=40），第 3 周（第 13-20 天）为 30.40%（n=43），第 4 周（第 21-30 天）为 31.28% (n=44)例；按年龄段分为四组：第 1 组（<30 岁）为 6.38% （n=9），第 2 组（30-40 岁）为 31.91% (n=45)，第 3 组（41-50 岁）为 58.16% (n=82)，第 4 组（>50 岁）3.55%（n=5）。在整个月经周期中，BPE 比值在四个周期周中无明显统计学差异（P=0.331）。在各个年龄段中，BPE 比值无明显统计学差异（P=0.108）。

结论：绝经前不同年龄段的中国妇女似适合在任何时间段进行乳腺 MRI 检查。

## PU-250

# 磁共振 NODDI 联合 DSC-PWI 对脑胶质瘤分级诊断价值的研究

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**目的**　探讨磁共振神经突定向扩散与密度成像（NODDI）联合 T2*加权磁敏感动态增强灌注加权成像（DSC-PWI）对脑胶质瘤分级诊断的临床价值。**材料与方法**　选取 2019 年 10 月至 2021 年 5 月我院临床高度怀疑胶质瘤并术后病理明确的患者 29 例作为研究对象，男 18 例，女 11 例，平均年龄（44.8±7.2）岁，其中高级别胶质瘤 17 例，低级别胶质瘤 12 例。患者于术前或者放化疗前行

常规 MRI 扫描、NODDI 及 DSC-PWI 扫描，利用后处理软件获取患者 NODDI 及 DSC-PWI 各参数图，如神经突内容积比（ICVF）、神经突起方向分散程度（ODI）和各向同性间隔体积分数（VISO）；局部脑血容量（rCBV）、局部脑血流量（rCBF）和平均通过时间（MTT），并测量各参数值，然后进行统计学比对分析。**结果**　瘤体区 ICVF 值为 NODDI 鉴别两者的最佳参数，其曲线下面积（AUC）为 0.824，特异度为 72.4％。瘤体区的 rCBV 值为 DSC-PWI 鉴别两者的最佳参数，其 AUC 为 0.883，特异度为 79.3％。联合两种技术的最佳鉴别参数，即瘤体区 ICVF 值和瘤体区的 rCBV 值，绘制 ROC 曲线分析单一技术及两种技术联合鉴别两者的诊断效能，发现两种技术联合时 AUC 最大为 0.920，特异度为 89.7％。**结论**　磁共振 NODDI 联合 DSC-PWI 对术前脑胶质瘤分级诊断具有较高价值，能够为脑胶质瘤治疗手段的选择及判断预后提供新的帮助。

PU-251

# 盆底动态 MRI 对子宫脱垂的临床诊断价值

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【摘要】目的:评价盆底动态 MRI 对子宫脱垂（Uterine prolapse，UP）的诊断价值并误诊原因分析。方法:回顾性分析 2017 年 1 月至 2019 年 11 月遵义医科大学第三附属医院 UP 患者 67 例和非 UP 患者 17 例的盆底动态 MRI 图像与临床诊断及分度情况。以临床诊断及传统分度作为金标准，对力排相 MRI 判断和分度 UP 分别进行诊断试验。采用 Pearson 相关分析判断力排相 MRI 宫颈前下缘与耻尾线（Pubococcygeal line，PCL）距离和 UP 传统临床分度间是否相关。探讨 MRI 漏诊假阴性病例的可能原因。结果:UP 组 67 例，非 UP 组 17 例，两组之间年龄(60.76±12.11 岁与 61.24±11.08 岁)、孕次(4.71±2.42 次与 4.28±1.91 次)和产次(3.94±2.11 次与 3.24±1.77 次)均无统计学差异。以临床诊断及传统分度作为金标准，力排相 MRI 诊断和分度 UP 的诊断准确率、灵敏度、特异度、阳性预测值、阴性预测值、假阳性率、假阴性率分别为 0.73 和 0.46、0.75 和 0.54、0.65 和 0.34、0.89 和 0.57、0.39 和 0.31、0.35 和 0.66、0.25 和 0.46。考虑 UP 严重程度的情况下，真阳性与假阴性相比，两组间 PCL 倾斜角（t=-2.542，P=0.014）差异有统计学意义，而组间骶尾椎曲率、后位子宫占比、骨盆出口前后径和骨盆出口面积差异无统计学意义。宫颈前下缘至 PCL 距离与传统分度呈正相关（r=0.562，P =0.000）。结论：盆底动态 MRI 对 UP 检出率较高，而与传统分度标准评估 UP 的严重程度一致性较差，MRI 检查技术及临床对 UP 检查方式均需改进。

PU-252

# SyMRI 技术研究脑恶性肿瘤弛豫时间及临床意义

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目的：
采用合成 MRI（synthetic magnetic resonance imaging，SyMRI）技术分析高级别胶质瘤（high grade glioma，HGG）和脑转移瘤（brain metastasis，BM）肿瘤实质及瘤周组织 SyMRI 定量参数值，与常规 MRI 成像相比，探讨 SyMRI 合成图像显示病灶的能力及鉴别 HGG 和 BM 的价值。
方法：
收集山西医科大学第二医院 2020 年 5 月-2021 年 3 月行 MRI 检查且经手术病理证实或随访证实为 HGG 或 BM 的患者。所有患者在静脉注射钆对比剂前后行 SyMRI 扫描和常规序列扫描，所得图像经主机处理后得出 SyMRI 合成图像与 MAP 图，比较两序列病灶与周围组织信号强度对比度，并在

MAP 图上测量 HGG 和 BM 肿瘤实质及瘤周水肿增强前 T1 值（pre-T1）、T2 值（pre-T2）及 PD 值（pre-PD），增强后 T1 值（post-T1）、T2 值（post-T2）及 PD 值（post-PD）。采用配对样本 *t* 检验分析或 Wilcoxon 符号秩检验分析 SyMRI 合成图像与常规图像的肿瘤-瘤周对比度的差异，采用独立样本 *t* 检验分析或 Mann-Whitney U 检验分析 T1 值、T2 值、PD 值的差异，采用多因素 Logistic 回归方法分析鉴别 HGG 和 BM 的独立影响因素，并绘制受试者工作特征曲线。*P*＜0. 05 为差异具有统计学意义。
结果：
最终纳入分析研究的为 51 例，其中 20 例 HGG 患者，31 例 BM 患者。51 例患者脑肿瘤平扫 SyMRI-T2 FLAIR 及增强 SyMRI-T1 FLAIR 肿瘤-瘤周对比度高于相应常规 MRI 加权图像，差异均具有统计学意义（*t*=4.018，*P*=0.010；*z*=3.180，*p*=0.001）。平扫 SyMRI-T1 FLAIR、SyMRI-T2WI 的肿瘤-瘤周对比度与常规 MRI 加权图像的差异均无统计学意义（*P*＞0.05）。
HGG 肿瘤实质 pre-T1（*t*=2.272，*P*=0.030）大于 BM，HGG 肿瘤实质 post-T1（*t*=2.754，*P*=0.010）小于 BM，HGG 肿瘤实质增强前后 T1 值变化的百分比（*t*=4.374，*P*＜0.001）大于 BM，差异有统计学意义。HGG 患者和 BM 患者肿瘤实质增强前、后 T2、PD 值的差异均无统计学意义（*P*＞0.05）。HGG 瘤周水肿 pre-T1（*t*=2.198，*P*=0.036）小于 BM，差异有统计学意义。HGG 患者和 BM 患者瘤周水肿 pre-T2、pre-PD、post-T1、post-T2、post-PD 的差异均无统计学意义（*P*＞0.05）。多因素 Logistic 回归分析肿瘤实质 post-T1 是 HGG 的独立预测因素（OR=1.010，95%*CI*=1.001~1.020，*P*=0.039）。HGG 和 BM 肿瘤实质 post-T1 的 ROC 曲线下面积为 0.857（*P*=0.007，95%*CI*=0.696~1.000），最佳截断点为 543.5ms，敏感度为 76%，特异性为 83.3%。
结论：
平扫 SyMRI-T2 FLAIR 及增强 T1 FLAIR 对脑恶性肿瘤的显示优于常规 MRI 加权像。SyMRI 定量参数值有助于反映 HGG 和 BM 的异质性，肿瘤实质的 post-T1 可作为鉴别 HGG 和 BM 的独立影响因素。

PU-253

# GABA Enhances in Epilepsy Associated with Focal Cortical Dysplasia

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Purpose: Focal cortical dysplasia (FCD) is a major cause of drug-resistant epilepsy; however the underlying epileptogenic mechanisms of FCD metabolism in epilepsy patients remain unclear. The aim of this study is to detect alterations of γ-aminobutyric acid (GABA), glutathione (GSH), and the composite of glutamate and glutamine (Glx) in MRI-typical and neuropathologically confirmed FCD-associated epilepsy using Hadamard Encoding and Reconstruction of Mega-Edited Spectroscopy (HERMES).
Materials and methods: Fourteen epileptic patients suspected to be caused by FCD and 14 healthy controls were enrolled prospectively in this study; all subjects underwent a 3T MRI scan, including 3D T1 weighted imaging and HERMES. The GABA signal detected by HERMES also contains signals from macromolecules and homocarnosine, so it is referred as GABA+. Signals of GABA+, GSH and Glx detected by HERMES from tumor foci, contralateral cerebral regions, and healthy controls were quantified using Gannet. Fitting errors and signal to noise ratios (SNRs) of GABA+ signals were also recorded. Differences of GABA+, GSH, Glx, fitting error and SNR of GABA+ among three groups were analyzed using linear mixed effects models.
Results: Twelve FCD-associated epilepsy patients (7 females, aged 21.9 ± 9.3 years) and 12 matched healthy controls (7 females, aged 22.8 ± 9.8 years) were finally enrolled in this study.

ANOVA results indicated that GABA levels were significantly increased in FCD foci compared with contralateral regions (p=0.008) and with healthy controls (p=0.003), while no difference was found in GSH and Glx levels. No difference of fitting errors or SNR of GABA+ was found among FCD foci, contralateral regions and healthy controls.
Conclusions: Increased GABA levels were found in FCD foci that indicated GABA may play a central role in the pathophysiology of FCD patients with epilepsy.

## PU-254

# Value of Diffusion Kurtosis Imaging in Detecting Isocitrate Dehydrogenase Genotype in Low-grade Gliomas

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Objectives: The aim of this prospective observational study was to assess the value of diffusion kurtosis imaging (DKI) in detecting Isocitrate dehydrogenase 1 (IDH 1) genotypes in low-grade gliomas.
Methods: Forty-five suspected low-grade gliomas were enrolled in this study, all cases underwent a 3T MRI scan, including DKI. Mean diffusivity (MD), Mean kurtosis (MK) and fractional anisotropy (FA) derived from DKI were evaluated in the tumor foci, perilesional white matter (pWM) and contralateral normal appearing white matter (cNAWM) regions. Independent samples t-test was performed to compare differences of the DKI parameters calculated from the foci between IDH 1-mutant and wild-type groups, and differences between pWM and cNAWM were analyzed using paired sample t-test.
Results: Thirty-eight low-grade gliomas were finally enrolled in this study, including 10 IDH 1 wild-type and 28 mutant cases. MK increased and MD decreased significantly in tumor foci wild-type gliomas compared with mutant-glioma, and both had great predictive value in detecting IDH 1 genotype, while no differences of FA values were observed. MD and MK was significantly different between pWM and cNAWM in gliomas. Intriguingly, there were marked differences of FA values comparing pWM with cNAWM in wild-type gliomas, while no difference was found in mutant-gliomas.
Conclusions: IDH 1 wild-type gliomas have higher MK and lower MD values in tumor foci compared with IHD 1 mutant gliomas, lower FA in pWM than cNAWM was only seen in wild-type gliomas. This finding indicated that DKI parameters may help differentiate the IDH 1 genotypes in low-grade Gliomas.

## PU-255

# DKI 及 NODDI 成像对早、中晚期帕金森病脑灰质核团微结构变化的应用研究

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目的 利用扩散峰度成像（DKI）及神经突起方向离散度及密度成像（NODDI）探索帕金森病（PD）患者脑灰质核团微结构的变化及其与疾病进展的关系。方法 选择 25 例我院经临床确诊的 PD 患者并根据 Hoehn-Yahr 分期分为早期 PD 组（10 例）和进展期 PD 组（15 例）；同期选择 25 名年龄及性别相匹配的健康志愿者作为对照组。PD 组与对照组均进行 DKI 及 NODDI 成像，测量双侧黑质、红核、壳核、丘脑、苍白球及尾状核的 DKI（FA、MK、MD）及 NODDI（Vic、

ODI、Viso）参数值，并取平均值。采用独立样本 t 检验比较 PD 组和对照组间各核团参数值差异;采用单因素方差分析比较早期、进展期和正常对照组、PD 患者间各核团参数值的差异;采用 Sperman 相关分析临床 Hoehn-Yahr 分期与各核团参数值的相关性。结果 早期和晚期 PD 患者双侧黑质 MK 值明显低于对照组，晚期 PD 患者双侧红核 MK 值也显著降低，双侧壳核 MD 值升高，PD 组和对照组之间 FA 值无显著差异。PD 患者黑质及壳核的 Vic、OD 明显低于健康对照组（P＜0.05）。结论 黑质 MK 值的降低可能有助于确定 PD 的严重程度，并有助于早期诊断。黑质和壳核中的 Vic 和 ODI 值与疾病持续时间和帕金森病 Hoehn-Yahr 分级呈显著负相关，这些指标可能有助于评估疾病进展。

## PU-256

# 扩散峰度成像对上皮性卵巢癌组织学分型的诊断价值

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目的：探讨扩散峰度成像（diffusion kurtosis imaging，DKI）在上皮性卵巢癌组织学分型（I 型/II 型）中的价值。
材料与方法：回顾性分析 2012 年 1 月至 2020 年 12 月我院经手术病理证实的 43 例上皮性卵巢癌患者临床及影像学资料。根据术后病理结果，按照组织学分型分为 I 型卵巢癌组 23 例，II 型卵巢癌组 20 例。所有患者在我院术前均行盆腔 MRI 检查，扫描 DKI（b = 0，1000，2000 s/mm2）序列，将图像传至 GE ADW 4.6 工作站，利用 Functool 后处理软件对 DKI 序列图像进行后处理。由两位放射科医师分别手动勾画 ROI，获取 DKI 序列的 MK、Ka、Kr、MD、Da、Dr、FA 和 FAk 值。采用组内相关系数（intraclass correlation coefficients，ICC）评估两位医师测量各参数的一致性，一致性良好则采用两位医师测量的平均值进行后续分析。对于存在统计学差异的参数利用 ROC 曲线分析该参数鉴别 I 型卵巢癌和 II 型卵巢癌的阈值、敏感度、特异度、阳性预测值(positive predictive value，PPV)、阴性预测值(negative predictive value，NPV)和准确率。
结果：两位观察者测量各序列定量参数值的一致性较好 （ICC 均≥0.75）。DKI 序列的 MK、Ka 和 Kr 值和 MD、Da、Dr 值在 I 型卵巢癌与 II 型卵巢癌之间存在统计学差异，I 型卵巢癌的 MK、Ka 和 Kr 值低于 II 型[(0.481±0.205) vs. (0.753±0.204)，P<0.001；(0.510±0.235) vs. (0.802±0.258)，P<0.001；(0.495±0.176) vs. (0.689±0.186)，P<0.001]。I 型卵巢癌的 MD、Da、Dr 值高于 II 型[(2.587±0.959) um2/ms vs. (1.643±0.570) um2/ms，P<0.001；(2.978±1.137) um2/ms vs. ( 1.908±0.660）um2/ms，P<0.001；(2.394±0.881) um2/ms vs.(1.524±0.519) um2/ms，P=0.001]。MK、Ka、Kr 的 ROC 曲线下面积分别为 0.822、0.815、0.814，当 MK 值取 0.504、Ka 值取 0.592、Kr 值取 0.516 时，诊断 II 型卵巢癌的敏感度分别为 95.0%、85.0%、90.0%，特异度分别为 65.2%、73.9%、69.6%，PPV 分别为 73.2%、76.5%、56.4%，NPV 分别为 92.9%、83.1%、76.0%，准确率分别为 80.1%、79.5%、60.2%。MD、Da、Dr 的 ROC 曲线下面积分别为 0.787、0.778、0.796，当 MD 值取 2.015、Da 值取 2.190、Dr 值取 1.575 时，诊断 I 型卵巢癌的敏感度分别为 69.6%、78.3%、82.6%，特异度分为 80.0%、75.0%、65.0%，PPV 分别为 77.7%、75.8%、70.2%，NPV 分别为 72.5%、77.6%、78.9%，准确率分别为 74.8%、76.7%、73.8%。FA 和 FAk 值在 I 型与 II 型卵巢癌组无统计学差异。
结论：扩散峰度成像对鉴别 I 型卵巢癌与 II 卵巢癌有一定价值。

## PU-257

# 四肢软组织平滑肉瘤的 MRI 特点

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目的 分析四肢软组织平滑肉瘤的ＭＲＩ特点。
方法 回顾分析经病理确诊的 7 例四肢软组织平滑肌肉瘤的ＭＲＩ及病理学表现， 每个病例均有ＭＲＩ增强检查。其中男 性 5 例，女性 2 例， 年龄 40～ 89 岁。
结果 7 例肿瘤均位于下肢，其中 4 例位于皮下，3 例位于深部肌间隙内，肿瘤形态规则或不规则。其中 2 例病变小于 3cm，位于皮下较小，形态不规则，边缘清晰，呈长 T1 长 T2 信号，增强扫描 1 例均匀强化，1 例不均匀强化，其内见坏死。其余 5 例病变大于 3cm，可见假包膜，其中 3 例病变内见囊变信号影。T 1WI 以不均匀等信号为主, T2WI 以片状稍高信号为主,出血及大片坏死多见，增强后以不均匀片状明显强化为多见。
结论 在四肢软组织检查中，发现皮下或深部规则或者不规则肿块，有假包膜，ＭＲＩ平扫显示病变信号不均匀，可出现囊变、出血及坏死，强化扫描实性病变明显强化，可侵犯周围血管及邻近骨， 应考虑软组织平滑肌肉瘤的可能。

## PU-258

# PET-CT 联合 MRI 基于体素形态学分析（VBM）在常规磁共振阴性癫痫定位中的应用价值分析

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目的:PET-CT 联合磁共振成像基于体素形态学分析（VBM）定位诊断 MRI 阴性癫痫的临床价值。
材料与方法：回顾性分析 26 例 MRI 阴性癫痫患者临床资料,以术中切除致痫灶后症状减弱或转阴为"金标准",分析 PET CT、MRI 基于体素的形态学分析（VBM）及二者联合定位诊断准确性区别,比较 PET CT 检出单侧受累患者兴趣区域与对侧区域定量参数[标准摄取值（SUV）]差异。结果：PET CTV 联合 MRI 基于体素的形态学分析（VBM）定位诊断 MRI 阴性癫痫准确率明显高于单纯 PET CE 与单纯 MRI 基于体素的形态学分析（均 P<0.05）。PET-CT 下单侧受累患者兴趣区域 SUV 值均明显低于对侧区域（均 P<0.05）。结论： PET CT 联合 MRI 基于体素形态学分析法应用于 MRI 阴性癫痫能提高定位诊断效能,有利于尽早准确定位癫痫病灶,对改善患者预后有利。

## PU-259

# Exploration of mechanism underlying the association of acute microinfarct and motor deficit: a preliminary structural and functional MRI study

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The effect of cerebral microinfarcts (CMIs) on motor function and its potential neural mechanism in vivo are still unclear. We identified 133 non-disabled participants (mean age 67.6 years) from the hospital-based population. Each participant underwent multi-sequence MRI scanning and comprehensive cognitive and movement assessment.
We grouped participants into 34 CMIs carriers and 99 non-carriers as controls, based on visual inspection of diffusion-weighted imaging. First, we assessed the effects of CMIs on motor function. To explore the pathological mechanisms of CMIs on the motor, we adopted the resting-

state functional MRI based mapping of degree centrality (DC) and eigenvector centrality (EC), reflecting local and global functional connectivity respectively. Then we used tract-based spatial statistics (TBSS) to assess white matter microstructure integrity. Structural and functional connectivity differences between groups were tested based on two-sample t-tests ($p<0.05$ corrected).
We found that CMIs carriers had worse motor than controls, especially the balance ability. Functionally, CMIs carriers had increased DC and EC in the middle temporal gyrus, increased DC in inferior frontal gyrus, and decreased EC in precuneus when compared to controls. However, widespread white matter disruption was found in CMIs carriers. TBSS differences between groups existed.
Conclusively, acute CMIs might represent an independent motor deficits cause. The lesion might affect the motor function via damaging executive and motor-related circuits, centring on precuneus.

## PU-260

# HISTO 及 RESOLVE-DWI 序列在脊柱结核中的应用

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目的：探讨高速多回波 T2 校正磁共振氢质子波谱成像(high-speed T2-corrected multiecho acquisition at 1 H MR spectroscopy，HISTO)及 MRI 高清扩散加权成像序列(RESOLVE-DWI)对脊柱结核患者的应用价值。
材料和方法：采用西门子 Skyra 3.0T MRI 扫描仪，18 通道体部线圈及 32 通道脊柱线圈组合使用，对 10 例脊柱结核病人均进行 HISTO 及 RESOLVE-DWI 序列扫描，HISTO 序列会自动根据扫描前选择的感兴趣区绘制曲线并计算曲线下面积，DWI 序列在拟合的 ADC 图上通过同一面积单位选择病变椎体、病变邻近 正常椎体、病变跳跃 2 个正常椎体、受累椎间盘及健康人群椎体、椎间盘正常区为 ROI 感兴趣区，分别得到 ADC 值。
结果：HISTO 序列上病变椎体较健康志愿者椎体 FF%值 及 R2water 值明显降低，DWI 上病变椎体与其邻近正常椎体、病变跳 跃 2 个正常椎体及健康志愿者椎体 ADC 值相差很大，差异有统计学意义 。
结论：HISTO 做为新型 MRS 序列较常规 MRS 可以得到更加准确的 FF%值 及 R2water 值，而高清弥散 RESOLVE-DWI 作为解剖弥散，对于非常规轴位的弥散成像变形更少，伪影更小，所测出 ADC 值更加准确；HISTO 联合 RESOLVE-DWI 有利于对脊柱病变的诊断及鉴别诊断。

## PU-261

# 心脏磁共振特征追踪技术对心肌炎早期损伤的预测价值探讨

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摘要 目的 通过运用磁共振特征追踪技术对心肌炎及健康志愿者进行心肌应变定量分析，对比分析二者之间的差异，探讨其与心功能之间的相关性，进一步探究该技术在心肌炎的应用价值。方法 选取 2019 年 8 月至 2020 年 12 月在本院行心脏磁共振并诊断为心肌炎的患者 14 例，同时段 9 例为健康对照组，在 CVI42 后处理软件得到心功能参数及心肌应变参数，通过 SPSS20.0 软件进行数据分析，比较两组间各指标差异，选取有意义参数绘制受试者特征曲线(ROC)，确定截断值；

对左室射血分数（LVEF）与心肌应变参数进行 Pearson 相关性分析。 结果 两组资料经后处理后得到经体表面积（BSA）标化后心功能参数，其中在左室每搏排出量（LVSV）、LVEF 上心肌炎组均低于对照组，且二者差别具统计学意义（P≤0.05）。在左室舒张末容积（LVEDV）、左室收缩末容积（LVESV）、左室心肌质量（LVmass）上心肌炎组高于对照组，在左室每分输出量（LVCO）、左室心肌指数（LVCI）上心肌炎组低于对照组，但以上差异不具统计学意义（P>0.05)。心肌炎组的径向应变（GRS)、环向应变（GCS）、纵向应变（GLS）均低于健康对照组（P 值分别为 0.204、0.010、0.112)。绘制应变参数及心功能参数对心肌炎或健康志愿者的 ROC 曲线，发现 GCS 能有效诊断心肌炎，其 AUC 最大，达 0.838(P=0.011)，灵敏度为 90.9%，特异度 66.7%，余应变参数无明显统计学意义。心功能参数中 LVSV 及 LVEF 能有效诊断健康志愿者，LVEF 的 AUC 为 0.754（P=0.044),灵敏度为 77.8%，特异度为 64.3%；LVSV 的 AUC 为 0.774（P=0.030）,灵敏度为 88.9%，特异度为 71.4%，余参数无明显统计学意义。对 LVEF 与心肌应变参数进行散点图绘制及 Pearson 相关性分析：LVEF 与环向应变呈强负相关（r=-0.853,P=0.000），LVEF 与径向应变呈弱相关（r=0.372,P=0.081）,LVEF 与纵向应变成中等相关（r=-0.663,P=0.001）。心肌炎组中 EF 不保留型在心肌径向应变、环向应变及纵向应变均较 EF 保留型减低，其中环向应变及纵向应变的差异具明显统计学意义（P=0.000),径向应变差异不具统计学意义（P>0.05)。结论 心肌炎患者心肌应变的变化早于心肌延迟强化及 LVEF 降低，其中以 GCS 敏感性最高，且在 LVEF 保留的心肌炎患者中 GCS 与 GLS 受损最具价值。

## PU-262

# MR 血管壁成像椎基底动脉斑块 T1WI 高信号与多发性脑梗死相关性研究

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目的 应用血管壁磁共振成像（Vessel wall magnetic resonance imaging VW-MRI)技术分析颅内后循环动脉粥样硬化(Intracranial atherosclerotic disease，ICAD)多发性梗死组与非多发性梗死组斑块的影像特征，探讨后循环 ICAD T1WI 高信号与多发性梗塞相关的影像特征。
方法 回顾性分析卒中患者影像及临床资料，根据 DWI 将患者分为多发性梗死组、非多发性梗死组。在患者 VW-MRI 图像评估斑块内 T1WI 高信号。比较多发性梗死组与、非多发性梗死组影像特征的差异，分析后循环 ICAD 斑块斑块内 T1WI 高信号与多发性梗死的关系。
结果 本研究共纳入患者 30 例，多发性梗死组 11 例，非多发性梗死组 19 例。与非多发性梗死组对比，多发性梗死组斑块内 T1WI 高信号更多。
结论 多发性梗死组斑块内出现 T1WI 高信号更多，提示斑块内 T1WI 高信号与斑块的不稳定性相关，可能更易发生斑块破裂导致动脉-动脉的栓塞。

## PU-263

# Aberrant Local Cortex Activation is Associated with the Levels of Dopamine in Depression with Thought Induction Psychotherapy

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**Objective**

Thought induction psychotherapy (TIP) has been shown to be effective for treating depression, yet its neural mechanisms are not well elucidated. The objective of this study is to investigate alterations in resting-state spontaneous brain activity and their relationship with monoamine neurotransmitters' levels in major depressive disorder (MDD) patients.

**Methods**
A longitudinal study was conducted in 20 MDD patients at baseline and after 6-week TIP treatment to investigated both regional fluctuation and inter-regional synchronization, compared with 20 age, gender, educational level matched healthy controls using resting-state functional magnetic resonance imaging (rs-fMRI). Among them, 1 MDD patient was excluded due to excessive head motion. The fractional amplitude of low-frequency fluctuation (fALFF) and functional connectivity (FC) was used to characterize regional and inter-regional brain function during resting state. 24-item Hamilton Depression Rating Scale (HAMD), 14-item Hamilton Anxiety Rating Scale (HAMA), and peripheral monoamine neurotransmitters (e.g., 5-hydroxytryptamine and dopamine) were employed to measure the effect of 6 weeks TIP treatment. The above measures were performed twice in MDD patients, before and after TIP, but once in healthy controls at baseline.

**Results**
The TIP led to an increased fALFF in the left dorsal medial prefrontal cortex (dmPFC) and left superior temporal cortex (STC) and increased FC of left STC with right insula in MDD patients. The baseline fALFF values of left STC were positively correlated with HAMD scores and peripheral dopamine concentration, and the baseline fALFF values of left dmPFC were correlated with the TIP-related concentration change of dopamine after 6-week TIP treatment.

**Conclusions**
Our results suggest that the altered resting-state activity across several neural networks involved in the pathology of MDD. The association between reduced fALFF in the left STC and dopamine, as well as HAMD, supports STC may be a state marker in MDD. Moreover, the correlation between the reduced fALFF in the left dmPFC and dopamine changes also supports the DMN may reveal a therapeutic target for MDD.

PU-264

# 基于 MRI 探讨经药物干预及未干预后多发性硬化患者脑病灶及脑灰质体积的纵向变化规律

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目的：本研究探讨为期 4 年的经药物干预及未干预多发性硬化（Multiple Sclerosis，MS）患者脑病灶及脑灰质体积的每年纵向变化规律。
材料与方法：本研究纳入 2 名 MS 患者，其中病人 1 进行疾病修饰药物干预，病人 2 未进行疾病修饰药物干预，并于 2017 年至 2021 年进行 4 次纵向随访（分别将 4 次节点的时间记录为 t1, t2, t3, t4），收集临床残疾量表评分并进行 3D-T1 序列和 flair 序列扫描。基于 IQBrain 软件处理 flair 序列对白质病灶进行分割、计算。基于 VBM 处理 3DT1 序列对脑室和脑灰质进行分割、计算。基于（t 后-t 前）/t 前的公式计算患者前后病灶体积、脑室体积和脑灰质总体积的每年变化率，初步评估经药物干预及未干预患者各指标变化规律与临床表现之间的相关性。
结果：病人 1，女，年龄 29 岁，病程为 2 年，EDSS 分别为 2.5 分，3.5 分，0 分，0 分，于 t1-t2 时间点内服用他克莫司病情加重，t2 时间点后至 t4 时间点内服用美罗华治疗后病情逐渐好转。病人 2，年龄 31 岁，病程为 10 年，EDSS 为 4 分，4 分，3 分，5.5 分，4 年期间未进行药物干预，

期间病情呈复发-缓解-复发变化。病人 1 的病灶体积呈缓慢增高后持平(5ml, 9 ml, 8 ml, 8ml), 病人 2 的病灶体积呈增高、减低后再增多(28 ml, 33 ml, 23 ml, 28ml)。病人 1 的脑室体积缓慢增大（226 ml，267 ml，274 ml，278ml）, 每年变化率分为：18%，3%，1%；病人 2 的脑室体积持续性增大(296 ml, 312 ml, 351 ml,345 ml), 每年变化率分为 5%，23%，-2%。病人 1 的脑灰质总体积呈减低，持平，增多变化（702 ml，667 ml，667 ml，694 ml）, 每年变化率分为-5%，0%，4%；病人 2 的脑灰质体积呈减低，升高并再次减低（611 ml，577 ml，605 ml，576 ml）, 每年变化率分为：-5%，4%，-5%。

结论：经药物干预患者的白质病灶体积及数量呈缓慢增多，药物干预有效前脑萎缩程度明显加重，经药物干预有效后呈萎缩状态持续性好转并到达稳定状态。未经过药干预患者的病灶体积呈逐年明显增多，脑灰质体积呈减低-升高-再次减低变化，可能与病情的复发-缓解-再复发的病情规律有关。

# PU-265
# 基于 MRI 列线图预测痉挛型脑瘫儿童粗大运动功能的 初步研究

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目的：粗大运动功能障碍严重影响痉挛型脑瘫（spastic cerebral palsy, SCP）儿童的生活质量和社会参与度。本研究拟探索与粗大运动功能障碍相关的责任病灶并建立评估粗大运动功能损伤程度的列线图，以提高临床适用性。
方法： 收集 2019 年 05 月至 2020 年 10 月经我院儿童康复科确诊的 SCP 儿童， 对其进行粗大运动功能分级系统（Gross Motor Function Classification System, GMFCS）评估，并行 T2 加权液体衰减反转恢复成像（T2-weighted fluid-attenuated inversion recovery imaging, T2-FLAIR）和扩散张量成像（diffusion tensor imaging，DTI）的颅脑磁共振（magnetic resonance imaging, MRI）检查。（1）GMFCS：根据 GMFCS 分级将 SCP 儿童分为粗大运动功能轻度损伤和重度损伤两组，其中 GMFCSⅠ、Ⅱ级为粗大运动功能轻度损伤，GMFCSⅢ~Ⅴ级为粗大运动功能重度损伤。（2）建立基于 T2-FLAIR 的 MRI 评分表，对 SCP 儿童颅脑损伤程度进行评价。（3）使用 FSL 软件对 SCP 儿童 DTI 数据处理得到各向异性分数（fractional anisotropy，FA）。（4）运用随机森林（random forest, RF）对 T2-FLAIR 评分项及 FA 值进行特征筛选，并分别构建粗大运动功能预测模型，采用受试者工作特征曲线（receiver operating characteristic, ROC）分析比较两模型间的预测效能，并进一步建立预测 SCP 儿童粗大运动功能的 MRI 列线图。通过校准图和 ROC 曲线评估列线图模型
结果：收集 SCP 儿童共 42 例，（1）其中粗大运动功能轻度损伤（GMFCSⅠ、Ⅱ级）17 例，粗大运动功能重度损伤（GMFCSⅢ~Ⅴ级）25 例，两组间的年龄（P=0.29）、性别（P=0.67）均无统计学差异。（2）基于 T2-FLAIR 建立的评分结果具有较好的组内和组间一致性（Kappa 值为 0.64~0.96）。基于 T2-FLAIR 粗大运动功能预测模型其曲线下面积（area under the curve, AUC）为 0.94，纳入的特征有扣带回、半卵圆中心、胼胝体、中央前回、内囊后肢和豆状核。（3）基于 FA 值粗大运动功能预测模型其 AUC 为 0.92，相应的特征有脑桥交叉束、左上纵束和小脑中脚。随后将两者筛选出的特征进行融合构建粗大运动功能预测模型，结果显示融合后的模型 AUC 为 0.93。对基于 T2-FLAIR 粗大运动功能预测模型与融合粗大运动功能预测模型进行 ROC 分析，显示 P=0.93。（4）基于以上结果，本研究选取 T2-FLAIR 评分绘制列线图，纳入半卵圆中心、扣带

回、豆状核和胼胝体（OR 值，0.13、6.69、18.15 和 0.06），其 AUC 为 0.91 并具有较好的校准度（*P*=0.88）。
结论：T2-FLAIR 评分比 FA 值更具有作为粗大运动功能预测指标的价值。半卵圆中心、扣带回、豆状核和胼胝体损伤可作为 SCP 粗大运动功能的预测因素，有利于确定责任病灶。由基于 T2-FLAIR 特定部位评分组成的列线图可初步预测 SCP 儿童粗大运动功能，进而帮助临床医生制定治疗方案。

# PU-266

## MR DTI 和 T2-mapping 在多发性肌炎及皮肌炎的应用研究

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目的：
本研究应用 DTI 和 T2-mapping 成像，通过定量评估 PM/DM 患者大腿肌肉常规 MRI 显示“正常”区域的微观变化，并与临床指标进行相关分析，采用 ROC 曲线预测大腿肌肉 T2 值在未水肿肌肉与对照组中的诊断效果，以期探讨该技术在临床评估 PM/DM 患者大腿肌肉受累的应用价值，为临床早期评估、干预提供依据。
材料与方法：
分别纳入 21 例 PM/DM 患者及健康志愿者作为病例组及对照组。两组受试者均行双侧大腿常规 MRI、DTI 及 T2-mapping 扫描，根据常规 MR 肌肉水肿程度分为 3 组，即水肿组、水肿肌块未受累部分、未见水肿组。分别测量各组的 ADC、FA 及 T2 值，采用独立样本 t 检验比较病例组与对照组的差异，采用 Games-Howell 检验分析未见水肿组 3 个肌群间 T2 值的差异；采用 Spearman 检验分析病例组水肿组 T2 值与临床指标（CK 值、MMT 评分）的相关性；并基于病例组的 T2 值构建了 ROC 曲线。
结果：
PM/DM 患者中，ADC 值与 T2 值在病例组与对照组的组间比较，差异有统计学意义（P＜0.05），未见水肿组中的股外侧肌、股薄肌及半膜肌与对照组间 FA 值的比较，差异无统计学意义（P＞0.05），余病例组与对照组 FA 值的比较，差异均有统计学意义（P＜0.05）。
PM/DM 组未见水肿组中前群肌肉 T2 值较内侧组高约 4.46ms、较后侧组高约 4.45ms，差异有统计学意义（P＜0.05）。
PM/DM 组水肿肌肉的 T2 值与患者肌力 MMT 评分存在高度的负相关关系（r=-0.884，P<0.01），与血清 CK 值存在中度正相关关系 （r=0.622，P<0.01）；血清 CK 值与四肢 MMT 评分存在中度负相关关系（r=-0.564，P<0.01）。
当 T2 阈值取值 44.65ms 时，鉴别 PM/DM 患者未见水肿肌肉与对照组的曲线下面积为 0.997，Youden 指数为 0.935，灵敏度为 94.9%、特异度为 98.6%。
结论：
PM/DM 患者大腿水肿最常受累股外侧肌和股直肌，在未见水肿肌肉中股外侧肌炎性改变最明显。
PM/DM 患者水肿肌肉、水肿肌块未受累部分、未受累肌块 ADC 值、T2 值高于对照组，而 FA 值较对照组减低。
PM/DM 患者大腿水肿肌肉的 T2 值与 MMT 评分高度负相关；与血清 CK 值存在中度正相关。
PM/DM 患者未见水肿肌肉与对照组肌肉的 T2 界值取 44.65ms 时，诊断灵敏度为 94.9%，特异度为 98.6%。

# PU-267

# Longitudinal changes in subcortical volumes and proteinopathy in tremor dominant Parkinson's disease

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ObjectiveResting tremor is one of the cardinal motor features of Parkinson's disease (PD). The current study aims to evaluate the diagnostic and prognostic utility of subcortical volume and cerebrospinal fluid protein for tremor dominant Parkinson's disease (PD) subtype longitudinally.
Method
Eighty-eight tremor dominant PD (TD-PD) and 35 non-tremor dominant (nonTD-PD) individuals and 59 healthy controls were completed structural magnetic resonance imaging (sMRI) scans and lumbar punctures for CSF protein levels of α-synuclein, β-amyloid, p-tau and t-tau for a maximum total of three longitudinal visits (including baseline). Linear mixed-effects models were used to examine longitudinal changes in subcortical volume and cerebrospinal fluid protein in TD-PD compared to nonTD-PD as well as in relation to baseline protein measures.
Results
First, the subcortical volumes showed different longitudinal trajectory between TD-PD and nonTD-PD patients: the right globus pallidus and right thalamus volumes remained stable in TD-PD patients, while the right globus pallidus volume showed decreasement in nonTD-PD patients during the first year; the right thalamus volume increasesd in TD-PD patients while the right thalamus volume decreased in nonTD-PD patients during the second year. Second, baseline CSF Aβ1–42 levels postively correlated with the longitudinal right globus pallidus volumes increase in TD-PD patients.
Conclusion
These results indicate that longitudinal patterns of globus pallidus and thalamus volume change may serve as a diagnostic and prognostic marker for the tremor dominant subtype in PD patients. Further, Aβ1-42 levels may influence longitudinal changes of subcortical volume in TD-PD patients.

PU-268

# 阿尔茨海默病的定量 MRI 研究

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目的：利用 MAGIC (Magnetic Resonance Image Compilation, MAGIC)序列来定量评估阿尔茨海默病（AD）脑改变
材料和方法：本研究共纳入 32 例受试者，其中 AD 患者 18 例，正常健康老年人(HE) 14 例。AD 受试者来自医院神经内科记忆门诊，健康老年人通过基于社区流行病学研究招募的志愿者。每个受试者的临床检查包括病史、神经系统检查、知情者面谈和神经心理评估（包括 MMSE、CDR）。两组受试者的年龄、性别比例、受教育年限匹配，神经心理评分在两组间有统计学差异($p < 0.001$)。所有 MRI 数据均采用 3-T GE Premier 系统，定量 MRI 采用 MAGIC 序列，同时用 3D-BRAVO 序列获得全脑 T1WI 解剖图像。
结果：使用 GE 工作站进行后处理，采用 3D-T1 结构图像进行解剖共配准。计算每个区域的定量测量值，包括 T1、T2、PD。AD 与 HE 在双侧海马、左内嗅皮层、左顶下小叶皮层等一系列区域的 T1/T2/PD 差异均有统计学意义($p<0.001$)。扣带回的组间差异见于 PCC；相关分析显示与 MMSE

评分之间的显著相关见于左侧半球的顶下小叶、内嗅皮层、岛叶、ACC 和 PCC，但是并不见于海马。
结论：MAGIC 序列获得的定量指标可以反映 AD 大脑的病理变化，可以成为可靠的 AD 诊断生物标志物。

PU-269

# APT 加权成像联合 mDixon-Quant 在宫颈鳞癌分级中的应用价值

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目的 探讨酰胺质子转移加权成像(Amide proton transfer weighted imaging, APTw)联合水脂分离定量技术(modified Dixon quantification, mDixon-Quant)对宫颈鳞癌病理分级的鉴别价值。方法 对 32 例经病理证实的宫颈鳞状细胞癌患者在 3.0T MR（Ingenia CX, Philips）上进行检查（包含 T2WI 、mDixon-Quant 和 APTw 序列）。根据病理结果分为低分化组 20 例和高中分化组 12 例。由两名观察者测量两组患者的 APT 值、脂肪分数(fat fraction, FF)和 R2*值。使用组内相关系数（intra-class correlation coefficients，ICC）来检验两位观察者测量值的一致性。采用独立样本 t 检验分析两组病例各参数值差异，并采用 Logistic 回归将 APTw 及 mDixon-Quant 参数中组间差异有统计学意义的参数进行联合。使用 ROC 评估不同参数及多参数联合的效能，并采用 Delong 检验进行效能比较。采用 Pearson 相关分析评估 APT 和 mDixon-Quant 各参数的相关性。结果 两个观察者测量值的一致性很好(ICC > 0.75)。低分化组 APTw 和 R2*值均高于高中分化组，差异有统计学意义(P< 0.05)。APTw、R2*及两者联合后的曲线下面积（area under curve, AUC）分别为 0.79、0.788 和 0.892；敏感性分别为 85%、90%和 85%，特异性分别为 66.67%、58.33%和 83.33%。APTw、R2*及两者联合后诊断效能提高，但差异无统计学意义（P＞0.05）。APTw 和 mDixon-Quant 各参数无显著相关性。结论 低分化宫颈鳞癌的 APT 及 R2*值要显著高于中高分化宫颈鳞癌。APTw 联合 mDixon-Quant 对宫颈鳞癌的病理分级有较高的鉴别价值。

PU-270

# Non-invasive assessment of Doxorubicin induced Cardiotoxicity in rats using cardiac magnetic resonance feature tracking analysis of myocardial strain

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Background: The clinical use of doxorubicin is limited because of its myocardial toxicity and non-invasive, and early cardiotoxicity markers are needed. The aim of this study was to assess doxorubicin induced cardiotoxicity using cardiac magnetic resonance tissue tracking for myocardial strain analysis in rat model and we also studied its pathological correlates.

Methods: Forty-eight rats were included and randomized to doxorubicin group (Dox, n=24, 2.5 mg/kg/week for 6weeks by intravenous injection) or control group (n=24, Normal saline of equal volume). We performed a longitudinal CMR and histological study at baseline (0), 5, 10 and 16 weeks in two groups. Measures of primary interest included global longitudinal strain (GLS), global circumferential strain (GCS), and global radial strain (GRS) and regional longitudinal strains including basal, mid and apical segments.
Results: Global longitudinal strain significantly decreased in the Dox group compared with the control group at 5 weeks (-14.01%±0.86% vs -17.6%±0.96%，p<0.001), followed by a reduction in left ventricular ejection fraction (61.39%±1.91% vs 68.02%±1.64%,p<0.001) and a decrease in global circumferential strain, global radial strain (–18.98%±3.69% vs. –24.13±1.23, and GRS: –17.75%±3.58% vs. –23.39%±1.48%;P<0.001, respectively) at 10 weeks. Regional longitudinal strain analysis showed that a significant reduction in the basal heart at 5 weeks(-14.52%±2.35% vs -17.06%±1.48% ,p=0.049). Global circumferential strain and global radial strain were unaffected. The pathological evaluation revealed that severe myocardial injury and fibrosis lesions began to appear in basal regional at week 5 and peaked at 16 week time point. Transmission electron microscopy (TEM) at week 5 showed fragmented mitochondria with severe morphological abnormalities in Dox rats, together with upregulation of fission and autophagy proteins, and overt mitochondrial fragmentation with structural fragmentation were found at 16 week time point in Dox rats. The receiver operating characteristic curve (ROC) showed that global and regional longitudinal strain had high diagnostic value of doxorubicin induced cardiotoxicity at 5 weeks. The pathological evaluation showed that myocardial injury was observed at 5 weeks and peaked at 16 weeks, followed by an increase in myocardial fibrosis.
Conclusions: Global longitudinal strain during treatment identifies basal strain changs as the earliest marker of doxorubicin-induced cardiotoxicity, in the absence of GCS, GRS, or left ventricular motion defects. The myocardial strain analysis allowed accurate and early evaluation of doxorubicin induced cardiotoxicity in a rat model, and has the clinical potential to detect subclinical myocardial dysfunction for chemotherapy patients. cardiac magnetic resonance tissue tracking is a promising intervention for testing in clinical trials in doxorubicin-induced cardiotoxicity.

PU-271

# Dynamic Alterations in the Amplitude of Low-Frequency Fluctuations in Patients with subcortical ischemic vascular disease

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Static changes in local brain activity in patients suffering from subcortical ischemic vascular disease (SIVD) have been studied,but have ignored the characteristics of local brain activity over time in SIVD.This study aimed to investigate the abnormal time-varying local brain activity of SIVD by using the amplitude of low-frequency fluctuation (ALFF) method combined with sliding-window approach.One hundred and eighteen SIVD patients were enrolled in our studies and according to results of the neuropsychological examinations categorized into the 3 groups:SIVD patients diagnosed as vascular mild-cognitive impairment (SIVD-VaMCI,n=40),SIVD patients without cognitive impairment(SIVD-NC, n=38), and Healthy controls (HCs,n=40).Group

comparison results showed that ALFF widespread differences were present predominantly in the frontal lobe,the medial frontal gyrus temporal lobe,the superior temporal gyrus,precentral gyrus,the right/left postcentral gyrus(PoCG.R/L),hippocampus.Post hoc pairwise comparisons show that in contrast with NCs,SIVD-MCI patients displayed increased dALFF in Limbic regions,frontal lobe,medial frontal gyrus,temporal lobe,superior temporal gyrus, right Precuneus hippocampus,Parahippocampa,right Cerebrum,.Statistical differences in ALFF and d-ALFF between both groups were used as features to explore whether they could differentiate SIVD-MCI from HCs through support vector machine method.We found that the abnormal dALFF c,used to distinguish between patients with SIVD-MCI and NCs.Increased dALFF variability values in the brainstem were positively correlated with SIVD symptom severity,Impairment in executive functions were positively correlated with average dALFF of the left frontal pole.This research showed that SIVD patients exhibited abnormal intrinsic-brain activities. Furthermore,altered dALFF was positively correlated with the cognitive impairment and executive function scores.This study provides insight into the brain dysfunction of SIVD from the perspective of dynamic local brain activity.

## PU-272

# 眼眶淋巴瘤的 MRI 影像诊断

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**目的**：探讨眼眶淋巴瘤的 MRI 影像特点，提高对本病的诊断和鉴别诊断水平。**方法**：回顾性分析 40 例共 53 侧经手术病理证实的眼眶淋巴瘤患者的临床和影像学资料。**结果**：病灶的部位、形态、与周围组织的关系：53 侧患者中单侧眼眶发病 27 侧，双侧眼眶发病 26 侧，21 侧（15 例患者）伴有其他部位淋巴结肿大。病灶多位于隔前眶周，以眼眶外上象限为主；22 侧表现为局限孤立的肿块；31 侧沿肌锥外向眶内生长呈不规则“铸型样”改变，表现为弥漫性肿块，18 侧包绕眼环，呈“光芒样”改变；3 侧包绕视神经，15 侧累及眼外肌，另有 3 侧侵犯泪腺。所有病例均未出现邻近骨质浸润及颅内硬脑膜侵犯等影像学特征。MR 信号特点：（1）MRI 具有较高的软组织分辨率，以及多方位成像的特点，因此能清楚地显示病灶部位及与周围组织结构的关系；（2）无包膜，呈塑形性生长。本组病例中 26 例表现为弥漫性肿块，沿肌锥外向眶内生长呈不规则“铸型样”，改变，18 侧包绕眼环，呈“光芒样”改变，6 例包绕视神经，符合淋巴瘤“”生长的特点；（3）病灶在 T1WI 上呈等信号或稍低信号，T2WI 上呈等信号或稍高信号，增强后病灶呈较明显均匀强化；其中 NK/T 细胞淋巴瘤表现为肿块不规则，信号不均匀，增强扫描不均匀显著强化，NK/T 细胞淋巴瘤多发生于鼻腔鼻窦，本组病例 3 侧 NK/T 细胞淋巴瘤中 1 侧为鼻腔鼻窦淋巴瘤浸润至眼睑，另有 1 侧为鼻咽部淋巴瘤术后复发沿鼻旁浸润眼内眦；（4）DWI 呈高信号，近年来国外已有相关学者利用 DWI 图像来研究眼眶内淋巴瘤，淋巴瘤是一种细胞密度很高的肿瘤，间质成分较少，弥散受限，故其 DWI 呈高信号[8-9]。**结论**：眼眶淋巴瘤 MRI 表现具有一定的特征性，MRI 多方位成像可对肿瘤明确定位，并有助于提高术前定性诊断率。

## PU-273

# 基于代谢生境成像个体化预测高级别胶质瘤患者无进展生存期

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研究背景 肿瘤内异质性与高级别胶质瘤（HGG）患者的不良预后有关，可以通过生境成像进行定量。肿瘤代谢的空间异质性有助于研究癌症代谢重编程模式，获得肿瘤治疗的代谢靶点。本研究设计了一项可行性研究，基于血流动力学异质性分析获得代谢生境
研究方法 前瞻性收集 97 例 HGG 患者的术前数据（2016 年 1 月至 2020 年 3 月），随后组织学证实为 HGG。两位神经放射科医生基于神经肿瘤反应评估 (RANO) 标准评价无进展生存期 (PFS)。基于动态磁敏感灌注 MRI 图像自动分割获得血管异质性相关的四个血流动力学生境。两名神经放射科医生筛选 HGG 患者肿瘤的增强或水肿区的 CSI 体素。基于加权最小二乘法 (WLS) 线性回归模型的进行血管生境的代谢物半定量分析（即 Cho/NAA 比率和 Cho/Cr 比率）。通过 ROC 曲线评估代谢生境在预测 IDH 突变状态的潜力。基于多变量 Cox 比例风险回归分析以获得比值比 (OR)加权估计量用于构建 PFS 的列线图。
结果 在 HAT 血流生镜，灌注指数与 Cho/Cr 比值（rCBV，r=0.712，p<0.000；rCBV，r=0.664，p<0.000）之间存在显著相关性。HAT 处代谢生境在鉴别 IDH 突变具有较高的诊断效能（Cho/Cr 比，AUC=0.661，Spec.=63.27%，Sens.=73.44%；Cho/NAA，AUC=0.688，Spec .=63.27%, Sens.=75.00%)。通过 1000 次 bootstrapping 验证，Cho/NAA 列线图的中位 PFS 预测的 C 指数为 0.769，Cho/Cr 列线图的 C 指数为 0.747。
结论 我们的研究结果表明，与血流动力学异质性相关的空间代谢生境对 IDH 突变具有明显的辨别力，并且可能与 HGG 化疗的关键预后信息显著相关。

PU-274

# 慢性失眠患者海马亚区体积改变

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目的 以海马功能性亚区体积为影像学特征，探讨海马体积与慢性失眠之间的关系，并建立预测慢性失眠的风险列线图模型。
方法 利用 3.0T 磁共振对病例组 120 名慢性失眠患者及 120 名年龄、性别和教育匹配的睡眠良好者进行 3D T1WI 扫描。将运用聚类分析海马分为 8 个功能亚区（L1、L2、L3、R1、R2、R3、R4、R5），并计算计算功能亚区的体积改变，分析慢性失眠是否引起海马亚区功能性萎缩。随后采用 logistic 回归分析慢性失眠增加海马亚区萎缩的风险。采用中介分析海马亚区萎缩与年龄、焦虑抑郁的因果关系。分析慢性失眠的独立危险因素,建立风险列线图模型,并对模型的预测性及准确度进行验证。
结果 与睡眠良好者相比，慢性失眠患者海马亚区 L1、R1、R2 和 R3 体积明显缩小；L1 海马体积：慢性失眠患者 0.61 ± 0.07，睡眠良好组 0.65 ± 0.06，P<0.001；R1 海马体积：慢性失眠患者 0.66 ± 0.07，睡眠良好组 0.71 ± 0.07，P <0.001；R2 海马体积：慢性失眠患者 0.55 ± 0.06，睡眠良好组 0.58 ± 0.06，P <0.001；R3 海马体积：慢性失眠患者 0.61 ± 0.06 ，睡眠良好组 0.63 ± 0.06，P <0.01。R1 的萎缩程度与较高的焦虑自评量表得分相关（R =-0.23, P = 0.02）。此外，慢性失眠分别使 L1 萎缩的风险增加约 2.91 倍（95％CI: 1.62-5.22, P<0.001），R1 萎缩增加约 2.14 倍（95％CI: 1.20-3.82, P=0.01），R2 萎缩增加约 2.74 倍（95％CI: 1.54-4.87, P=0.001）。此外，年龄（OR 值: 1.04 , CI: 1.02-1.07, P<0.001）、性别（OR 值: 2.80 , CI: 1.65-4.76, P<0.001）也是慢性失眠的独立危险因素。风险列线图预测模型预测值同实测值基本一致。Bootstrap 内部验证显示 C-index 高达 0.824(95％CI:0.582～0.891)。

结论 通过 MRI 形态学研究能客观揭示慢性失眠患者海马功能亚区体积的萎缩改变，以及慢性失眠患者的海马部分功能体积萎缩与焦虑情绪具有一定相关性。风险列线图模型有较高的预测效能和精确度,对临床筛查慢性失眠患者和制定更合理的治疗方案具有指导意义。

## PU-275

# 乳腺简化磁共振的临床应用研究

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研究目的： 乳腺常规 MRI 检查耗时 30-40 分钟左右，而简化乳腺 MRI 技术耗时 10 分钟左右，大大的缩短了检查时间，本文旨在验证简化后的诊断准确性，为临床筛查乳腺癌疾病提供一种新的检查手段。
研究方法：收集常规 50 例乳腺疾病患者 MRI 图像；将简化 MRI 序列图像传输至另一工作站。简化序列包括：T1 加权序列、压脂 T1 序列及注射对比剂后第一期增强序列、第一期增强剪影序列、最大 MIP 序列。由 2 名高年资诊断医师，分别分两组对常规及简化图像进行诊断。乳腺简化 MRI 与常规乳腺 MRI 进行比较研究，应用配对 T 检验统计方法验证两种检查的诊断结果的差异性。乳腺简化 MRI 的诊断结果与病理结果对照，验证其准确性。
研究结果：乳腺简化 MRI 的诊断结果与常规乳腺 MRI 诊断结果差异没有统计学意义。
研究结论：乳腺简化 MRI 技术在极大的缩短检查时间的同时，还可以保证诊断的准确性，可以成为临床乳腺疾病筛查的一种新的手段。

## PU-276

# Quantitative susceptibility mapping detects early alterations of brain venous blood oxygenation in fetuses with complex congenital heart disease

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Background: Congenital heart disease (CHD) in fetuses can change the brain's hemodynamics and blood oxygen level, resulting in impaired neurodevelopment. The purpose of this study was to investigate the early changes (gestational age (GA): 20 – 30 weeks) of venous blood oxygen saturation (SvO2) in fetuses with complex CHD (SvO2CHD) and normal pregnancies (SvO2Normal) across GA by quantitative susceptibility mapping (QSM) in utero.
Methods: In this study, in vivo 3D susceptibility-weighted imaging (SWI) was performed in 88 normal fetuses (GA: 30.5 ± 3.8 weeks, range 21.6 – 37.9 weeks) and 22 fetuses with CHD (GA: 26.3 ± 2.2 weeks, range 23.0 – 29.6 weeks). QSM images were reconstructed from the SWI phase images to quantify the SvO2 of the superior sagittal sinus (SSS). The association between SvO2 and GA was assessed for both CHD and normal fetuses using a linear regression model. In addition, we compared the SvO2 between CHD and GA-matched normal fetuses (GA: 20 - 30 weeks) using covariance analyses.
Results: The SvO2Normal demonstrated a downward trend across GA (p = 0.038). Forty-two GA-matched normal fetuses (GA: 27.4 ± 2.4 weeks) were selected to compare the SvO2 difference with CHD fetuses. The GA-matched SvO2Normal decreased as GA advanced (p = 0.022). However, SvO2CHD did not change significantly with GA (p = 0.281). The SvO2CHD (80.8 ±

4.6%) was significantly higher than that in GA-matched SvO2Normal (75.7 ± 8.0%) after the effects of GA were excluded (p = 0.038).
Conclusions: The SvO2Normal showed a downward trend with proceeding GA. The increased SvO2CHD changes were present between 20 and 30 weeks, suggesting altered fetal brain oxygen metabolism during the early stages of human brain development.

## PU-277

# 基于磁共振 Delta 影像组学预测肝细胞癌的微血管浸润

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**目的：** 本研究拟通过分析钆对比剂磁共振（MRI）不同增强期相的影像组学特征值及其变化，探讨基于 MRI 的 Delta 影像组学模型对肝细胞癌（HCC）患者微血管浸润（MVI）的预测效能。
**方法：**回顾性分析术前一个月内行钆对比剂增强 MRI 扫描的肝细胞癌患者 105 例，将患者随机分为训练集（*n*=84）与验证集（*n*=21)。采用 3D Slicer 软件分别在平扫 T1WI、动脉期、门脉期、平衡期和肝胆期上勾画 HCC 病灶（VOIs），并使用 Pyradiomics 包分别提取影像组学特征，得到 5 组单期相的组学特征;并将相邻期相的特征值相减（动脉期-平扫，门脉期-动脉期，平衡期-门脉期，肝胆期-平衡期)，得到 4 组 Delta 影像组学特征。采用 LASSO 算法结合 10 折交叉验证分别对 9 组特征进行筛选，并利用逻辑回归算法建立各影像组学模型。采用受试者工作特性下面积（AUC）、敏感度、特异度和准确度评估各模型的预测效能。采用 Delong 检验与净重分类改善指标（Net Reclassification Index, NRI） 比较不同模型的预测效能。
**结果：**动脉期模型、动脉期-平扫模型与门脉期-动脉期模型的 AUC 值在训练集与验证集上均高于 0.8。其中，动脉期-平扫模型的 AUC 值最高，其在训练集和验证集上分别为 0.922(95%CI: 0.858-0.969)和 0.889(95%CI: 0.709-1.0)；门脉期-动脉期模型次之，其 AUC 值分别为 0.873(95%CI: 0.788-0.946)与 0.843 (95%CI: 0.639-0.978)；两个模型的 AUC 值无统计学差异（*p*>0.05）。而门脉期-动脉期模型相比于动脉期-平扫模型、动脉期模型的 NRI 值在训练集与验证集上均大于 0，且 *p* 值小于 0.05。
**结论：**Delta 影像组学有助于提高 HCC MVI 的预测能力，比传统影像组学具有更高的预测效能。

## PU-278

# DKI 评估转移性前列腺癌侵袭性

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目的：探讨扩散峰度成像(DKI)技术对转移性前列腺癌(PCa)的诊断性能及评估其侵袭性的应用价值。
材料与方法: 该研究纳入 63 位接受 DKI 序列 3.0T MR 扫描并经病理证实的 PCa 患者，b 值取 1000、2000 s/mm²，在 30 个正交方向施加扩散梯度。根据骨转移病灶的数量，分为两组组:局限病灶组（无骨转移病灶）和骨转移组。由两位观察者分别测量两组病灶 DKI 各参数值，包括各向异性分数( FA) 、平均扩散系数( MD) 、平行扩散系数( Da) 、垂直扩散系数( Dr) 、峰度各向异性分数( FAk) 、平均扩散峰度( MK) 、平行扩散峰度( Ka) 和垂直扩散峰度( Kr) 值。采用组内相关系数(ICC)检验两位观察者各参数测量结果一致性；采用两独立样本 t 检验和 Kruskal-Wallis 秩和检验比

较两组的 DKI 参数值的差异；采用受试者工作特征(ROC)曲线评估有鉴别价值的参数的鉴别诊断效能；采用 Spearmen 相关系数分析 DKI 参数与前列腺特异性抗原(PSA)之间的相关性 。
结果：两位观察者测得病灶各参数一致性良好(ICC 均>0.75)。两组的 MD、Da、Dr、FAk、MK、Ka 和 Kr 值差异有统计学意义（*P*<0.001，*P*=0.001，*P*<0.001，*P*=0.017，*P*=0.005，*P*=0.002，*P*=0.032），局限病灶组的 MD、Da 和 Dr 值显著高于骨转移组，局限病灶组的 FAk、MK、Ka 和 Kr 值显著低于骨转移组。MD、Da 和 Dr 与 PSA 呈显著负相关(*P* 值均<0.05)，MK、Kr 和 Ka 与 PSA 呈显著正相关(*P* 值均<0.05)。FAK 或 FA 在各组之间以及与 PSA 之间未显示统计学上的显著相关性(*P*>0.05)。DKI 参数中 MD、Da、Dr、FAk、MK、Ka 和 Kr 值对局限病灶和骨转移组具有鉴别诊断价值，Dr 值的 AUC 最大。
结论：DKI 可以区分诊断局限性 PCa 和转移性 PCa。同时 DKI 参数中的 MK、Ka、Kr、MD、Da、Dr 值与 PSA 存在相关性，且有潜力评估 PCa 的肿瘤负荷和侵袭性。

# PU-279
# 2 型糖尿病对帕金森患者脑铁沉积分布的影响：QSM 初步研究

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目的：
采用定量磁化率成像(QSM)技术来定量测量脑灰质核团高铁区(R II)和非高铁区(R I)的磁敏度值(MSVs)，研究帕金森伴 2 型糖尿病患者的磁敏感性值(MSVs)与临床实验室指标的相关性。
材料和方法：
帕金森合并 2 型糖尿病（PDDM）患者 35 例(平均年龄 68.03±7.13 岁，范围:58-84 岁，14 例女性)和 35 例帕金森病不合并 2 型糖尿病(PDND)患者(平均年龄:65.94±9.2 岁，范围:47-83 岁，14 例女性)，并获得知情同意。临床检验指标收集情况见表 1。所有患者均采用常规 MRI 扫描，采用 GE signa HDXT 3.0T MRI 扫描仪，8 通道头线圈，梯度回波 T2*加权血管造影(ESWAN)。ESWAN 参数保持一致
(TR=36ms,TE=3.6ms;7.8ms;11.9ms;16.1ms;20.3ms;24.4ms;28.6ms;32.8ms,FOV=24x24cm2,层厚=1mm,层间距=0mm,矩阵=256x256)。采用美国韦恩州立大学馈赠的核磁共振信号处理软件(SPIN)在 QSM 图像上测量双侧灰质核团的 MSV 值，包括双侧尾状核(HCN)、苍白球(GP)、壳核(PUT)、红核(RN)、黑质(SN)、齿状核(DN)(图 1)。由于部分核团铁沉积不均匀，将每个核团进一步划分为高铁含量区(R II)和非高铁含量区(R I)，根据 SPIN 软件设置的阈值自动划分各亚区。参照文献，所有核团阈值的产生都是由 MSV 值的均值和标准差(SD)设定的。在本研究中，根据具体数据情况，使用的阈值为平均值减去标准差。R II 区的临床实验室指标(年龄、总胆固醇、甘油三酯、高密度脂蛋白、低密度脂蛋白、同型半胱氨酸、尿酸、空腹血糖、收缩压、舒张压)和两组间平均 MSV 值、两组间 R II 区 MSV 值和两组间 R I 区 MSV 值比较采用独立样本 t 检验和 Mann-Whitney U 检验。采用 Pearson 相关分析和 Spearman 相关分析对 PDDM 组灰度核 RII 的 MSV 与临床实验室指标进行相关性分析(P<0.05 为显著差异)。
结果：
由表 2 可知，与 PDND 组相比，PDDM 组各核团平均 MSV 值均增加，左侧 CN、右侧 PUT、双侧 GP、双侧 SN MSV 值均有显著差异(P<0.05)。除左侧 DN 外，PDDM 组 R II 区的 MSV 值均大于 PDND 组，双侧 CN、双侧 PUT、双侧 GP、双侧 SN 差异有统计学意义(P<0.05)，见表 3。由表 4 可知，两组间 R I 区 MSV 值无显著性差异。RII 区右侧 CN (R =-0.343, P= 0.044)和左侧 PUT(R =-0.407,P=0.015)的 MSV 值与高密度脂蛋白(HDL)含量呈负相关。RII 区右侧 CN 的 MSV 值(R =0.372, P =0.028)与低密度脂蛋白(LDL)含量正相关。
结论:MSV 值升高与脑灰质核团铁沉积的增多相一致。PDDM 组脑铁在灰质核团内沉积较多，并集中在 RII 区，说明 T2DM 加重了 PD 患者铁沉积的异质性。

PU-280

# T1mapping 对乳腺癌定量评估中的应用价值

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目的 探讨 T1-mapping 定量技术在乳腺癌定量评估中的价值。
材料与方法 对 28 例经病理确诊的浸润性乳腺癌患者于治疗前行常规 MRI、扩散加权成像( DWI) 、3D-MAX 增强和 T1-mapping 检查，采用 B1 修正变量翻转角( B1-corrected VFA ) T1-mapping 序列分别于增强前及增强后 5 min 采集 T1-mapping 图像，由两位高年资医师采用双盲法测量肿瘤和正常乳腺组织的增强前 T1 值( T1 pre ) 、增强后 T1 值( T1 post ) 和表观扩散系数( ADC) 值。对比 T1 pre、T1 post 和 ADC 值在肿瘤与正常乳腺组织的差别。
结果 两位高年资医师分别测量肿瘤和正常乳腺组织 T1 pre、T1 post、ADC 值无差异( P > 0． 05) ;肿瘤和正常乳腺组织 T1 pre、T1 post、ADC 值差异均有统计学意义( P 均 ＜ 0． 05) ; 乳腺癌组的 T1 pre、T1post 明显高于乳腺正常组织( P ＜ 0．05) ； 乳腺癌癌 ADC 值明显低于正常乳腺组织( P 小于 0． 05) 。
结论 T1-mapping 定量技术可以应用于定量评估乳腺癌。

PU-281

# The value of prediction model based on MRI radiomics in evaluating the histological grade of urinary carcinoma fo bladder

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Objective: To explore the value of prediction model based on MRI radiomics in evaluating the histological grade of urinary carcinoma of bladder.
Methods: A total of 100 patients with bladder urothelial carcinoma confirmed by postoperative pathology were retrospectively analyzed, including 28 cases of low-grade urothelial carcinoma (LGUC) and 72 cases of high-grade urothelial carcinoma (HGUC). All MRI data were divided into training and testing group by stratified sampling method with the ratio of 7:3. The ITK-SNAP software was used to manually delineate the volume of interest(VOI) of tumor on T2WI, DWI and ADC maps, and then import A.K. software to extract radiomic features. The variance analysis, the minimal redundancy maximal relevance (mRMR) and the least absolute shrinkage and selection operator (LASSO) were used to select and reduce the dimension of the features.The logistic regression algorithm was used to construct the predictive model, and the receiver operating characteristic curve (ROC) was drawn to evaluate the performance of the model, and it was verified in the testing group.
Results: Four prediction models based on MRI radiomics were constructed: T2WI model, DWI model, ADC model and T2WI+DWI+ADC combined model. Among the prediction models based on single-sequence radiomics, the ADC model in training group and testing group has the highest AUC value in distinguishing LGUC from HGUC (AUC=0.825,0.818, respectively), which is higher than that of DWI model (AUC=0.794, 0.750, respectively) and T2WI model (AUC=0.811, 0.739,

respectively). Compared with the prediction model based on single-sequence radiomics, the T2WI+DWI+ADC combined model had higher AUC value, and its sensitivity, specificity and AUC for distinguishing LGUC from HGUC were 100%, 80.0% and 0.912 in the training group, and 77.3%, 87.5% and 0.824 in the testing group.
Conclusion: The prediction model based on MRI radiomics has great application value in distinguishing LGUC and HGUC, and the T2WI+DWI+ADC combined mode shows higher performance than that based on single-sequence.

# PU-282
# DWI 在小细胞肺癌脑转移瘤和原发性脑淋巴瘤鉴别诊断价值研究

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目的：分析小细胞肺癌（SCLC）脑转移瘤和原发性脑淋巴瘤（PLB）的 MRI 表现，探讨常规 MRI 及 DWI 在二者鉴别诊断中的应用价值。
材料与方法：
收集 2015 年 1 月至 2020 年 12 月在本院行头颅 MRI 平扫和增强扫描的 SCLC 脑转移瘤 32 例和 PLB 37 例，回顾性分析其 MRI 表现，包括病灶形态、数量、部位、瘤周水肿程度、肿瘤实质 T1WI 和 T2WI 信号特征、强化特点（包括方式、程度）及肿瘤实质、瘤周水肿的弥散特点,并对 SCLC 脑转移瘤和 PLB 的肿瘤实质 rADC 值进行 ROC 曲线分析。运用 SPSS26.0 版统计学软件分析，组间采用独立样本 t 检验，计数资料采用卡方检验或非参数秩和检验，P＜0.05 视为有统计学意义。
结果：肿瘤的形态：SCLC 脑转移瘤常表现为圆形或类圆形（204 个，89.47%），PLB 常表现为不规则形（59 个，58.42%），SCLC 脑转移瘤和 PLB 两者肿瘤形态有显著统计学差异（P＜0.01）。肿瘤的数量：SCLC 脑转移瘤以多发常见（22 例，68.75%），PLB 以单发常见（21 例，56.76%），二者发病数量具有统计学差异（P=0.034）。肿瘤的部位分布：SCLC 脑转移瘤发病部位以额叶（71 个，31.14％）多见，PLB 相比于 SCLC 脑转移瘤更容易发生在基底节及胼胝体（36 个，35.64％），二者发病部位具有显著统计学差异（P＜0.01）。肿瘤实质信号分析：SCLC 脑转移瘤和 PLB 平扫多显示 T1WI 低或稍低、T2WI 高或稍高信号影，伴出血者表现为混杂的 T1WI、T2WI 信号，二者 T1WI 及 T2WI 信号均不具有统计学差异（p=0.067,p=0.092）。肿瘤强化特点：（1）SCLC 脑转移瘤多表现为环形或不均匀强化（82 个、35.96%，80 个、35.09%），PLB 多表现为均匀强化（85 个，84.16%），二者强化方式具有显著统计学差异（p＜0.01）；（2）SCLC 脑转移瘤和 PLB 均以显著强化多见，二者强化程度不具有统计学差异（p=1.171）。肿瘤弥散特点：（1）SCLC 脑转移瘤实质 rADC 值高于 PLB，分别为 0.74±0.12，0.63±0.12，二者差异具有显著统计学意义（p＜0.01），rADC 值鉴别 SCLC 脑转移瘤和 PLB 的敏感度为 66.8%，特异性为 67.6%；（2）SCLC 脑转移瘤瘤周水肿 rADC 为 2.46±1.13，PLB 瘤周水肿 rADC 值为 2.83±1.11，二者差异不具有统计学意义（p=0.180）。
结论：病灶的形态、数量、发病部位及强化方式可以用来鉴别 SCLC 脑转移瘤和 PLB；肿瘤实质 T1WI、T2WI 信号、肿瘤强化程度不能用于鉴别 SCLC 脑转移瘤和 PLB。肿瘤实质弥散受限情况可以用于鉴别 SCLC 脑转移瘤和 PLB，肿瘤瘤周水肿弥散受限情况不能用于鉴别 SCLC 脑转移瘤和 PLB。

# PU-283

# Corpus callosum abnormalities in patients with moderate to severe OSAHS

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Purpose: To analyze the specific injury segment of corpus callosum in obstructive sleep apnea hypopnea syndrome (OSAHS) by using automated fiber quantification (AFQ) data processing method, and the correlation between the damaged fiber segments and the score of anxiety scale was analyzed .
Materials and Methods: Collection of 33 untreated patients with moderate to severe OSAHS and its matching 28 volunteers without sleep disorders (NSD), all the subjects are line 3.0 T MRI scanning head for DTI data and high resolution T1 thin layer image. Then, AFQ technology was used to automatically extract the corpus callosum forceps (Fmajor) and corpus callosum forceps (Fminor) , and subdivide them into 100 isometric segments, and quantitatively analyze the difference between different tensor indexes of each segment between the two groups. Finally, the correlation between the damaged fiber segments and the anxiety scale score (SAS) was analyzed.
Results: Compared with the NSD group, the FA value of OSAHS group decreased in segment 77-78 of the Fmajor ($p<0.05$, TFCE corrected), and the FA value of segment 78 of the Fmajor was positively correlated with the SAS scale score ($r=0.447$, $p=0.009$).
Conclusion: Compared with the traditional Voxel-based analysis and Tract-based spatial statistics methods, AFQ analysis method can find out the specific parts of corpus callosum injury in OSAHS patients more precisely and accurately, and part segment injury of Fmajor may be the neuropathological basis of anxiety in these patients.The application of AFQ to explore the condition of corpus callosum damage in OSAHS patients is helpful to further improve our understanding of the neural mechanism of psychological anxiety in OSAHS patients with abnormal white matter microstructure.

PU-284

# Abnormality of right inferior frontal occipital fasciculus in patients with severe OSAHS and its clinical correlation

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Purpose: to analyze the characteristics of right inferior frontal occipital fasciculus changes in obstructive sleep apnea hypopnea syndrome (OSAHS) by using automated fiber quantification (AFQ) data processing methodand and the correlation between abnormal fiber segments and scores of anxiety scale.
Materials and Methods: this study collected 24 untreated patients with severe OSAHS and its matching 29 volunteers without sleep disorders (NSD), line 3.0 T MRI scanning head for DTI data and high resolution T1 thin layer image, using AFQ technology method for automatic extraction of the right inferior frontal occipital fasciculus, and the fine can be divided into 100 isometric segment, then every segment of the tensor indexes between the two groups of quantitative analysis, after that using the abnormal fiber segment of right inferior frontal occipital fasciculus with OSAHS patients and anxiety rating scale for correlation analysis.
Results: compared with the NSD group, the FA value of segment 82-84 of the right inferior frontal occipital fasciculus was increased and RD value of segment 81-84 was decreased in the OSAHS group ($p<0.05$, TFCE corrected). Furthermore, the RD value of the damaged fiber segment 81 of

the right inferior frontal occipital fasciculus was negatively correlated with the SAS scale score (r=-0.461, p=0.027).
Conclusion: the AFQ analysis method can be used to find the segment of white matter fiber bundle injury in OSAHS patients more accurately and precisely. The local bundle injury of the right inferior frontal occipital fasciculus may be the neuropathological basis of anxiety in OSAHS patients. The application of AFQ to explore the condition of right inferior frontal occipital fasciculus damage in OSAHS patients is helpful to further improve our understanding of the neural mechanism of psychological anxiety in OSAHS patients with abnormal white matter microstructure.

## PU-285

# 颅内动脉钙化评价方法在脑小血管病风险评估的可行性研究

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【摘要】目的：本研究旨在探讨颅内动脉钙化（IAC）评价方法在评估脑小血管病（CSVD）风险的可行性。方法：回顾性分析 2018 年 12 月至 2020 年 7 月本院住院的 303 例研究对象的临床及影像资料。根据 CSVD 总体负担评分，将实验组分为 4 组（1～4 分），无 CSVD（0 分）人群作为对照组，均进行头颅 CT 及 MRI 检查，在头颅 CT 评价 IAC 情况，在头颅 MRI 评价腔隙、脑白质高信号、脑微出血、血管周围间隙 4 个征象并计算 CSVD 总体负担评分；采用单因素方差分析检验或卡方检验比较 5 组研究对象的临床资料，采用多元有序 Logistic 回归分析评价 IAC 与 CSVD 的相关性。结果：在 5 组研究对象组间比较中，CSVD4 分组的患者年龄最大[68.50（62.25，74.75）岁]，高血压发病率最高（88.5%），CSVD3 分组的患者糖尿病发病率最高（41.6%），差异均有统计学意义（P＜0.05）。在调整了年龄、糖尿病、高血压 3 个混杂因素之后，CSVD 严重程度与 IAC3～4 级（OR=4.697，95%CI 1.349～16.346；P=0.015）独立相关。结论：IAC 与 CSVD 的严重程度独立相关，IAC 的定量评价有助于临床借助 CT 筛查评估 CSVD 的风险。

## PU-286

# Automated fiber quantification technique was used to precisely evaluate the white matter damage in patients with severe OSAHS

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Purpose: In order to determine the specific segment of white matter fiber tract damage in patients with severe obstructive sleep apnea hypopnea syndrome (OSAHS) used by automated fiber quantification (AFQ) analysis.
Materials and Methods: Collection 24 untreated patients with severe OSAHS and its matching 29 volunteers without sleep disorders (NSD), all subjects underwent 3.0T MRI head scan to obtain DTI data. Before using AFQ to process the obtained DTI data, we also used FSL software to obtain the diffusion tensor indexes of these two groups of subjects: FA, MD, AD, RD. And then use the tract-based spatial statistics (TBSS) method to build a white matter fiber skeleton based on all the subjects to compare the difference of the average diffusion tensor between the two groups. Then, AFQ method was used to process and analyze the two sets of data, and 20 main

fiber tracts were automatically and efficiently extracted from the whole brain, and each fiber was finely divided into 100 nodes, so as to determine the specific segment where the white matter fiber tract changed.
Results: After using the TBSS analysis method, FA, MD, AD, RD did not find any difference between the two groups after correction. But after automated fiber quantification technique was applied, compared with the no sleep disorder group, the FA value of segment 9-10 of Callosum Forceps Minor and segment 82-84 of right Inferior Fronto-occipital Fasciculus in OSAHS group increased, the AD value of segment 81-87 of Callosum Forceps Minor increased, and the RD value of segment 9-11 of Callosum Forceps Minor and segment 81-84 of right Inferior Fronto-occipital Fasciculus increased. ($p < 0.05$ after corrected by TFCE).
Conclusion: By using the AFQ analysis method,we can find the changes in the white matter of OSAHS patients that cannot be found in the TBSS analysis method. And can also be accurate to the specific location of the fiber bundle damage, which can provide new ideas for exploring the changes of white matter fiber bundles in OSAHS patients, while providing better neuroimaging assistance for clinical work. In the future, it may be considered to use AFQ to determine whether OSAHS patients have progressed in the same fiber tract during the entire disease degree change from mild to moderate to severe.

## PU-287

# 术后复发肛瘘患者的术前临床及影像资料特征的比较分析

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目的 比较肛瘘术后复发病例和术后痊愈病例的术前临床及磁共振资料特征的差异
方法 回顾性搜集 2020 年 4 月至 2021 年 5 月于我院就诊并进行手术治疗的肛瘘患者，共 51 例，均有 MRI 平扫序列（包括高分辨率 T2WI、DWI 序列[b=1000 s/mm2]和 T1WI），部分包含增强序列。由一名高年资放射医生（有超过 7 年的直肠和肛管 MRI 诊断经验）采用盲法评估所有 MRI 图像，并随访所有患者术后复发情况，将患者分成术后复发组和痊愈组。使用 SPSS 20.0 软件进行统计分析，比较复发组和痊愈组的临床及 MRI 资料特征的差异。
结果 51 例病例中，有 9 例患者术后出现复发，42 例患者术后恢复情况好，未见明显复发征象。复发组的平均年龄约 36.67 岁，痊愈组的平均年龄约 38.95 岁，差异没有统计学意义（P＞0.05）；复发组中复杂肛瘘有 8 例（88.89%），痊愈组中复杂肛瘘有 23 例（54.76%），差异有统计学意义（P＜0.05）；复发组中高位肛瘘有 9 例（100%），痊愈组中复杂肛瘘有 26 例（61.90%），差异有统计学意义（P＜0.05）；复发组与痊愈组在病程、Parks 分型、有无脓肿的比较中均无明显统计学差异。
结论 高位复杂性肛瘘在术后更容易出现复发，需要做好充分的术前准备并密切随访。

## PU-288

# 侵入性凶险性前置胎盘腹主动脉球囊封堵下剖宫产大出血的 MRI 预测模型

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目的：探讨产前 MR 检查在预测侵入性凶险性前置胎盘(IPPP)产妇腹主动脉球囊封堵联合剖宫产(AABO-CS)大出血的价值并构建 MRI 预测模型。方法：回顾性分析 122 例（粘连型 23 例、植入型 77 例及穿透型 22 例）经手术及（或）病理证实的 IPPP 产妇的临床及 MRI 资料，根据 AABO-CS 术中出血量的差异将其分为大出血组和非大出血组，采用独立样本 t 检验、Mann-Whitney U 检验及 c2 检验分析出血量与临床特征及 MRI 征象的关系，将单因素分析中有统计学差异的 MRI 征象进行多因素 Logistic 回归分析，建立回归模型，采用 Hosmer-Lemeshow goodness-of-fit 检验及受试者工作特性曲线（ROC）评估此模型的诊断效能。结果：单因素分析显示胎盘穿透、胎盘主体附着于子宫前壁下段、胎盘增厚、胎盘凹陷征、T2WI 胎盘低信号带、子宫局限性膨凸、子宫肌层欠连续、浆膜下异常血管影、胎盘内异常血管影及宫颈形态异常在两组间的差异有统计学意义（P 均＜0.05）。多因素分析显示胎盘内异常血管影（X1：OR= 6.971,P=0.001）、浆膜下异常血管影（X2:OR=6.306,P=0.002）、胎盘增厚（X3:OR=5.490, P=0.008）及宫颈形态异常（X4：OR=5.012, P=0.007）为预测 AABO-CS 术中大出血的独立危险因素，Logistic 回归模型为 Logit P=-3.899+1.942X1+1.841X2+1.703X3+1.612X4，其准确率为 86.9%，ROC 曲线下面积为 0.923（95%CI：0.873～0.972），Hosmer-Lemeshow goodness-of-fit 检验表明模型的拟合度较好（P=0.582），当最佳预测概率＞45.4%时，其敏感度，特异度分别为 82.0%及 90.3%。结论：产前 MRI 对 IPPP 产妇 AABO-CS 术中大出血有提示作用，本研究建立的 MRI 回归模型能够较好地量化评估其出血风险，为个体化治疗方案的制定提供参考。

## PU-289

# 头颅 MR 增强扫描联合 3D-ASL 、DWI 及 ADC 定量分析在鉴别高级别脑胶质瘤术后复发与假性进展中的价值研究

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【摘要】 目的 探讨头颅 MR 3D-ASL 、DWI 联合基因检测在鉴别高级别胶质瘤术后复发与假性进展中的价值。方法 对 30 例术后和放化疗后随访 MR 中发现新的异常强化灶的胶质瘤患者进行 3D-ASL 检查及 DWI 检查。术后均已进行 MGMT 基因检测。患者基于随后的病理或随访分为假性进展组（A 组）和复发组(B 组)。分别测量 A 组及 B 组的相对平均脑血流量 ( rCBF) 、相对平均表观扩散系数 ( rADC) ，行组间统计学分析。评估 rCBF 及 rADC 值在复发与假性进展中的诊断价值。结果 rCBF 及 rADC 值在 A、B 两组病灶间差异均有统计学意义，并与 MGMT 基因检测是否启动子甲基化有明显的相关性。结论 MR 3D-ASL 、DWI 联合 MGMT 基因检测能够有效鉴别高级别胶质瘤术后复发与假性进展。

## PU-290

# 颅内动脉钙化定量评价与脑小血管病总体负担评分的相关性

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目的 旨在探讨 3 种颅内动脉钙化（IAC）评价方法结果与脑小血管病（CSVD）的相关性。方法 回顾性分析 303 例观察对象的资料。CSVD 患者为实验组，无 CSVD 人群为对照组。在头颅 CT 采用 Agaston、改良 Woodcock、Babiarz 这 3 种方法评价 IAC，在头颅 MRI 评价腔隙性脑梗死、脑白质高信号、脑微出血、血管周围间隙 4 个征象并计算 CSVD 总体负担评分，采用 Spearman 秩相关分析评价 CSVD 与 IAC 的相关性；采用 Kruskal–Wallis 检验比较 5 组观察对象的 IAC。结果 Agaston 钙化分级、改良 Woodcock 钙化积分、Babiarz 钙化分级与 CSVD 总体负担评分（r 分

别为 0.643、0.666、0.681）、深部白质高信号（r 分别为 0.503、0.536、0.539）、脑室旁白质高信号（r 分别为 0.535、0.578、0.570）、脑微出血（r 分别为 0.452、0.480、0.479）、腔隙性脑梗死（r 分别为 0.466、0.518、0.541）、血管周围间隙（r 分别为 0.585、0.577、0.554）均呈正相关，P 值均＜0.001。结论 3 种 IAC 评价结果均与 CSVD 呈正相关，IAC 可能是 CSVD 的危险因素。

PU-291

# Cortical Area Alterations in Patients with Parkinson Disease: A Surface-Based Morphometry Study

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**Background:** Surface-based analysis is a sensitive measure of cortical information content. This study aimed to explore microstructural alterations in brain surface-based morphometry area in patients with Parkinson's disease (PD). As one of the quantitative measures of the cerebral cortex in surface-based analysis, cortical area has been widely used in brain morphology research, and it larging with age and disease.
**Methods:** Twenty-seven PD patients and thirty-seven healthy controls (HCs) were included. For all participants, 3.0T magnetic resonance imaging (MRI) and high-resolution 3D structural images were acquired with a 3D-BRAVO pulse sequence. Structural image data preprocessing was performed using the DPABISurf toolbox. Spearman correlation was used to correlate the cortical area and Unifed Parkinson's Disease Rating Scale part-III (UPDRS-III) scores, time up and go test scores, Berg balance test scores and so on. For descriptive purpose, clinical characteristics were described as percentage for categorical variables and median with interquartile range for continuous variables. Comparison was done by Pearson x2 or nonparametric test. Spearman correlation analysis were used in the statistical analysis.
**Results:** Nonparametric test showed in the two groups in area as surface-based morphometry were observed in left Lateral Temporal Cortex (LTC) and right Inferior Parietal Cortex (IPC) (all $P< 0.05$) (Fig.1). Compared to HCs, those in PD group had significantly lower area in the left LTC and right IPC. The time up and go test scores and Berg balance test scores in LTC and IPC were negatively correlated with UPDRS-III score (all $P < 0.01$).
**Conclusions:** PD has progressive microstructural alterations in the LTC and IPC. Cortical area is sensitive to detect microstructural alterations in PD movement disorder. These brain regions may serve as potential neuroimaging biomarkers. Combining area and movement scale can achieve r a good performance in diagnosing PD.

PU-292

# 集成磁共振成像技术研究进展

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集成磁共振成像（synthetic magnetic resonance imaging, SyMRI）是在临床可接受的时间内通过一次扫描即能提供多种定量和不同对比度图像的一种新型成像方法，可以弥补传统 MRI 多序列扫

描、扫描时间长和无法精准定量等不足，从而简化工作流程。自其投入临床应用以来，不仅在多种疾病的诊断中展现出独特的优势和良好的诊断效能，而且对某些疾病的研究也具有潜在应用价值。本文对 SyMRI 基本原理及应用现状进行综述，并对其发展进行展望。

PU-293

# Differential diagnosis of Prostatic Cancerfrom Benign Prostatic Hyperplasia using the Correlation between APT signal intensity and Permeability parameters

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Materials and Methods：
This study was approved by the local IRB.A total of 62patientswereincluded in the analysis. All of the patients were categorized into two groups: prostate cancers group (n=30) and benign prostatic hyperplasiagroup (n=32)according to pathologyresults.MR exiamination were performed on a3.0T MR scanner(IngeniaCX; Philips Healthcare, Netherlands) with a 16-channel abdominal coil. MR protocols included3Damide-proton-transfer weighted imaging (3D-APT), DWIand DCE imaging. The detailed scan parameters are listed in Table 1.All data were transferred to the IntelliSpace Portal workstation (PhilipsHealthcare, Netherlands) and measuredindependently by two radiologists (Lihua C and Shuang Meng, with 5 and 7 years of experiences respectively) blinded to the clinical information of the patients.Regions of interest(ROIs) were manually placed on the fused APTw and DWI images on the slicewiththe largest lesions(Figure 1). The average APTand perfusionvalues (Ktrans, Kep, et al) were calculated. Inter-observerconsistency was evaluatedusing intra-class correlation coefficients (ICC) onSPSS software. Pearson test was performedto explorethe correlation between APT values and permeability parameters.
Results：The representative APT and permeability images with thelocation of ROIs were shown in Figure 1.The measurement consistency between the two radiologists was good (ICC> 0.75).Therewere statistically significant differences in both APT signal and permeabilityparameters between BPH and PCa. There was a moderate negative correlation($R = -0.427$, $p < 0.05$)between the APT and perfusion values (Ktrans: $r=0.345$, $P< 0.05$; Kep: $r=0.429$, $P< 0.05$;Ve: $r=0.256$, $P< 0.05$) in the whole samples.
Discussion:
Both APT and Permeability are sensitive to the contents of tiusses. When the occurance of PCa, the protein synthesis and cell proliferation elevated significantly. Furthermore, a moderate negative correlation between the APT and perfusion values is observed, suggestingthecombination of APT and Permeability might be a promising method for differential diagnosis of BPH and PCa.
Conclusion
In conclusion, there is amoderatepositive correlation between the APT and Permeability in both Pca and BPH, suggesting an improved differential diagnosis of BPH and PCa using APT combinatedwithpermeability.

PU-294

# Improved differential diagnosis between Prostate Cancer and Benign Prostate Hyperplasia using APT and IVIM

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Introduction:
IVIM imaging has been previously explored in the differential diagnosis ofbenign and malignant prostate tumors, and the diagnosis confidence remains to be elevated1-2.Amide proton transfer-weighted (APTw) imaging is a novel MRI imaging tool to detect amide protons in mobile cellular proteins and peptides3.This study aimed to differentiate prostate cancers and benign prostate hyperplasia with combinational use of APT and IVIM.

Materials and Methods
The study was approved by the institutional IRB. A total of 54 patients were prospectively included. According topathology results, the patients were categorized into two groups: Group A prostate cancers (n=21, mean age 68.95±6.68years, range 58-84 years)and Group B benign prostate hyperplasia (mean age 67.97±7.76years, range 48-84 years).All the patients underwent MRI at 3.0T (Ingenia CX, Philips Healthcare, the Netherlands) with a 16-channel abdominal coil. The MR protocol included: DWI, APT, and IVIM, parameters detailed in Table 1. After the MRI scanning is completed,all data were interpretedindependently by two radiologists (CM and LC, with 2 and 5 years of experiences respectively, blinded to the clinical information of the patients).Regions of interest(ROIs) were manually placed on the hyperintense signal area of DWI slice with the largest lesion demonstration. Then APT images were fused onto the DWI images to ensure the ROI measurement at the same position (Figure 1). The average APT values (MTRasym) and parameter values of IVIM were calculated to reduce measurement error. Inter-observerconsistency of all the values was tested using intra-class correlation coefficients (ICC) withSPSS (IBM). All the parametervalues between two Groupswere detectedusing the t test. Logistic regression and ROC plot were used to evaluatethe differential diagnostic efficiency of malignant tumours. Delong test was used to compare the diagnostic efficacy.
Results
The measurement consistency between the two radiologists was good (ICC> 0.75, data not shown).APT values in Group A was significantly higher than in group B ($P<0.05$),diffusion and perfusion parameters (D-mono, D-Bi, D*-mono, D*-Bi, f-Bi, et al) of IVIM in Group A was significant lower than in group B($P<0.05$, Table 2). As for ROC curves, the AUC values of all the parameters were more than 0.7. The diagnostic efficiency of APT combining with parameters of IVIM was higher than those of either APTorIVIM parameters if used separately (Table 3, Figure 2).
Discussion and Conclusion
Significantly higher APT and lower diffusion and perfusion parameters in prostate cancers were observed than in benign prostate hyperplasia, which might be attributed to higher proliferation rate, elevated cancer cells metabolism, and more dense and more complicated micro structure in the cancers. In conclusion, APT together with IVIM may provide a non-invasive tool to distinguish prostate cancers and benign prostate hyperplasia.

# PU-295
# 急性缺血性卒中液体衰减反转恢复序列中血管高信号征的相关因素

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目的：液体衰减反转恢复序列(FLAIR)上的血管高信号征(FVH)并非在所有急性缺血性卒中病例中都能显示。我们的目的是调查急性前循环缺血性卒中患者 FVH 存在的相关因素。
材料与方法：连续入组多中心在发病后 24 小时内接受了急诊常规序列 MRI 检查的急性前循环缺血性卒中患者，共有 720 名患者入选，其中 FVH 发生率为 33.3%。使用单变量分析和多变量 Logistic 回归分析 FVH 的相关因素。
结果：单因素分析显示 FVH 阳性组与 FVH 阴性组在病变类型(是否存在 DWI 病灶)、责任血管、狭窄程度、穿支动脉、高血压、房颤、NHISS、发病时间等方面有显著性差异。多因素 Logistic 回归分析显示，存在明显 DWI 病灶(OR 6.6；95%可信区间(CI)2.1~20.5)、大血管病变(OR 2.9；95%CI 2.2~3.8)和血管严重狭窄或闭塞(OR 6.7；95%CI 4.0~11.2)是 FVH 的独立危险因素。
结论：存在 DWI 病灶、大血管病变和血管严重狭窄或闭塞与 FLAIR 上血管高信号征的存在独立相关。

## PU-296

# 肝细胞癌 MRI 表现、分化程度与 GPC3、CD34、CK19、CK7 表达、预后的相关性研究

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目的：探讨肝细胞癌的磁共振成像表现与 GPC3、CD34、CK19、CK7 表达的相关性；GPC3、CD34、CK19、CK7 表达情况与 HCC 病理分化程度的相关性；影响 HCC 患者预后的 MRI 表现及病理分化程度的多因素分析。
方法：收集临床资料、影像数据完整的 HCC 患者共 112 例为研究对象，所有患者术前均进行 MRI 平扫+增强检查，术后病检将癌组织进行免疫组织化学染色，检验癌组织中 GPC3、CD34、CK19、CK7 的表达情况。将所有 HCC 病灶的术前 MRI 影像表现与术后癌组织中 GPC3、CD34、CK19、CK7 表达情况做相关性分析。HCC 分化程度与 GPC3、CD34、CK19、CK7 表达情况行相关性分析。随访到 71 例患者，患者的预后进行单因素 Kaplan-Meier 分析。
结果：CD34 在否合并肝硬化的 HCC 中表达存在差异，HCC 合并肝硬化是影响 CD34 表达的独立危险因素。CK19 在是否合并淋巴结肿大、是否合并囊变坏死、是否合并癌栓的 HCC 中表达存在差异。CK7 在是否合并淋巴结肿大的 HCC 中表达存在差异。GPC3 表达与 HCC 的分化程度存在相关性，GPC3 在中、低分化的 HCC 中表达的阳性率高于在高分化的 HCC 中表达的阳性率。HCC 患者预后与 MRI 显示 HCC 的边缘、是否合并淋巴结肿大、是否合并肝硬化、是否合并癌栓存在相关性； HCC 合并肝硬化是影响 HCC 患者预后的独立危险因素；HCC 合并癌栓是影响 HCC 预后的独立危险因素。
结论：（1）HCC 的 MRI 表现可以在一定程度上反映 GPC3、CD34、CK19、CK7 的表达情况；（2）GPC3、CK19 在一定程度上可以反映 HCC 的分化程度；（3）HCC 的 MRI 表现可以反映患者的预后情况，并且可以为 HCC 患者的预后提供有参考价值的影像学信息。

## PU-297

# The value of APTw imaging combined with DWI to identify Prostate Cancer with or without Bone Metastasis

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Purpose
To explore the potential of APTw MRI and DWI for differential diagnoses of prostate cancers with and without bone metastasis.
Materials and Methods
This study was approved by the local IRB. A total of 30 pathology-proven prostate cancers and PET-CT-proven with or without bone metastasis patients (mean age 70.50±6.68years, range 58-84 years) were included in the analysis. The patients were categorized into two groups, Group A with bone metastasis and Group B without bone metastasis, and underwent MRI at 3.0T IngeniaCX (Philips Healthcare, the Netherlands) with a 16-channel abdominal coil. Sequences: 3Damide-proton-transfer weighted imaging (3D-APT), T2WI SPAIR, and diffusion weighted imaging (DWI) (parameters listed in Table 1). All data were transferred to the IntelliSpace Portal workstation (Philips Healthcare) and interpreted independently by two radiologists (Yunsong L and Lihua C, with 3 and 5 years of experiences respectively, blinded to the clinical information of the patients). Regions of interest (ROIs) were manually placed on the fused APTw and DWI images on the slice showing the largest lesions to cover the whole lesion in the slice (Figure 1). The average APTw (MTRasym) and ADC values were calculated to minimize measurement bias. Measurements consistency of APTw and ADC values between the two observers was tested using intra-class correlation coefficients (ICC) with SPSS (IBM). APTw and ADC values were compared between Groups A and B using the Mann-Whitney U test. Logistic regression and ROC plot were used to evaluate the diagnostic efficiency of prostate cancers with bone metastasis. Delong test was used to compare the diagnostic efficacy.
Results
Measurements by the two observers were in good agreement (Table 2). APTw values in Group Awas significant higher than in group B ($P<0.05$), and ADC values in Group A was significant lower than in group B($P<0.05$)(Table 3). As for ROC curves, the AUC values of APT and ADC valueswere all more than 0.7. The diagnostic efficiency of APT combining with ADCwas higher than those of APT or ADC when used separately (Table 4, Figure 2).
Discussion and Conclusion
Prostate cancers with bone metastases were observed with significantly higher APTw and lower ADC values than those without bone metastasis, which might be attributed to higher proliferation rate and hence higher aggressiveness in the cancers with metastasis. In addition, the diagnostic efficiency of APT combining with ADC was higher than those of APT or ADC when used separately. In conclusion, APTw imaging together with DWI may provide a non-invasive tool to evaluate the metastasis potential of prostate cancers.

# PU-298

# 磁共振 3D-DESS 序列在膝关节软骨 3D 模型重建中的应用

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目的：对比分析磁共振三维各向同性分辨率双回波稳态序列(three dimensional dualecho steady state,3D DESS)序列、快速自旋回波质子密度加权成像（fast spin—echo proton density—weighted imaging，PDWI）序列、脂肪抑制（turbo inversion recovery magnitude，TIRM）序列在膝关节软骨 3D 模型重建中的价值。方法：对 30 例膝关节单髁置换患者术前采用 SIEMENS Magnetom Verio 3.0T 磁共振成像系统行常规膝关节 MRI 扫描后加扫水激发 3D DESS 序列。获得 3D DESS（A 组）、PDWI（B 组）和 TIRM（C 组）三组序列 DICOM 3.0 格式的影像数据，利用 Mimics 16.0 软件重建膝关节软骨 3D 模型。采用 SPSS19.0 软件统计分析，比较三组图像质量的主观评分及 3D 模型与术中所见软骨缺损面积一致性。结果：三组图像质量评分分别为 A 组 4.71 ±

0.15， B 组 4.08 ± 0.16， C 组 4.25 ± 0.34； A 组 vs.B 组 q 值=9.12（P＜0. 05）， B 组 vs. C 组 q 值=1.96（P＞0.05）， A 组 vs. C 组 q 值=7.23（P＜0.05）。3D 模型软骨平均缺损面积(3.80±1.62)cm2；术中软骨平均缺损面积(4.08±0.15)cm2。 3D 模型与术中软骨缺损面积测量值之间差异有统计学意义（P<0.05）。结论：3D-DESS 序列为膝关节软骨 3D 重建优势序列，3D 模型能清晰精确地模拟膝关节软骨的三维几何形态，软骨缺损面积评估在临床术前具有指导意义。

## PU-299

# OLT 软骨炎性因子 MMP-3，TIMP-1 表达与磁共振软骨 T2 值的相关性分析

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目的

探讨距骨骨软骨损伤（osteochondral lesions of the talus，OLT） 软骨基质金属蛋白酶-3 ( matrix metalloproteinase-3)、基质金属蛋白酶组织抑制因子-1（tissue inhibitor of metalloproteinase-1）的表达与磁共振 T2 值之间的关系及其在距骨骨软骨损伤的机制 。

材料与方法

1.收集 60 例踝关节距骨骨软骨损伤行微创治疗术患者，招募 60 名健康志愿者，OLT 患者及志愿者均行 3.0T 常规踝关节磁共振成像及 T2 -mapping 功能成像，测量距骨骨软骨 T2 值。

2.OLT 患者术后离体距骨骨软骨行苏木精 — 伊红染色(HE) 和 Western Blot 法分析距骨骨软骨 MMP-3，TIMP-1 的表达；

3.统计学分析 OLT 距骨骨软骨 T2 值与 MMP-3，TIMP-1 蛋白表达的相关性。

结果

距骨骨软骨损伤以内中侧最为多见（磁共振 6 分区法），距骨骨软骨 T2 值随软骨损伤 Mankin 分级明显增大( P<0.05)。软骨 MMP-3，TIMP-1 蛋白表达高级别与低级别差异明显( P<0.05)。软骨 T2 值与软骨 MMP-3，TIMP-1 表达呈线性相关趋势，Pearson 分析距骨骨软骨损伤 T2 值增加与 MMP-3 蛋白表达含量呈直线性正相关( r = 0.779， P<0.0001) ，距骨骨软骨损伤 T2 值增加与 TIMP-1 蛋白表达含量呈直线性负相关( r =- 0.802， P<0.0001) 。

结论

距骨骨软骨损伤以内中侧最为多见，距骨骨软骨磁共振 T2 值随软骨损伤分级逐级递增;距骨骨软骨损伤磁共振 T2 值与 MMP-3 蛋白表达呈正相关，与 TIMP-1 蛋白表达呈负相关，距骨骨软骨磁共振 T2 -mapping 功能成像 T2 值定量分析可在体、无创性预测不同级别软骨损伤 MMP-3，TIMP-1 蛋白的表达含量，为临床治疗 OLT 提供影像学定量依据。

## PU-300

# 不同加速因子对 mDIXON-Quant 技术分析肝脏脂肪浸润的影响

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目的：探讨基于压缩感知技术不同加速因子对 mDIXON-Quant 技术分析肝脏脂肪浸润的影响，旨在寻求既能缩短扫描时间又不影响脂肪含量测定的合适加速因子。资料与方法：选取 20 名无内科

疾病的健康志愿者，分别进行上腹部常规 mDIXON-quant、CS-2.5 倍、CS-3 倍及 CS-3.5 倍扫描。分别测量肝脏脂肪分数（FF 值），肝脏 ROI 选择为肝右叶最大显示层面且避开血管处。采用单因素方差分析比较三组间 FF 值，以 P＜0.05 作为有统计学意义。结果：随着加速因子增加，肝脏 FF 值依次减低；肝脏常规组与 CS-2.5 倍、CS-3 倍组 FF 值差异均无统计学意义（P＞0.05），肝脏常规组与 CS-3.5 倍组 FF 值差异有统计学意义（P＜0.05）。结论：基于压缩感知技术的 mDIXON-Quant 可以缩短屏气时间，但随着加速因子的增加，测得的肝、胰 FF 值均递减；推荐将加速因子设置为 2.5 倍，可减少 40%屏气及扫描时间，且测得肝脏 FF 值相对准确。

## PU-301

# MRI 增强扫描后处理技术在肝癌热消融治疗后肿瘤活性评价中的临床应用

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目的 探讨基于 e-THRIVE 序列的磁共振减影技术在肝癌经皮穿刺微波凝固治疗（Percutaneous Microwave Coagulation Therapy, PMCT）近期疗效评估中的临床应用价值。
材料与方法 选取并收集了 2018 年 3 月至 2019 年 12 月于西藏自治区人民政府驻成都办事处医院经 PMCT 治疗肝癌的患者资料，共计 27 例患者。所有入组患者 PMCT 治疗至少一个月后行 MRI 动态增强检查，并对图像进行减影处理。以患者肿瘤生物标记物甲胎蛋白（Alpha-fetoprotein, AFP）值作为金标准，对 MRI 动态增强扫描及减影图像进行比较分析。
结果 27 例患者共发现 112 个病灶，对照 AFP 值水平得到有活性病灶为 91 个（金标准），其中动态增强扫描检出有活性病灶 73 个，其中真阳性活性病灶 67/91 个，敏感度 73.6%，真阴性病灶 15/21 个，特异度 74.4%；减影图像检出有活性病灶 87 个，其中真阳性活性病灶 84/91 个，敏感度 92.3%，真阴性病灶 18/21 个，特异度 85.7%。敏感度差异具有统计学意义（p＜0.05），而特异度差异没有统计学意义（p＞0.05）。
结论 MRI 减影技术对于肝癌 PMCT 术后肿瘤活性评估的临床应用价值值得进一步探讨，临床上通过结合 MRI 增强扫描和 MRI 减影技术可以更有效地评估患者的预后，并制定更加适宜的治疗方案。

## PU-302

# 应用多时相 DCE-MRI 参数及 ADC 预测乳腺癌腋窝淋巴结转移的临床研究

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目的：评估不同时间点（time points, TPs）动态增强磁共振成像（dynamic contrast enhanced magnetic resonance imaging, DCE-MRI）参数的差异，比较 DCE-MRI 参数和表观扩散系数（apparent diffusion coefficient, ADC）对乳腺癌腋窝淋巴结（axillary lymph node, ALN）转移的预测价值。
材料和方法：回顾性纳入 107 例临床、病理和影像资料完整的浸润性乳腺癌患者。增强前采集常规 MRI 及弥散加权成像（diffusion weighted imaging, DWI）（b 值为 0 s/mm2 和 800 s/mm2）序列，增强后采集 50 期 DCE-MRI 图像。在 Nordic ICE 软件中使用前 67.8s、128.5s、189.2s、249.9s 及 310.5s（分别定义为 TP1、TP2、TP3、TP4 和 TP5）的 DCE-MRI 图像生成 Ktrans、

Kep、Ve、TTP、Peak、Washin、Washout 和 AUC 的参数图并提取其均值及标准差；在 FireVoxel 软件中使用 DWI 图像生成 ADC 图并提取 ADC 的均值及标准差。采用 Fridman M 检验比较不同 TPs 的 DCE-MRI 参数；根据最大约登指数确定截断点，基于截断点对 DCE-MRI 参数及 ADC 进行二分类，使用 logistic 回归分析 DCE-MRI 参数及 ADC 对乳腺癌 ALN 转移的预测价值，并构建受试者工作特性（receiver operating characteristic, ROC）曲线评价其预测效果。
结果：5 个 TPs 提取的 DCE-MRI 参数的差异有统计学意义（P < 0.05）。DCE-MRI 参数值达到最大的 TPs 被确定为最佳 TPs。Ktrans、Kep 和 Ve 的最佳 TPs 分别为 TP2、TP2 和 TP4（Ktrans2、Kep2 和 Ve4），Washin 和 Washout 的最佳 TPs 是 TP1（Washin1 和 Washout1），TTP、Peak 和 AUC 的最佳 TPs 均为 TP5（TTP5、Peak5 和 AUC5）。在 DCE-MRI 参数的多变量 logistic 回归分析中，AUC5 预测乳腺癌 ALN 转移的能力最佳（AUC (Area under ROC curve) = 0.656, P < 0.05），AUC5 的截断点为 3819.6，当 AUC5 大于 3819.6 时，ALN 具有转移倾向；在 ADC 的单变量 logistic 回归分析中，ADC 值在阳性 ALN 组和阴性 ALN 组之间不存在统计学差异（P = 0.582），其 AUC = 0.536，小于除 TTP5 之外的 DCE-MRI 参数的 AUC。
结论：
1．不同 TPs 提取的 DCE-MRI 参数值不同；
2．AUC5 是乳腺癌 ALN 转移的独立预测因子，预测能力强于 ADC。

## PU-303

# 两种三维 MR 胰胆管成像技术的对比研究

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目的：比较三维屏气梯度-自旋回波（3D BH-GraSE）MR 胰胆管成像(MRCP)与三维呼吸门控触发压缩感知（3D RT-CS）MRCP 的图像质量及临床应用价值。材料与方法：回顾性分析 2021 年 2 月至 2021 年 5 月间在广东省人民医院接受 MR 胰胆管检查的患者 44 例，采用 3D BH-GraSE 和 3D RT-CS 两个序列成像。根据所得图像的图像质量及胰胆管显示情况进行评分，记录扫描时间，计算图像对比噪声比（CNR）和信噪比（SNR）。采用 t 检验比较两个序列的扫描时间，采用 Mann-whitney U 检验比较图像质量评分、CNR 和 SNR。结果：3D BH-GraSE 序列扫描时间为 15s，3D RT-CS 序列扫描时间为(75.5±8.7)s，差异有统计学意义（t=32.310，P＜0.001），扫描时间缩短 80%。2 名医生的评分一致性较强（Kappa 值为 0.801）。主观评分中，3D RT-CS 序列图像整体质量、背景抑制、胆囊及胆总管的评分高于 3D BH-GraSE 序列，差异有统计学意义（P＜0.05）；两个序列在肝内胆管和胰管的显示评分中差异无统计学意义（P＞0.05）。客观分析中，3D RT-CS 序列的 CNR 优于 3D BH-GraSE 序列，差异有统计学意义（Z 值=-3.333，P=0.001），两组序列的 SNR 差异无统计学意义（Z 值=-1.573，P＞0.05）。结论：在 MRCP 检查中，优化的 3D RT-CS 序列结合 3D BH-GraSE 序列可提供优良的图像质量，提高检查效率，满足各种临床需求。

## PU-304

# SPAIR 和 WE 两种抑脂方式在胸部 DWI 应用的比较研究

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SPAIR 和 WE 两种抑脂方式在胸部 DWI 应用的比较研究杨晶 李琼阁 高艳 单艺 赵澄 卢洁*

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摘要
目的 探讨选择性水激发（water excitation, WE）和频率衰减反转恢复脉冲序列（spectral attenuated inversion recovery，SPAIR）压脂技术在胸部扩散加权成像（diffusion-weighted imaging, DWI）中的应用价值。
材料和方法 采用 3.0T（VERIO，Siemens）磁共振扫描机对 38 例胸部占位患者进行胸部磁共振 DWI 扫描两次，分别采用 SPAIR 和 WE 的压脂方式，对 DWI（SPAIR）和 DWI（WE）在 b=150mm2/s 时的图像占位信号特点进行比较，并对脂肪抑制、伪影程度和病灶显示程度做主观评分，采用 Wilcoxon 符号秩和检验；测量 DWI（SPAIR）和 DWI（WE）在 b=150mm2/s 时的图像的 SNR 和 CNR 值，采用 Mann-Whitney U 检验分析。
结果 DWI（SPAIR）扫描时间为 7 分 30 秒，DWI（WE）扫描时间为 4 分 10 秒，后者比前者节省了 43.83%，两者图像在 b=150mm2/s 时占位信号特点一致，脂肪抑制、伪影程度和病灶显示主观评分均无显著性差异；两者图像在 b=150mm2/s 时的 SNR 和 CNR 值中值分别为 17.79vs.15.17，和 2.41vs.1.20，均无显著性差异（P>0.05）。
结论 两种压脂方式 SPAIR 和 WE 的胸部 DWI 图像质量无显著差异，但是采用 WE 技术的胸部 DWI 可以节省 43.83%的扫描时间。本研究更推荐压脂技术选择性水激发 WE 应用于临床胸部 DWI 检查中。

PU-305

# 获得性重建抗伪影技术在腹腔积液患者盆腔 MRI 扫描中的应用价值

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目的：研究 ARMS(Acquision and Reconstruction with Motion Suppresion)技术在改善有腹腔积液患者的盆腔 MRI 图像质量、减少伪影方面的应用价值。
材料与方法：使用联影 uMR588 磁共振机器采集盆腔扫描图像，收集 2020 年 5 月至 2021 年 6 月共 48 例有腹腔积液的患者数据。每位患者行 ARMS-T2WI 、FSE- T2WI 轴位及矢状位盆腔扫描。采用两位高年资诊断医师对图像进行 5 分量表法评分的主观评价法及信噪比(SNR)客观评价对图像全面分析。相同方位的 ARMS 和常规扫描方法图像对比后采用 Wilcoxon 符号秩和检验。
结果：ARMS-T2WI 轴位及矢状位主观评分显著高于 FSE- T2WI 扫描图像（$\chi 2 = 6.84$, $P < 0.01$），采用 ARMS 技术扫描的矢状位图像 SNR 高于普通 FSE 扫描（P<0.05）。
结论：ARMS 技术在有腹腔积液患者的盆腔 MRI 扫描中可以改善图像质量，可以减少运动伪影及化学位移伪影。

PU-306

# MR 波谱技术在诊断腰椎骨质疏松症中的价值

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对比分析 MR 波谱技术在评价骨质疏松症的诊断价值。方法 选取我院 100 例患者作为本次实验研究对象,分别记录性别、年龄、体质指数（BMI）等。患者均行双能 X 线（DXA）骨密度（BMD）检查和 L3 椎体脂肪比（FF）MR 波谱检查。以骨密度 T 值（T≤-2.5 为阳性组，T＞-2.5 为阴性组）进行区分，分析两组数据的相关性。结果 阳性组与阴性组之间的脂肪与骨密度差异均有统计学意义（p<0.01）；脂肪与骨密度平均值存在高度负相关（p<0.01）。结论 MRS 技术在评价骨质量方面有更好的优势，对骨质疏松症的早期诊断和及时治疗具有较高的临床意义。

PU-307

# Comparison of Personalized Liver CT and MR Imaging in the Detection of Hepatocellular Carcinoma in Patients with Cirrhosis Induced by HBV Infection

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Purpose: To prospectively evaluate the diagnosis performance of personalized liver CT (MDCT), unenhanced magnetic resonance (MR) imaging and unenhanced combined contrast -enhanced MR imaging in the detection of hepatocellular carcinoma (HCC) in patients with cirrhosis induced by HBV infection.
Materials and Methods: This study was performed based on the database of 126 patients confirmed with cirrhosis induced by HBV infection and suspected of HCCs underwent unenhanced combined contrast-enhanced MRI and multiphasic personalized liver MDCT within 30days. Three independent readers qualitatively analyzed the images in three separate reading sessions (CT, unenhanced MR, unenhanced combined enhanced MR). Using strict diagnostic criteria for HCC, readers classified all detected lesions with use of a five-point confidence scale. The reference standard was a combination of pathologic proof, interventional therapy results and substantial tumor growth at follow-up CT or MRI. The diagnostic performance of these techniques for the detection of HCC was assessed by the accuracy， sensitivity and specificity.
Results: The mean sensitivity and negative predictive value of unenhanced combined contrast-enhanced MR images (95.09%；80.28%) were significantly higher than those of unenhanced MR images alone (82.64%；53.27%) and multidetector CT images (87.02%；60.00%) (P<0.05) for both comparisons. For lesions 2cm or smaller, the results were similar.
Conclusion: Unenhanced combined contrast-enhanced MR imaging improves diagnostic accuracy for the detection of HCC in patients with cirrhosis induced by HBV infection compared with either unenhanced MR or multiphasic multidetector CT images.

PU-308

# 基于压缩感知技术的快速头颅 MRI 优化扫描方案在急性缺血性脑梗死中的应用价值

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目的：探讨基于压缩感知技术快速头颅 MRI 优化扫描方案在急性缺血性脑梗死中的应用价值。方法：选取 20 名健康志愿者，分别行常规头颅 FLAIR、DWI、TOF-MRA、SWI（扫描时间为 10min32s），及 CS-FLAIR、CS-DWI、CS- TOF-MRA、CS-SWI 扫描（扫描时间为 3min6s）；两名阅片者分别独立阅片，对图像质量进行 3 分级评分，同时测量两组图像的 SNR、CNR，分析比较两组图像质量的主观评分及客观 SNR、CNR 值。同时选取自我院 2020 年 10 月--202 年 4 月急诊科收治的急性缺血性脑卒中 24 例患者为研究对象，均进行 CS-FLAIR、CS-DWI、CS-MRA 及 CS-SWI 扫描，观察分析 30 例患者影像学表现，并比较其与溶栓出血和复发的关系。结果：1、两组图像质量主观评分差异无明显统计学意义（P＞0.05），且两名阅片者的主观评价结果的评分一致性较高（k=0.87）；客观评价中，常规组 FLAIR、DWI、TOF-MRA、SWI 图像均较压缩感知组 SNR 高（P<0.05）， CNR 比较差异无统计学意义（P＞0.05）。2、24 例脑梗死患者中，DWI 均可见高信号区，FLAIR 等信号 2 例、高信号 22 例，TOF-MRA 发现责任血管狭窄 10 例、阴性者 14 例，24 例均可见 SWI 血管突出征、其中 2 例可见磁敏感血管征、2 例可见点状或结节状低信号。3、24 例患者中治疗后出血 2 例，SWI 均可见梗死区点状或结节状低信号；再发梗死 4 例，其中 2 例 SWI 可见磁敏感血管征。结论：基于压缩感知技术快速头颅 MRI 优化扫描方案可以在保证图像一定质量的前提下，大幅度减少扫描时间，同时对急性缺血性脑梗死部位、面积、责任血管及预后进行准确判断，为临床提供及时、有效的信息。

# PU-309

# 磁共振 3D-SPACE-STIR 序列在下肢静脉曲张诊断中的价值

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目的: 探讨磁共振三维可变反转角快速自旋回波短时间反转恢复（3D-SPACE-STIR）序列在下肢静脉曲张诊断中的价值。
方法:于 2021 年 1 月 1 日至 2021 年 4 月 1 日之间，收集在本院共计 27 位为下肢静脉曲张的患者。14 名男性，13 名女性，整体年龄 44-85 岁，平均年龄 60.10 岁。排除标准如下:（1）MRI 检查禁忌症如心脏起搏器等（2）无法配合完成磁共振检查的患者。每位患者均告知相关检查注意事项并签署检查知情同意书。在此排除标准下，除去纳入的 20 名患者之外，7 名患者未进行超声检查。其中 20 名患者在行下肢 3.OT 3D-SPACE-STIR 磁共振检查前后，均完成下肢静脉彩色多普勒超声检查。MR 扫描方法：病人采用仰卧位、足先进方向进行扫描。扫描时联合使用 36 通道的下肢专用线圈以及 6 通道的体部线圈，以覆盖病人整个双下肢范围。整个双下肢静脉血管扫描分为三段式扫描，依次扫描小腿段、膝段及大腿段，结束扫描后，可生成冠状面最大信号强度投影图像。分别由两位磁共振医生对下肢静脉进行显像评分，采取图像质量 5 分制(1:差，2:可，3:中，4:良，5：优）。使用 Wilcoxon 秩和检验分析二者评分间一致性。以单侧下肢为基础，分析 2 名观察者之间诊断下肢静脉曲张表现间一致性.并将两名观察者诊断下肢静脉曲张表现与彩超诊断结果进行比较。
结果:两名磁共振医生的大隐静脉图像质量平均得分分别是 4.78 士 0.29 和 4.67 士 0.60。观察者间一致性好。以双侧肢体为基础，磁共振诊断为 40 条下肢静脉曲张中，经彩超均诊断为曲张静脉。对于这些曲张静脉，两名观察者均作出了与彩超相同的诊断。
结论: 3D-SPACE-STIR MRV 序列作为一种非对比剂下肢磁共振血管造影技术，在下肢静脉成像中，血管信号突出，与周边软组织具有极高对比度。下肢静脉曲张形态学显像质量较高，基于形态及磁共振表现特点成像，即可对下肢静脉曲张做出初步诊断意见。3D-SPACE-STIR MRV 序列可作为一种辅助影像检查工具，联合超声，完善对下肢静脉曲张的评估。

PU-310

# MRI 在婴幼儿先天性髋关节脱位术后随访评价中的应用

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目的：探讨 MRI 在婴幼儿先天性髋关节脱位手术后定期随访评价的应用价值，为临床提供准确可靠的测量数据。
方法：收集 20 例采取临床治疗的先天性髋关节脱位的患儿，年龄范围在 6 个月到 3 岁间，治疗方式主要有：Pavlik 吊带、闭合复位、切开复位、骨盆截骨等，婴幼儿通常应用人字石膏外固定。对患儿治疗前后、随访过程中进行多次 MR 扫描，评价时间节点：术前、术后即刻、术后三周、术后三个月、末次。设备采用西门子 3.0T skyra，序列组合包括定位、冠位 PDWI/fs、轴位 PDWI/fs、T1WI 冠/轴位。冠状位需测量双侧 FAD、股骨头中心到 H 线/P 线的距离（Disp-H、Disp-P）。轴位需测：双侧 FAD（a/b/c）、股骨头中心点相对于 P 线的先后移位距离（Disp-AP）。
结果：测量数据，冠状位 FAD、Disp-H、Disp-P 及轴位上 FAD（a/b/c）、Disp-AP 在术后随访过程中与时间存在明显相关性，FAD 值变小，证明髋臼内股骨头的位置改善；Disp-H 标记点向头侧移位为阴性，向下移位为阳性。Disp-P 标记点向外侧移位为阴性，向内侧移位为阳性。Disp-AP 向后移位为阴性，向前移位为阳性。
结论　MRI 可以作为临床评价婴幼儿髋关节脱位治疗后随访评估的重要影像检查手段。

PU-311

# 胰腺扩散加权成像扫描时间优化：同时多层技术与传统加速技术的比较

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目的：探讨胰腺扩散加权成像（DWI）应用磁共振同时多层（Simultaneous Multi-slice, SMS）技术与传统加速技术的图像质量的系统分析与比较，评估其临床应用的可行性。
材料和方法：前瞻性收集 2019 年 2 月至 6 月在安庆市立医院接受胰腺磁共振扫描的 30 名患者。采用西门子 Skyra 3.0T MRI 扫描仪，18 通道体部线圈及 32 通道脊柱线圈组合使用。三套 DWI 扫描协议分别为：A、EPI-DWI：FOV 400mm×318（79.5%）mm、TR/TE 6000ms/75ms、层厚 6mm、层间距 1.2mm、层数 24、带宽 1776HZ/px、分辨率 1.1×1.1×6 、弥散模式为 3-scan trace、GRAPPA 2、b 值为 50s/mm 2（2 averages）及 800s/mm 2（8 averages），TA 为 3min32s；B、C SMS-DWI：B 协议的 TR 为 3500ms、层数加速因子为 2（AF2），TA 为 2min，C 协议的 TR 为 2500ms、层数加速因子为 3（AF3），TA 为 1min29s，其他参数均与 A 扫描协议完全一致，。图像质量评估：采用配对 t 检验比较 A 和 B（AF2）、A 和 C（AF3）图像 SNR、ADC 值的差异。
结果：与 A 协议相比，B 协议与 A 协议具有相似的 SNR，差异无统计学意义（p=0.162），C 协议 SNR 明显低于 A 标准协议，差异具有统计学意义（p=0.003）；A、B、C 扫描协议在胰腺正常组织及病灶的 ADC 值比较，差异均无统计学意义（P＞0.05）。
结论：在显著减少扫描时间且不会对图像 SNR、ADC 值定量产生影响的情况下，使用 SMS-DWI（AF2）扫描协议能取得很好的临床应用效果；SMS-DWI（AF3）尽管能进一步减少扫描时间，但图像 SNR 明显下降，无法满足临床诊断需求。因此，SMS 作为一种新的磁共振加速技术，在肝脏 DWI 中具有良好的应用前景。

PU-312

# 时间空间标记反转脉冲技术测量肾脏皮髓质面积比与年龄相互关系的研究

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目的：（1）探讨时间-空间双重标记反转脉冲技术（time-spatial labeling inversion pulse，T-SLIP）在肾脏皮髓质分离的应用及显示肾脏皮髓质分离最佳的黑血翻转时间（BBTI）；（2）应用 T-SLIP 技术测量肾脏皮髓质面积比，并研究肾脏皮髓质面积比与年龄的相互关系。
方法:选择健康志愿者 61 例，年龄 17-79 岁；其中男 21 例，女 40 例，分为 17-39 岁、40-59 岁、60-79 岁 3 个年龄组。所有志愿者在东芝 1.5T 磁共振设备上采用结合了 T-slip 脉冲的稳态自由进动（SSFP）序列进行上腹部扫描。每位志愿者在同等条件下分别给予 800 ms、1000 ms、1200 ms、1400 ms、1600 ms 5 组不同 BBTI 值进行冠状面 T-SLIP SSFP 序列扫描。采用 4 分法定性分析图像质量，并运用计算机通过图像训练算法自动分割左侧肾脏皮髓质区域,分别计算皮髓质区域内的平均信号值，得到 3 个年龄组下不同 BBTI 值下各实验组肾脏皮髓质的平均相对信号强度比。定性定量统计分析获得 3 个年龄组最佳的 BBTI 值。同时测量 3 个年龄组在最佳 BBTI 值下的肾皮髓质面积比，统计分析 3 个年龄组的肾皮髓质面积比与年龄的相关性。
结果:61 名受检者均成功完成所有序列磁共振扫描。肾皮髓质分界均能清晰显示。17-39 岁、40-59 岁、60-79 岁 3 个年龄组的最佳 BBTI 值分别为 1200 ms、1000 ms、800 ms。肾皮髓质分离最佳的 BBTI 值与年龄呈负相关性。3 个年龄组的肾皮髓质面积比分别为 0.3228±0.0191、0.3496±0.0142、0.3939±0.0123。肾皮髓质面积比与年龄呈明显负相关。
结论：Time-slip 技术可在不使用造影剂的情况下可使肾脏皮髓质清楚显示，肾皮髓质分离最佳的 BBTI 值随着年龄的增大而减小，因而要根据年龄选择合适的 BBTI 值.肾皮髓质面积比随着年龄的增大而减小。

PU-313

# 正常四肢骨骼肌 T1-mapping 的定量研究 及变异度对比分析

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目的 比较分析 T1-mapping 的 Look-locker 和 B1-corrected VFA 两种成像技术在正常四肢骨骼肌的 T1 值及变异度。方法 对 55 名患者分别行 Look-locker 和 B1-corrected VFA 扫描，采用组内相关系数对不同医师所测 T1 值进行一致性分析；用配对样本 T 检验比较在 Look-locker 和 B1-corrected VFA 成像技术上所测正常四肢骨骼肌 T1 值的差异，以 $P < 0.05$ 为差异有统计学意义；用变异系数（coefficient of variation，CV=方差/平均值）评价所测 T1 值的变异度。 结果 共收集 55 例患者。两位医师分别在 Look-locker 和 B1-corrected VFA 成像技术上所测正常四肢骨骼肌的 T1 值一致性较高，ICC 值分别为 0.856、0.833；在 Look-locker 和 B1-corrected VFA 成像技术上所测正常四肢骨骼肌的 T1 值差异有统计学意义（$P = 0.000$，t 值为-29.907），其变异度分别为 0.062、0.121。结论 在正常四肢骨骼肌上采用 Look-locker 和 B1-corrected VFA 成像技术所得 T1 值间存在差异，在 Look-locker 成像技术上所测正常四肢骨骼肌的 T1 值变异度小，数据稳定性高。

PU-314

# 高分辨弥散定量成像评估骶髂关节活动性病变最适合 b 值的初步研究

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【摘要】目的：探讨高分辨弥散加权成像（RESOLVE DWI）不同 b 值评估中轴型脊柱关节炎(axial spondyloarthritis,SpA)骶髂关节活动性病变效能的差异，以寻求最适 b 值。方法：纳入 70 例临床诊断的 SpA 患者为病例组，17 例排除 SpA 诊断的正常骶髂关节受检者为对照组。病例组分为活动组和非活动组。所有对象均行骶髂关节常规 MRI 及不同 b 值 RESOLVE DWI 检查，观察病例组和对照组骶髂关节软骨下骨髓区域表现，测量感兴趣区表观扩散系数（apparent diffusion coefficient,ADC）值，ADC1 为 b 50、500s/mm2 拟合，ADC2 为 b 5、700s/mm2 拟合，ADC3 为 b 50、500、700s/mm2 拟合，比较不同 b 值 RESOLVE DWI 在对照组与病例组诊断效能。结果：（1）ADC1 和 ADC3 对应的 DWI 图像显示骶髂关节清晰，对比度好；ADC2 对应的 DWI 图像有变形及伪影干扰，对比度差；（2）对照组和病例组骶髂关节骶侧、髂侧关节软骨下骨髓 ADC 值在不同 b 值 RESOLVE DWI 组内对比均无明显统计学差异，P>0.05；（3）病例组、非活动组与活动组骶髂关节软骨下骨髓在不同 b 值的 RESOLVE DWI 的 ADC 值均高于对照组，差异具有显著统计学意义，P＜0.05，其中 ADC3 和 ADC2 值在非活动组与活动组之间差异具有统计学意义，P＜0.05；而 ADC1 在非活动组和活动组之间差异不具有统计学意义，P＞0.05；在对照组和病例组、对照组和非活动组、对照组和活动组、非活动组和活动组之间，ADC3 具有最高曲线下面积，较高灵敏度和特异度，诊断效能优于 ADC2，ADC1 曲线下面积最小，诊断效能最差。结论：多 b 值拟合（b 50、500、700s/mm2）RESOLVE DWI 成像兼顾了图像质量及病灶检出，ADC 值为评估 SpA 骶髂关节活动性病变临床诊断及治疗提供有效定量指标。

PU-315

# 关于 T2_haste-COR 序列在腹部大范围扫描中的应用

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**目的**：探讨 MRI 腹部扫描中 T2_haste-COR 序列成像原理、优化参数及临床应用。

**材料与方法**：T2_haste-COR（half-Fourier acquisition single-shot turbo spin-echo）序列为腹部 MRI 常规序列之一，具体操作：患者需空腹，禁食、水 4 小时以上（怀疑胰腺占位病变的患者，检查前喝 1000ml 水），患者仰卧位，双手上举于头颈部两侧（不交叉），选用腹部线圈，正中矢状面对准线圈竖中心。选择 T2_haste-COR 序列，成像参数：TR=∞，TE=72ms，FOV=400mm,层厚/层间距=4.0mm/0.0mm,激励次数=1 次，扫描次数=3 次，分辨力=1.3x1.3mm。扫描范围；膈肌下方至髂前上棘冠状位大范围成像。优化技术；半傅里叶采集，只需填充 K 空间的一半多一点即可，剩余 K 空间则根据 K 空间对称性原理进行填充，也称半 K 空间技术，在更进一步加快成像速度的同时空间分辨力不变，信噪比（SNR）下降不明显。

**结果**：该序列成像速度快、回波间隙（ES）短，没有纵向弛豫对图像对比的污染，尤其是在特殊患者（儿童、老人）不能进行呼吸配合（闭气）做检查时也没有明显的呼吸运动伪影。由于 ETL

很长，回波链中大部分回拨的 TE 较长，得到 T2WI 的权重很重，也可用于屏气或呼吸触发水成像（MRCP、MRU 等）。

**结论：**磁共振多参数成像特点决定了其在腹部病变（原发、转移）的重要价值，对于妇科病变导致淋巴结肿大患者，除常规盆腔 MRI 检查外应加扫腹部序列。T2_haste-COR 序列成像速度快，扫描范围广。在大范围诊断病灶淋巴结和精准定位检查部位时具有重要意义。

PU-316

# Monitoring the efficacy of TNF-α antagonists in the treatment of Axial Spondyloarthritis-A preliminary study based on MRI biochemical Imaging technique

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Synopsis
This study aimed to evaluate the feasibility of using MRI to monitor the efficacy of tumor necrosis factor-α antagonists in the treatment of SpA (axial spondyloarthritis).
Introduction：
SpA (Axial spondyloarthritis) belongs to serum-negative spondyloarthritis. Early sacroiliac joint involvement is the characteristic manifestation of SpA. Such disease is characterized by younger age of onset, high prevalence rate and long course of disease, which is often characterized by alternating inactivity and active period. In severe cases, it can cause ankylosis of sacroiliac joint and axial spine, which greatly affects the quality of life and working ability of patients. At present, early diagnosis, early treatment, early control and reduction of disease activity to improve the quality of the patient's life is the main purpose of clinical treatment. TNF-α (Tumor necrosis factor-α) antagonists can effectively control inflammation, reduce the active state of SpA disease, delay the progression of SpA, and improve the prognosis. However, there is a lack of scientific and effective quantitative indicators to evaluate the efficacy of active sacroiliitis and TNF-α antagonists in the treatment of active sacroiliitis. Therefore, it is of great significance to find a method for quantitative evaluation of sacroiliac joint inflammation and curative effect evaluation. Quantified MRI parameters, including T1-mapping, T2-mapping, and T2*-mapping, can reflect the change of water content in bone marrow by detecting the small changes of water molecules in tissue, and quantify the degree of subchondral bone marrow edema of sacroiliac joint, which is beneficial to the early diagnosis and condition monitoring of bone marrow lesions. Such technique is expected to provide an effective quantitative index for the monitoring of inflammatory activity and curative effect of SpA. In this study, T1, T2 and T2* mapping methods were used to quantitatively evaluate the changes of subchondral bone marrow edema of sacroiliac joint in axial spondyloarthropathy, so that to provide scientific and effective quantitative indexes for clinical diagnosis, activity staging, curative effect evaluation and monitoring of SpA.
Methods：
From October 2017 to May 2020, 114 patients (69 men and 45 women, mean age, 35.3 years; range, 14–71 years) with including 15 normal sacroiliac joint patients without SpA as a control group, 99 patients with clinically diagnosed SpA as the case group. In the case group,20 patients in the case group who were treated with systematic TNF-α antagonists as the treatment group. According to ASDAS-CRP (ankylosing spondylitis disease activity score), the case group is divided into an Active group and an Inactive group. The Activity group was divided into 3 subgroups: moderate activity group, high disease activity group, and very high disease activity group. According to the different dates of treatment, the treatment group is divided into the pre-treatment, 3-week treatment, 6-week treatment, and 12-week treatment groups (The results are

detailed in Table 1).All patients were scanned by a 1.5T MRI scanner (Magnetom Aera, SIEMENS Healthcare, Erlagnen, Germany) with transverse axial and oblique coronal planing from the upper edge of the pelvis to the acetabulum. The used sequence included conventional transverse axial T1WI, T2WI, T2WI-fs and coronal PDWI-fs, plus coronal T1-mapping (TR 11ms, TE 1.57ms, flip angle 5,27 °, FOV 240mm x 240mm, Matrix 256 x 256, layer thickness 3.0mm, layer number 22 (3D scan), interval 0.6mm, iPAT factor 2, scanning time 2min07s), T2-mapping (TR 1200ms, TE 13.8, 27.6, 41.4, 55.2, 69.0ms, flip angle 180°, FOV 240mm x 240mm, Matrix 256 x 256, layer thickness 3.5mm, layer number 15, interval 0mm, iPAT factor 0, scanning time 5min29s), T2*-mapping (TR 422ms, TE 4.18, 11.32, 18.46, 25.60, 32.74ms, flip angle 60 °, FOV 240mm x 240mm, matrix 256 x 256, layer thickness 3.0mm, layer number 15, interval 0mm, iPAT factor 2, scanning time 3min46s). For data analysis, the differences of T1 mapping value, T2 mapping value and T2* mapping value of bone marrow between the case group and each subgroup were compared. Receiver operating characteristic (ROC) curve analysis was utilized to examine the accuracy of biochemical Imaging values. The decreasing rate of T1 mapping in each group was compared.
Results:
1. There was no significant difference in three kinds of relaxation time in subchondral bone marrow region of sacroiliac joint and iliac joint among different groups (P > 0.05) (table2). 2. Compared with the control group, the values of three different relaxation times in the subchondral bone marrow region of the sacroiliac joint in the case group increased in varying degrees, and T1-mapping shown the best diagnostic efficacy and had a good differential effect between the group with high disease activity and the group with very high disease activity(table3,4).3.The decreasing rate of T1-mapping in the subchondral bone marrow of sacroiliac joint in different treatment periods has a good effect on the monitoring of the curative effect(figure1).
2. Discussion & Conclusions:
This study indicates that T1-mapping technique is preferred in quantitative diagnosis. T1-mapping is superior to T2*-mapping and T2-mapping in the diagnosis of subchondral bone marrow edema of the SpA sacroiliac joint. It can provide quantitative monitoring of inflammatory changes during treatment, which is beneficial to clinical individualized treatment and timely adjustment of the treatment plan.

# PU-317

# 磁共振检查技术在小鼠闭合性颅脑损伤诊断中的应用

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目的：探讨在小鼠闭合性颅脑损伤模型中，磁共振成像在伤情诊断中的应用价值。
方法：选取 60 只 C57 小鼠分为 A、B、C 三组，每组 20 只，其中 A 组为轻型损伤组，B 组为中度损伤组，C 组为重度损伤组，使用 BRUKER 70/20USR 小动物磁共振进行相关扫描，其中各组均采集建模前数据（PRE），并于建模后分别采集 24h、3day、7day 的磁共振数据，每只小鼠进行常规 T1 WI、T2 WI、DTI、1H MRS 及 DCE 扫描，其中 DTI 采用 EPI 序列，基本参数为 TR=3000ms，TE=44ms，Averages=4，层厚 0.5mm,MTX 128×128,FOV 30mm×30mm,Direction 30,B Value(0,1000),测量其 FA 值;波谱成像采用单体素 PRESS 序列，基本参数为 TR=3000ms，TE=20ms，Averages=512，Flip Angle=90°，180°，180°，体素大小为 1.5×1.5×1.5mm$^3$。通过测量各组中 Cr、CHO、NAA、Lip、Lac、Glu/Gln、Ins 等代谢物平均浓度，比较各组之间差异性。DCE 扫描中主要分析 Ktrans、Vp 及 TTP 值。
结果：A 组与 B 组比较，FA 值无明显统计学差异；CHO、Lac 代谢物浓度有显著统计学差异（P<0.05）；B 组与 C 组比较，FA 值有显著统计学差异（P<0.05）；CHO、Lac 代谢物浓度有显著统计学差异（P<0.05）;A 组与 C 组比较，FA 值有显著统计学差异（P<0.05）；CHO、NAA 代

谢物浓度有显著统计学差异（P<0.05）;A、B、C 三组互相比较，Ktrans 值有明显统计学差异；其余无明显统计学差异。
结论：在小鼠颅脑损伤模型磁共振成像中，可通过联合 DTI、MRS 及 DCE 检测结果，判别伤情严重情况，为治疗方案提供有效的保障。

## PU-318

# DCE-MRI 的不同后处理技术在脑胶质瘤分级中的应用比较

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目的：探讨 DCE-MRI 的不同后处理技术在鉴别脑胶质瘤级别的诊断价值。
材料与方法：收集大坪医院共 52 例经术后病理证实的胶质瘤患者,其中Ⅱ级 17 例、Ⅲ级 13 例、Ⅳ级 22 例。所有患者均于术前行 DCE-MRI 检查并取得图像，分别用 Tissue-4D（热点分析）以及点 OK 后处理软件（热点及直方图分析）进行数据分析，获得相应参数值。运用 ANOVA 单因素方差分析比较不同级别胶质瘤参数值的差别，Spearman 等级相关分析各参数与胶质瘤级别的相关性，ROC 曲线分析各参数在鉴别不同级别胶质瘤的 AUC 值。
结果：热点分析获得参数，两个软件 Ktrans 值在不同级别胶质瘤间均有明显差异，Ⅳ级高于Ⅲ级高于Ⅱ级（P<0.05）,Kep 值Ⅳ级低于Ⅱ级（P<0.05），Ve 值Ⅳ级和Ⅲ级高于Ⅱ级（P<0.05）。鉴别Ⅱ级与Ⅲ级、Ⅱ级与Ⅳ级、Ⅲ级与Ⅳ级胶质瘤诊断效能上，Ktrans（OK）参数 AUC 值分别为 0.848、0.949、0.906，Ktrans（Tissue-4D）参数 AUC 值分别为 0.816、0.949、0.749。Ktrans、Ve 与肿瘤分级呈显著正相关（P<0.01），Ktrans（OK）与等级之间相关性最大（r=0.775）。直方图参数，Ktrans 值的 50th，Ve 值的平均值、75th、90th 及 Kep 值的熵、50th 在鉴别Ⅱ级与Ⅲ级、Ⅱ级与Ⅳ级中的差异均具有统计学意义（P<0.05），Vp 值的平均值、能量、熵、50th、75th、90th 及 Kep 值的平均值、能量，鉴别Ⅱ级与Ⅳ级、Ⅲ级与Ⅳ级中的差异均具有统计学意义（P<0.05）。
结论：OK 后处理模式的参数更丰富，Ktrans 值对胶质瘤分级诊断效能最高，其次为 Ve 值，可作为胶质瘤分级后处理分析的主要方法及参数选取的重要临床参考。

## PU-319

# T2-mapping 联合 mDIXON-Quant 鉴别前列腺癌与前列腺增生的应用价值

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目的：T2-mapping 是一种定量的测量组织水分含量的 T2 弛豫时间的 MRI 成像技术。随着组织含水量的增加，T2 的弛豫时间通常会增加。以往的研究表明 T2-mapping 在心肌和关节软骨中的应用较多。然而，据我们所知，其在前列腺病变中的应用很少。本研究旨在探讨 T2-mapping 联合 mDIXON-Quant 在鉴别前列腺癌与前列腺增生中的应用价值。

方法：本研究得到本院的伦理委员会批准。本研究回顾性分析 71 名有前列腺疾患的患者，且都经过病理证实，根据病理结果，患者分为两组：前列腺癌（平均年龄 71.03±7.86 岁，55-94 岁）和良性前列腺增生（平均年龄 67.69±9.40 岁，39-84 岁）。所有患者均行 CX (Philips Healthcare,

the Netherlands) 3.0T 磁共振扫描仪，采用 16 通道腹部线圈，扫描序列包括：DWI、T2-mapping、mDIXON-Quant 详细参数见（表 1）。扫描后数据自动上传到后处理工作站（ISP）。由两名观察者，采用盲法进行测量。测量两组的 T2 值和 mDIXON-Quant 的各参数值。参考 T2WI、DWI 图像，我们将感兴趣区域(ROI)手动放置在具有最大病变的 DWI 图像的高信号区域上。然后将 mDIXON-Quant 和 T2-mapping 图像与 DWI 图像融合，以确保在同一位置进行 ROI 测量（见图 1）。在病灶显示最大层面手动勾画 3 个 ROI，计算 T2 值和 R2*值的平均值。统计分析采用 SPSS 19.0 统计学软件。两名观察者间的一致性采用组内相关性分析（ICC），两组间各定量参数比较采用 t 检验。采用逻辑回归和 ROC 曲线进行诊断效能分析，诊断效能的比较采用 Delong 检验。

结果：2 名观察者测得的两组各参数值一致性良好(ICC 均>0.75)（表 2）。 前列腺癌组的 T2 值显著低于前列腺增生组(P<0.05)，前列腺癌组 R2*值显著高于前列腺增生组(P<0.05)（表 3）。各参数值诊断效能良好，在 ROC 曲线中，T2 值和 R2*值的 AUC 值均大于 0.7（AUCT2=0.837，AUCR2* = 0.700 ， P），Delong 检验差异无统计学意义。T2 值联合 R2*值的诊断效能高于 T2 值、R2*值的单独诊断效能（AUCT2+R2* = 0.860）。

结论： T2 值和 R2*值能够用于鉴别前列腺癌与前列腺增生，诊断效能良好，T2 值联合 R2*值的诊断效能得到提高。而 MRI 作为一种无创的检测手段，利用 T2-mapping 与 mDIXON-Quant 两功能序列联合，对前列腺癌和良性前列腺增生进行鉴别，为临床提供了一种比较有价值的诊断方式。

# PU-320

# 不同压缩感知因子对脑 SWI 图像质量及核团铁定量的影响

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**目的：**优化压缩感知（Compressed SENSE，CS）技术加速因子（Acceleration Factor, AF），寻找脑 SWI（Susceptibility Weighted Image, SWI）图像质量与灰质核团铁定量的最适 AF。**材料和方法：**征募 40 名志愿者（平均年龄：38.6±17.3 岁，范围：13-84 岁，女性 29 名，男性 11 名）进行头部 3.0TMRI 检查，包括 SWI 序列（加速因子 AF=0 及 CS SENSE 2、4、6、8、10)。扫描参数详见表 1。利用核磁共振信号处理（Signal Processing in Nuclear Magnetic Resonance, SPIN）软件对 SWI 的相位图像进行后处理和测量，在尾状核（head of caudate nucleus, HCN）、壳核（putamen nucleus, PUT）、苍白球（globus pallidus, GP）、丘脑枕（thalamus pulvinar, TP）、红核（red nucleus, RN）、黑质（substantia nigra, SN）、齿状核（dentate nucleus, DN）及顶叶白质（white matter of parietal lobe, PWM）手动勾画 ROI（图 1），测量相位值（phase value, PV）并计算信噪比（signal to noise ratio, SNR）及对比信噪比（contrast to noise ratio, CNR）。使用 Cohen's κ 对图像主观评价的一致性进行分析，通过计算组内相关系数（ICC），分析 PV 值测量结果组内一致性。使用单因素 ANOVA 中最小显著性差异法（LSD）对比不同加速因子条件下图像质量及定量差异，*P* 值经 FDR 校正（$P_{校正}$<0.05）。**结果：**6 个加速因子的 SWI 扫描时间依次为 5min53s、3min21s、1min41s、1min8s、51s 和 41.1s。2 名放射科医师对图像主观评分一致性好（$\kappa$＞0.60），PV 值测量结果具有高度一致性（ICC＞0.80）。随 AF 增加，PUT 和 GP 之间界线逐渐模糊，以 AF=8 为著（图 2）。由图 3、4 可见，双侧 SNs、DNs 的 SNR、CNR 在 AF=4 时开始出现差异（$P_{校正}$＜0.05），而其它核团在 AF≥6 时出现差异（$P_{校正}$＜0.05）。图 5 所示，与 AF=0 图像相比，双侧 SNs、DNs 的 PV 值在 AF=2 时即出现差异（$P_{校正}$＜0.05），而其它核团在 AF≥8 才出现差异（$P_{校正}$＞0.05）。**结论：**压缩感知技术有效的缩短 SWI 扫描时间，采用加速因子 CS SENSE 2 对脑 SWI 图像质量没有影响，扫描时间缩短 2min32s(43.06%)；而灰质核团的量化建议采用无加速因子图像。

PU-321

# 不同压缩感知因子对脑 SWI“燕尾征”显示的影响

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**目的：**比较不同脑压缩感知（Compressed SENSE, CS）SWI 的加速因子（acceleration factor, AF）对中脑“燕尾征（swallow tail sign, STS）” 显示，寻找最适 AF。**材料和方法：**征募 40 名健康志愿者（平均年龄：38.6±17.3 岁，范围：13-84 岁，女性 29 名，男性 11 名）进行头部 3.0T MRI 检查，包括压缩感知（CS）-SWI 序列 （加速因子 AF= 0 及 CS SENSE 2、4、6、8、10)。扫描参数详尽列于表 1。利用核磁共振信号处理（Signal Processing in Nuclear Magnetic Resonance, SPIN）软件对 SWI 的相位图像进行后处理和测量，对黑质（substantia nigra, SN）和顶叶白质（white matter of parietal lobe, PWM）手动勾画 ROI（图 1），测量信噪比（signal to noise ratio, SNR）、对比信噪比（contrast to noise ratio, CNR）和相位值（phase value, PV）；计数不同 AF 中“STS”显示数量。使用单因素 ANOVA 中 LSD 方法对比不同加速因子条件下图像质量及定量差异，*P* 值经 FDR 校正（$P_{校正}$<0.05）。使用 Cohen’s κ 对黑质和燕尾征主观评价的一致性进行分析；通过计算组内相关系数（ICC），分析相位值测量结果的重复测量之间的一致性。**结果：**6 个加速因子（0, 2, 4, 6, 8, 10）的 SWI 序列的扫描时间分别为 5min53s、3min21s、1min41s、1min8s、51s 和 41.1s。2 名放射科医师的主观评分一致性好（κ＞0.60）。重复测量数据结果之间具有高度一致性（ICC＞0.80）。随 AF 增加，当 AF=6 时，“STS”表现清晰度明显下降（图 2），且表现出 STS 的数量也随着 AF 增加而减少（表 2）。由图 3 可知，双侧 SNs 的 SNR 和 CNR 在 AF=2 时开始出现差异（$P_{校正}$＜0.05）。与 AF=0 图像相比，双侧 SNs 的 PV 值在各个 AF 条件下均出现明显差异（$P_{校正}$＜0.05）。**结论：**由中脑 SWI 图像定量数据结果可知，“STS”的定量分析建议使用原始图像，对“STS”结构的观察可根据 SNR、CNR 以及主观评分和数量变化，最适 AF 可考虑 CS SENSE 2，扫描时间减少 43.06%（2min32s）。

PU-322

# 对比分析不同场强对磁共振 IDEAL-IQ 技术腰椎椎体脂肪定量的影响

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目的：探讨不同场强下磁共振（Magnetic Resonance Imaging，MRI）非对称回波的最小二乘估算法迭代水脂分离序列(iterative decomposition of water and fat with echo asymmetry and least-squares estimation-iron sequence, IDEAL-IQ)对腰椎椎体脂肪定量评估的影响。材料和方法：于 2018 年 4 月至 6 月在我院招募健康志愿者 21 名，均为女性，年龄 21～50 岁，平均（27.95±9.92）岁。所有志愿者分别在 1.5T MRI 和 3.0T MRI（Signa HDxt，GE Medical System, Inc, Waukesha, WI, USA）设备上进行腰椎 MRI 常规序列以及 IDEAL-IQ 序列检查，同一患者的检查在 4～6 小时内完成。在 GE AW4.6 工作站测量 L1～L5 椎体脂肪分数（fat fraction，FF）（%）值，并比较不同场强 MRI 腰椎椎体 FF 值的差异。所有数据经 SPSS 19.0 进行统计分析。采用 Shapiro-Wilk 检验分析数据的正态性。采用组内相关系数（intra-class correlation coefficients，ICC）检验两位观察者测量数据的一致性。应用 Bland-Altman 法分析 1.5T 和 3.0T 不

同场强 MRI 测量 FF 值的一致性，并采用配对样本 t 检验对比分析不同场强下腰椎椎体 FF 值。Pearson 相关分析用于比较不同场强 MRI 测量 FF 值的相关性。结果：IDEAL-IQ 技术定量测量腰椎各椎体 FF 值在 1.5T 和 3.0T MRI 间无明显统计学差异（P>0.05），且两种场强下测得的腰椎椎体 FF 值高度相关（r=0.978，P<0.01）；Bland-Altman 法分析结果显示 1.5T 和 3.0T MR 定量测量腰椎椎体（L1～L5）FF 值具有较高的一致性，95%一致性界限（下限-1.3403，上限 1.5689）。结论：磁共振 IDEAL-IQ 技术可精确定量腰椎椎体脂肪含量，其结果在 1.5T 和 3.0T 场强下具有较高的一致性和可靠性。

## PU-323

# 3D-TOF 结合图像融合后处理技术对颌面部肿瘤术前引导的价值研究

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目的：比较 3D-TOF、CE-MRA 技术、CT 增强分别结合图像融合后处理技术对于颌面部包块患者的手术前评估优劣，以提供更好的临床支持。方法：回顾性分析 2019 年 3 月～2019 年 6 月期间在我科行颌面部 MRI 检查的 11 例患者，均选择 3D-TOF（A 组）及 CE-MRA（B 组）病灶区图像采集，其中 9 例患者行颌面部 CT 增强检查（C 组）；分别比较病灶周围图像的信噪比（SNR）、对比噪声比（CNR）、血管与病灶的关系显示优良情况由两名有独立诊断经验的放射诊断医师对影像进行评价。结果：①SNR：A 组＞C 组＞B 组，差异有统计学意义（P＜0.05）；②CNR：A 组＞C 组＞B 组，差异有统计学意义（P＜0.05）；③影像质量评价：A 组＞C 组＞B 组，差异有统计学意义（P＜0.05）。结论：CE-MRA 能动态的显示病灶及血管的供血过程但由于采集时间较短图像信噪比较低，对于病灶及周围血管间关系显示较差；CT 增强检查由于病灶的强化时机与周围动脉的强化时机差异较大不能在同一期相显示，导致病灶与周围血管关系显示不佳；3D-TOF 结合图像融合后处理技术对于病灶显示及病灶与周围血管间的关系显示最优，且无辐射危害、无需注射对比剂，降低了患者风险，能为临床手术引导提供更好的支持。

## PU-324

# 基于压缩感知的 3D mDixon Quant 对腰椎椎体脂肪含量的定量研究

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目的：探讨敏感度编码(sensitivity encoded，SENSE)和压缩感知(compressed SENSE，CS)不同加速因子(acceleration factor，AF)对 3D mDixon Quant 技术腰椎椎体脂肪定量的影响，并分析腰椎椎体脂肪含量(fat fraction，FF)与年龄、性别和体质量指数(body mass index，BMI)的关系。材料与方法：招募健康志愿者 96 名（男性 45 名，女性 51 名），年龄 16～79 岁，平均年龄(43.85±17.98)岁。将志愿者按照年龄段分为 3 组，青年组(＜40 岁)、中年组(40～60 岁)、老年组(＞60 岁)。在 Philips Ingenia CX 3.0 T MRI 设备上采用 3D mDixon Quant 序列并使用不同加速技术(SENSE 和 CS)结合不同 AF(SENSE AF=2、4)和(CS AF=2、3、4、5、6、7、8)对志愿者行全腰椎扫描。两名放射科医师在 Philips ISP (IntelliSpace Portall Version7)工作站上采用双盲法测量腰椎椎体(L1～L5) FF 值，并对不同 AF 时图像信噪比(signal noise ratio，SNR)、对比噪声比(contrast noise ratio，CNR)及扫描时间进行比较。

结果：两名观察者测量结果具有良好的一致性(ICC 值均＞0.75)。不同 AF 时 3D mDixon Quant 序列测量腰椎椎体 FF 值无明显统计学差异(P=0.653)，但不同 AF 时 SNR 和 CNR 有明显统计学差异(P=0.001、0.006)。其中，CS3 和 CS7 组、CS4 和 CS7 组、CS4 和 CS8 组间 SNR 和 CNR 差异有统计学意义(P＜0.05)。CS6 时扫描时间较 SENSE 2 时缩短了 60.66%，但 FF 值、SNR 和 CNR 较其他组(S2、S4、CS2、CS3、CS4、CS5)而言无明显统计学差异(P＞0.05)。腰椎椎体 FF 值在 3 个年龄组间有明显统计学差异(F=20.876，P＜0.01)。其中，青年组 FF 值分别小于中年组与老年组，差异有统计学意义(P＜0.01)，而中年组与老年组间差异无统计学意义(P=0.086)。青年组中，男性腰椎椎体 FF 值高于女性(P＜0.05)，而在中年组和老年组，男性 FF 值略低于女性，但无统计学差异(P＞0.05)。男性腰椎椎体 FF 值与 BMI 呈中等正相关(r=0.634，P＜0.01)，而女性 FF 值与 BMI 无相关性(r=0.207，P=0.146)。
结论：3D mDixon Quant 序列结合 CS 技术评估腰椎椎体脂肪含量是可靠的，且选择 CS 的 AF 最大为 6 时可在保证图像质量的同时大大缩短扫描时间，实现脂肪含量的快速、精准测量。年龄、性别和 BMI 等因素均对腰椎椎体脂肪含量产生影响，在对不同个体进行腰椎椎体脂肪含量分析和评估时应综合考虑这些影响因素。

## PU-325
# T1 mapping 在直肠腺癌分级及分期中的初步应用

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目的 探讨 T1 mapping 在直肠腺癌病理类型鉴别、分级及分期中的应用价值。材料与方法 以 93 例临床病理证实为直肠腺癌的患者为研究对象，行高分辨 MRI、DWI、增强前及增强后 T1 mapping 扫描，测量增强前 T1 弛豫时间（T1pre）、增强后 T1 弛豫时间（T1post）及 ADC 值。结果 直肠黏液腺癌 T1pre、T1post、ADC 值高于普通腺癌，差异具有统计学意义([2069.7±223.0ms] vs. [1558.8±251.3ms], [892.4±304.4ms] vs. 582.9±114.5ms], [1.66±0.14ms] vs. [0.98±0.12ms]，P<0.05)；在直肠普通腺癌组，高级别腺癌 T1pre、T1post 值高于低级别腺癌，ADC 值低于低级别腺癌，T1pre 值差异具有统计学意义([1792.5±370.8ms] vs. [1501.5±174.4ms], P<0.05)，T1post、ADC 值差异无统计学意义（P＞0.05）；pT1-2 期 T1pre、T1post 值低于 pT3-4 期，ADC 值高于 pT3-4 期，差异无统计学意义（P＞0.05）；pN1-2 组 T1pre、T1post 值高于 pN0 组，ADC 值低于 pN0 组，差异无统计学意义（P＞0.05）。结论 T1 mapping 可以鉴别直肠普通腺癌与黏液腺癌，平扫 T1 值对直肠腺癌的分级具有一定的诊断价值。

## PU-326
# 功能磁共振 T2、T2* Mapping 技术在糖尿病性黄斑水肿的应用价值

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**目的** 探讨功能磁共振 T2 、T2* mapping 技术对糖尿病性黄斑水肿的诊断价值。
**方法** 前瞻性入组 2020 年 11 月至 2021 年 5 月在云南大学附属医院就诊的糖尿病性黄斑水肿（diabetic macular edema，DME）患者 23 人（27 只眼），其中 18 人（21 只眼）为激光治疗术后，均排除其他眼底疾病，收集临床资料，在首次抗 VEGF 治疗前行功能磁共振检查。磁共振检查包括眼眶轴位、冠状位及矢状位 T2WI、眼球 T2 、T2* mapping 扫描。另 20 名年龄、性别匹配的

无糖尿病、无高血压、无眼底疾病的健康志愿者作为对照组，入组者均行眼底照相、血糖及糖化血红蛋白检测、测量血压，筛除一位患者的右眼（眼底照相有眼底出血），共计 20 名（39 只眼）。由两位眼眶影像诊断经验超过 5 年的医生进行重复测量取平均值。取 ROI 为 0.5mm2 分别测量视网膜上 6 个区域（黄斑区、视盘区、内直肌眼环附着点交角（鼻侧）、外直肌眼环附着点交角（颞侧）、以及视盘区与鼻侧中点（鼻中）、视盘区与颞侧的中点（颞中））以及该 6 个区域对应视网膜前方 6 个区域的 T2、T2* 值；采用统计学非配对 t 检验分析比较对照组与病例组的 T2、T2* 值的差异，并将 T2*mapping 结果与眼底镜结果进行比对,Bland–Altman 分析评价诊断试验一致性，组内相关系数(ICC)来评估观察者的一致性。

**结果** 病例组 12 个 ROI 的 T2 值均高于对照组（*P* 均<0.05），差异有统计学意义；病例组鼻侧、颞侧、颞中、视盘区前方、黄斑区前方、鼻中前方、颞中前方 ROI 的 T2*值均低于对照组（*P* 均<0.05），差异有统计学意义；病例组视盘区、黄斑区、鼻中、鼻侧前方、颞侧前方 ROI 的 T2*值无统计学意义（*P*>0.05）；Bland–Altman 图显示 T2*mapping 与眼底镜对视网膜出血检出率一致性良好。两个观察者间具有良好的 ICC 系数（ICC＝0.85）。

**结论** T2 mapping 技术可以定量反映 DME 患者视网膜组织水肿及视网膜微血管渗透功能，T2* mapping 技术定量反映 DME 患者视网膜区微量出血，眼球 mapping 技术具有良好的临床运用前景。

PU-327

# 压缩感知技术在腰椎磁共振快速成像中的应用

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目的 探讨压缩感知（Compressed SENSE，CS）不同加速因子（Acceleration Factor，AF）对腰椎磁共振图像质量的影响。方法 招募 24 例受检者（男 10 例，平均 42.96±13.81 岁）。Philips Ingenia CX 3.0T MRI（Philips Healthcare，Best，the Netherlands）设备行结合平行采样技术（Sensitivity Encoding，SENSE）以及 CS 的腰椎矢状位 T1WI、T2WI 和轴位 T2WI 序列扫描，采用的 AF 分别为无加速、SENSE AF=2、CS AF=2、3、4、5。两观察者在矢状位 T1WI、T2WI 和轴位 T2WI 划定感兴趣区（Region Of Interest，ROI）测量信号强度（Signal Intensity，SI）和噪声强度(Standard Deviation，SD)，并计算信噪比（Signal to Noise Ratio，SNR）和对比噪声比（Contrast to Noise Ratio，CNR）。对图像质量进行四分法主观评分。组内相关系数（intraclass correlation coefficient，ICC）、Kappa 检验两观察者测量数据和主观评分的一致性，若一致性良好，选择高年资医师主观评分进行后续分析。使用 Friedman 检验三个序列不同 AF 之间 SNR、CNR 及主观评分的差异性。若差异性有统计学意义，使用最小差异性检验（LSD 法）进行两两比较。结果 两观察者测量数据和主管评分一致性良好（p=0.757-0.997）。Friedman 检验矢状位 TSE-T1WI、T2WI、轴位 TSE-T2WI 不同 AF 间 SNR、CNR 及评分差异有统计学意义（p＜0.01）。两两比较结果当 CS=5 时，矢状位 T1WI 的 SNR、CNR 和主观评分较常规序列差异有统计学意义（p＜0.05）；当 CS=4 时，矢状位和轴位 T2WI 的 SNR、CNR 和主观评分较常规序列差异有统计学意义（p＜0.05）。结论 腰椎 MR 扫描时间随着 AF 的增加，扫描时间逐渐降低，在保证图像质量的前提下，临床推荐 AF 分别为 4、3、3 行腰椎矢状位 T1WI、T2WI 和轴位 T2WI 序列扫描。

PU-328

# 3D PC MRA 技术在颈部动脉的应用

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目的 比较 PC 相位法磁共振血管成像（PC-MRA）和高分辨增强磁共振血管成像（CE-MRA）对颈部动脉成像效果及各级血管的显示。
方法 采用 60 例随机患者同时作 PC 相位法磁共振血管成像（PC-MRA）和高分辨增强磁共振血管成像（CE-MRA），进行自身对照，分别对血管段显示、血管信号强度和静脉污染进行评分；以高分辨增强磁共振血管成像为标准，对颈动脉分叉、颈总动脉起始部狭窄进行评价。
结果 与 CE-MRA 比较，PC-MRA 评分 4 分血管段显示比例低（Z=-3.13,Z=-3.16,P＜0.05）。静脉污染：PC-MRA 与 CE-MRA 比较，出现静脉污染比例略高（Z=-8.62，P＜0.05）。PC-MRA 诊断颈总动脉分叉处狭窄及颈总动脉起始部狭窄与 CE-MRA 基本一致。
结论 PC-MRA 能实现满足临床基本诊断的颈部动脉图像,对于颈总动脉分叉处、颈总动脉起始部及两处狭窄与 CE-MRA 显示无明显差异。由于 PC-MRA 成像无需使用钆对比剂，避免了钆对比剂对肾的毒性作用，临床适应症更广，且可以短期内重复检查，可以作为颈动脉血管疾病的临床筛查手段。

## PU-329

# 磁共振 T2mapping 技术鉴别腮腺肿瘤的应用

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目的 本文旨在评价 T2mapping 技术在腮腺肿瘤鉴别诊断中的价值。方法 回顾性分析 2018 年 6 月至 2020 年 7 月郑州大学第一附属医院就诊经病理证实的 73 例单发腮腺病变患者资料，术前均行常规 MRI 及 T2 mapping 成像检查。测量病变的 T2 均值，采用 t’检验分析腮腺良恶性肿瘤 T2 值的差异，用单因素方差分析比较腮腺多形性腺瘤、Warthin 瘤和恶性肿瘤 3 组间 T2 均值的差异，运用受试者工作特征（ROC）曲线评价 T2 值的诊断价值。结果 良恶性肿瘤的 T2 均值差异有统计学意义（P<0.05），以 T2 值为 98.1ms 为临界点判断腮腺良恶性肿瘤的曲线下面积（AUC）为 0.692，灵敏度为 64.6%，特异度为 85.7%。多形性腺瘤、Warthin 瘤和恶性肿瘤三组 T2 均值比较，差异有统计学意义（P＜0.001），两两比较显示，除恶性肿瘤和 Warthin 瘤两组比较差异无统计学意义外（P=0.175），其余各组两两比较差异均有统计学意义（P<0.05）。以 T2 值为 91.25ms 为临界点诊断多形性腺瘤与恶性肿瘤的 AUC 为 0.832，灵敏度为 79.6%，特异度为 94.3%。以 T2 值为 80.75ms 为临界点诊断 Warthin 瘤与恶性肿瘤的 AUC 为 0.914，灵敏度为 93.2%，特异度为 89.8%。结论 T2 mapping 技术鉴别诊断腮腺良恶性肿瘤具有一定参考价值。
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## PU-330

# 磁共振同时多层（SMS）加速技术在乳腺单次激发平面回波扩散加权成像中的可行性研究

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目的：探讨应用磁共振同时多层（Simultaneous Multi-slice, SMS）加速技术对乳腺单次激发平面回波扩散加权成像（DWI）的图像质量进行系统分析，评估其临床应用的可行性。 材料和方法：搜集应用 Siemens Skyra 3.0T MRI 进行乳腺磁共振扫描的 60 例患者（乳腺癌病灶 30 个、纤维腺瘤 17 个、正常 13 例）。三套 DWI 扫描协议分别为：A 协议-经典单次激发平面回波 DWI（EPI-DWI）：FOV 360mm×227.4mm、TR/TE 5200ms/72ms、层厚 5mm、层间距 1 mm、层数 30、分辨率 0.9×0.9×5mm$^3$、弥散模式为 3-scan trace、b 值为 50 及 800 s/mm$^2$，扫描时间为 2min31s；B、C（SMS-DWI）协议：除 TR 时间以外其他参数均与 A 扫描协议完全一致，B 扫描协议的为 TR 2600ms、层面加速因子为 2（AF2），扫描时间为 1min15s，C 扫描协议的 TR 为 1800ms、层面加速因子为 3（AF3），扫描时间为 55s。图像质量评估：以经典平面回波（A 协议）为参考标准，（1）主观评价：对 B（AF2）和 C（AF3）协议图像质量进行分级评估；（2）客观评价包括图像信噪比（SNR）、乳腺正常腺体实质及病灶的 ADC 值。采用配对 t 检验比较图像 SNR、ADC 值的差异，观察者组间及组内的主观评价、SNR 和 ADC 值一致性评估应用 ICC 进行比较。 结果：与 A 扫描协议相比，C（AF3）协议图像质量明显降低（ICC=0.4），B（AF2）协议表现出稳定的图像质量（ICC=0.9）。A、B（AF2）、C（AF3）扫描协议的图像 SNR 分别为 21.2±3.0、19.8±3.3、15.3±3.7，B（AF2）协议与 A 协议差异无统计学意义（p=0.162），C（AF3）协议 SNR 明显低于 A 标准协议，差异具有统计学意义（p＜0.05）。B（AF2）、C（AF3）协议分别与 A 协议乳腺正常腺体实质及病灶 ADC 值比较，差异均无统计学意义（p＞0.05）。 结论：在显著减少扫描时间且不会对图像 SNR、ADC 值产生影响的情况下，使用 SMS-DWI（AF2）扫描协议能取得很好的临床应用效果；SMS-DWI（AF3）尽管能进一步减少扫描时间，但图像 SNR 明显下降。因此，SMS 作为一种新的磁共振加速技术，在乳腺单次激发平面回波 DWI 中具有良好的应用前景。

## PU-331

# 梅尼埃病经鼓室注射钆造影剂的 MR 内淋巴积水显像

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目的：通过经鼓膜穿刺鼓室内注射造影剂钆，应用三维 MR 液体衰减快速翻转恢复序列成像技术（FLAIR MR），探讨其对梅尼埃病内淋巴积水判断的应用价值。材料与方法：对 14 例确诊为梅尼埃病的患者（单侧 12 例，双侧 2 例）经双侧鼓膜穿刺、鼓室内注射钆喷酸葡胺稀释液，24 小时后使用 3.0T GE MR3D－cube 序列进行内耳扫描，而后工作站进行图像重建、分析，以横断位水平半规管层面前庭内淋巴占全部内耳面积 1/3 以上判断为前庭内淋巴积水。结果：磁共振内耳 FLAIR 成像对 14 例 28 耳均清晰区分内耳内外淋巴间隙，内淋巴间隙显示为膜迷路低信号暗区，外淋巴液呈高信号，显示梅尼埃病的患侧均有内耳前庭内淋巴积水（16/16）。14 例患者均随访均未见鼓膜穿孔、感染等并发症。结论：经鼓室注射钆造影剂，GE MR 3D－cube 成像技术可以区分内耳内外淋巴间隙，可以作为梅尼埃病膜迷路积水的直接显示方法。

## PU-332

# Tumor-fat on MRI response to neoadjuvant chemotherapy in HER2 positive breast cancer

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Objective: The purpose of this study was to evaluate the value of the tumor-fat measured on MRI for predicting pathologic complete response (pCR) in HER2 positive breast cancer patients treated with Neoadjuvant chemotherapy (NAC).
Materials and methods
This study has been approved by the local IRB. Twenty patients (49.95±10.52,range: 24-68years) in HER2 positive breast cancer with NAC enrolled in local hospital from May 2020 to July 2021 were included in this retrospective study, who were divided into two groups : Group 1, 12 patients with pCR; Group 2, 8 patients with non-pCR, and underwent the breast MR scans on a 3.0 T MR scanner (Ingenia CX, Philips Healthcare, the Netherlands) using the CS 3D mDIXON-Quant sequence (CS factor=2). On the vendor-provided post-processing workstation (IntelliSpace Portal, Philips healthcare), the threshold extraction and the traditional ROI-based methods were used by two observers for quantification of tumor-fat fraction for all patients. The change value of tumor fat content (ΔT-fat) after NAC was calculated. The intra-class correlation coefficient (ICC) method was used to confirm the measurement stability between the two observers. The mean values of fat contents measured by the two observers were used to perform the K-W test for evaluation of measurement correlation between the two groups.
Results
A representative set of images of pCR and non-pCR patients along with the ROI placements are shown in Figure 1. ΔT-fat was significantly different between the two groups (p = 0.030).
Conclusion
Our results suggest that the ΔT-fat is a potential prognostic imaging biomarker to predict the treatment response to neoadjuvant chemotherapy in HER2 positive breast cancer.

## PU-333

# 磁共振扩散峰度成像参数与鼻咽癌 EGFR、Ki-67 表达相关性的研究

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目的：磁共振扩散峰度成像参数平均扩散率(mean difusivity,MD)、各向异性分数(fractional anisotropy,FA)和径向扩散率(radial diffusion,)、轴向扩散率(axial diffusion,AD)与鼻咽癌 EGFR、Ki-67 表达相关性的研究。资料与方法：对 74 例病理证实的鼻咽鳞状细胞癌治疗前行磁共振扫描，以 EGFR、Ki-67 基因是否突变作为分组依据，分别将 MD、FA 、RD 、AD 在 EGFR、Ki-67 突变组别间进行两独立样本 T 检验，采用受试者工作特性（ receiver operating characteristic，ROC）曲线分析 MD、FA 、RD 、AD 对 EGFR、Ki-67 突变的诊断效能。结果：EGFR 基因突变组与非突变组间的 MD、FA 具有差异性（P<0.05），ROC 曲线下面积分别为为 0.819（P<0.05）、0.723（P<0.05）； Ki-67 基因突变组与非突变组间的 MD 具有差异性（P<0.05），ROC 曲线下面积为 0.756（P<0.05）；结论：MD、FA 对预测鼻咽鳞状细胞癌 EGFR 突变具有一定意义，其中，MD 的预测价值要优于 FA；MD 对预测鼻咽鳞状细胞癌 Ki-67 突变具有一定临床意义。

## PU-334

# X 线与 MRI 检查对骨质疏松性骨折诊断的价值

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目的：X 线平片、CT、MRI 检查诊断应力骨折诊断的价值。

方法：选定 X 线平片、CT 平扫（3D、MPR 重建），MRI 常规序列进行检查。选择 23 例患者，年龄 65-75 岁，平均为 70 岁，均没有暴力外伤史，8 例膝关节检查，5 例股骨颈检查，10 例腰椎检查，其中 18 例行 X 线、CT、MRI 检查，5 例 MRI 检查。
结果：7 例 X 线 DR 检查未见骨质异常，软组织略肿胀，1 例骨纹理紊乱，3 例 CT 平扫加 MPR 重建骨小梁紊乱，4 例骨皮质连续性欠佳，骨小梁紊乱，6 例 MRI 检查骨质内 T1 条带状低信号，T2 及压脂高信号，骨髓水肿，软组织肿胀，1 例骨质内散在 T1 低信号，T2 及压脂高信号。2 例股骨颈行 X 线及 CT 检查未见骨折征象，20 天复诊 X 线发现股骨颈边缘可见骨痂生成，3 例行 X 线检查未见骨折，行 MRI 检查股骨颈内 T1 低 T2 及压脂高信号，骨纹理断裂信号，股骨颈骨髓水肿，软组织肿胀。7 例腰椎患者行 X 线检查腰椎退行性变，CT 检查骨质密度不均匀，MRI 检查 T1 低 T2 及压脂高信号，骨纹理见线形信号影，3 例 MRI 检查 T1 低 T2 及压脂高信号，骨纹理见线形信号影。这些患者均为年龄偏大，骨质疏松为著，根据以上检查发现 MRI 诊断衰竭骨折为最佳检查方法。
结论：诊断应力骨折患者首选 MRI 为著，CT，X 线为辅价值更高。

## PU-335

# 儿童 MRI 检查颈胸椎疾病新发现

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目的：儿童颈胸椎结合部不适，MRI 检查颈椎疾病的新发现。
方法：利用低场开放式 MRI 平扫，T1WI、T2WI 及脂肪压制序列对儿童颈椎疾病的诊断。
结果：该组病人 30 例，年龄为 12-16 岁儿童，男女比例几乎相等，在季节变换明显的地区，夏天发现儿童颈胸部软组织凸起明显，部分出现头晕、颈部及肩部不适症状，患者家属发现后及时到医院就诊，临床触诊及外部观察为软组织内肿物，建议 MRI 检查。MRI 诊断为颈椎曲度变直，椎间盘及椎体信号正常，后缘颈胸部为脂肪信号堆积所致。仔细询问病史，30 例患者均为留守儿童，父母外地打工，孩子跟着爷爷奶奶或外公外婆在家上学，由于老人溺爱孩子对其管教不严，放学后、假期内玩手机游戏，低头看视频，不正确的学习姿势等。长期低头致使颈椎曲度变化，颈胸部脂肪堆积，引发后缘软组织凸起明显。
结论：成年人引发的颈椎病在治疗中方法几乎相同，儿童引发的颈椎病需要谨慎治疗，在防范中应加强颈部肌肉的锻炼，正确的学习姿势也非常重要，严防儿童长时间玩手机和电脑游戏。

## PU-336

# MRI 与 X 线对非人工植入金属伪影诊断的价值

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目的：X 线平片、MRI 检查非人工植入金属伪影诊断。
方法：在 MRI 常规序列进行检查中发现，头颅、膝关节无手术内置入物，无外伤史，外表未见异物。2 例头颅 MRI 常规检查，3 例膝关节 MRI 常规检查，图像完全影响诊断 3 例，伪影 2 例。
结果：2 例头部不适，年龄 59 岁，临床诊断脑血管病，建议 MRI 检查，在额部、鼻窦处可见条索状高信号伪影，技师多次询问患者、无手术史、无外伤史，检查患者体表未见异物，更换患者检查后，证实线圈、机器没问题。3 例膝关节检查，平均年龄 45 岁，临床以半月板损伤为诊断检查 MRI，膝关节 2 例伪影过大不能检查，1 例不影响半月板诊断。以上 5 名患者均进行了 X 线平片检查，2 例头颅内额部、鼻窦炎皮下点状高密度金属影。3 例膝关节检查，2 例关节囊内高密度金属

影，1 例皮下高密度金属影。不能 MRI 检查的为多发和异物较深。以上 5 名患者均为工地电焊工，诱因为电焊喷发的铁粉贱至体表毛孔，铁粉随血液流动等原因从浅表到深部，引发患者疾病。
结论：询问患者自述无手术史和外伤史，但 MRI 检查出现伪影时，一定要进行普通 X 线检查，严重的要 CT 扫描确定金属异物的实际方位，影响患者健康的呈度进行评估，检查前患者病史、职业进行询问，确保患者健康为第一。

## PU-337

# MRI 对老年人应力性骨折的影像学分析

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目的：DR 平片、CT、MRI 检查对应力骨折的影像学分析。
方法：选择 DR 平片、CT 平扫（3D、MPR 重建），MRI 常规序列进行检查。
结果：本组选择 30 例患者，年龄 50-75 岁，平均为 63 岁，18 例腰椎检查，12 例膝关节检查，其中 18 例行 DR、CT、MRI 同时检查。12 例行 MRI 检查。本组 18 例腰椎患者均年龄偏大，无直接外伤史，多因弯腰、坐凳子骶起身快后出现腰部不适。膝关节 12 例患者 9 例跑步运动量过大，3 例患有严重骨性关节炎。
结论：应力性骨折指由节律性的反复阈值损伤所引起的骨连续性破坏，分疲劳骨折与衰竭骨折。前者发生于正常骨折，多见于参运动后或行军时。后者发生于骨矿物质含量减少或弹性降低等异常骨组织，在正常重复应力刺激下发生，一般无明显异常外力，多见于老年人。诊断应力性骨折患者首选 MRI 为著，CT，X 线为辅价值更高。
关键词：应力性骨折 影像学检查 分析

## PU-338

# MRI 对青少年膝关节应力性骨折的影像学分析

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摘要
目的：运动后青少年应力性骨折、骨髓水肿、多发生与关节。
方法：利用 MRI 平扫，常规扫描患者膝关节发现应力性骨折。
结果：该组患者为 2020 年的非典型肺炎疫情缓解后，复学后出现青少年膝关节、髋关节疾病的增加，特别是胫骨近端应力性骨折、关节滑膜炎，髋关节积液，运动后关节疼痛，脊柱也有类似病变发生。疫情封城后，实行的网络教学，居家隔离，不走亲访友，运动量的减少致使发育性的青少年骨骼、肌肉等松弛，紧迫性减少。当复学后运动量过大，才让一些体质稍差的出现关节疾病的增加。本组主要是运动后出现的膝关节、髋关节、脊柱疼痛，X 线检查大部分未见异常，疼痛持续加重，MRI 检查表现，骨小梁断裂，骨皮质完整，骨髓水肿、关节积液等影像学表现。
结论：对发育性的青少年应该加强平时的日常锻炼，适当补充营养，出现关节疼痛时及时就诊，严防疾病深度扩张。

## PU-339

# 原发性胰腺淋巴瘤影像学误诊 3 例并文献复习

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目的 分析原发性胰腺淋巴瘤(Primary pancreatic lymphoma，PPL)的影像学表现，以提高对该病的认识，减少误诊。方法 回顾性分析本院 2018 年 1 月-2020 年 12 月经病理证实的 3 例原发性胰腺淋巴瘤的影像学表现，归纳其影像学特征并进行文献复习。
结果 本组病例均为胰腺淋巴瘤误诊病例，3 例患者均行计算机断层（computerized tomographic ；CT ）平扫及动态增强扫描，2 例行 MRI 平扫及动态增强扫描。2 例发生在胰头区，1 例累及胰头及胰体尾部，CT 上均表现为胰腺形态饱满，胰头部或胰腺体尾部软组织肿块影，内见片状低强化区，病变包绕邻近血管；MRI 上 T1WI 呈不均匀等低信号，T2WI 呈不均匀等高信号，扩散加权成像（diffusion weighted imaging，DWI）呈高信号，ADC 图信号减低，强化程度呈渐进性轻中度强化。
结论 原发性胰腺淋巴瘤比较罕见，影像学表现结合实验室检查能提高本病的诊断率。

PU-340

# Assessment of the Differences of Coronary Microvascular Dysfunction in Hypertrophic Cardiomyopathy Patients with or without Left Venticular Outflow Tract Obstruction by 3.0 T MR

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Purpose: To investigate the effect of left ventricular outflow tract (LVOT) obstruction on coronary microvascular dysfunction (CMD) in patients with hypertrophic cardiomyopathy (HCM).
Methods and Materials: 65 HCM patients, including HCM with LVOT obstruction (HOCM, n=18) and HCM without LVOT obstruction (NOHCM, n=47), and 28 healthy controls (HCs) were retrospectively analyzed. All subjects underwent a 3.0 T CMR (Achieva, Philips Medical Systems, Nederland). The CMD in HCM patients were evaluated by resting first-pass perfusion imaging, parameters including upslope, time to maximum signal intensity (TTM), max signal intensity (Max SI), and maximum signal intensity ratio of myocardium to blood pool (Max SImyo/Max SIblp). The cardiac structural and functional parameters and ratio between LVOT and aortic valve diameter (LVOT/AO) were also measured. Parameters were compared between HCs and HCM patients.
Results: Cardiac structural and functional parameters were seen in Table 1A. HCM patients had reduced upslope and increased TTM (all P < .001), but there were no significant differences in Max SI and Max SImyo/Max SIblp, compared with those in HCs. Compared with NOHCM group, upslope in HOCM group was decreased (P < .001) and TTM was increased (P < .001), but there were no significant differences in Max SI and Max SImyo/Max SIbl (seen in Table 1A). HCM patients had reduced upslope and increased TTM in the basal, mid and apical part of LV myocardium (all P < .001), and HOCM group had lower Max SI in basal segment (P < .05), compared with those in HCs. Compared with NOHCM group. HOCM group had a lower upslope and a a longer TTM in the basal, mid and apical part of LV myocardium (all P < .05, seen in Table 1B). There were significant differences in the LVOT/AO among the HCs and HCM subgroups (all P < .001, seen in Table 1A). LVOT/AO correlated with both upslope (r=0.567, P < .001) and TTM (r=-0.759, P < .001) in HCM patients.

Conclusions: HCM patients with or without left ventricular outflow tract obstruction have CMD, which can be evaluated by CMR resting perfusion imaging and may be a vital factor in clinical decision making.

## PU-341

# 肾血管平滑肌脂肪瘤伴左肾静脉、下腔静脉瘤栓一例

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目的：探讨肾血管平滑肌脂肪瘤伴静脉瘤栓的 CT、MRI 表现。方法：回顾性分析我院发现的一例肾血管平滑肌脂肪瘤患者的临床资料和 CT、MRI 表现，总结肾血管平滑肌脂肪瘤继发静脉瘤栓时的影像学表现。结果：肾血管平滑肌脂肪瘤当肿瘤巨大时可向下腔静脉和肾静脉蔓延，影像上表现为肿瘤呈混杂密度/信号，向肾静脉和下腔静脉延伸，增强后静脉瘤栓与肿瘤强化程度一致。结论：CT、MR 可明确显示肾血管平滑肌脂肪瘤的形态、大小、范围和有/无静脉瘤栓的形成，对于指导临床医生诊疗具有重要价值。

## PU-342

# 大脑前动脉变异的 MRA 成像研究

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目的 探讨 MRA 对大脑前动脉各种变异类型的诊断价值。方法 搜集 480 例行 MRA 检查的患者的影像和临床资料，统计大脑前动脉变异的数量及类型。
结果 480 例患者中，大脑前动脉变异 138 例，其中 A1 段变异 101 例，A2 段变异 47 例，单侧重复大脑前动脉 1 例，单侧大脑前动脉全程发育不良 11 例。A1 段变异主要表现为发育不良、缺如和开窗畸形，其中发育不良 62 例，缺如 36 例，开窗畸形 3 例；A2 段变异主要表现为奇大脑前动脉、三倍体大脑前动脉、发育不良及单侧数量异常，其中奇大脑前动脉 9 例，三倍体大脑前动脉 26 例，发育不良 11 例，单侧大脑前动脉 A2 段为两支 1 例。结论 MRA 能清晰显示大脑前动脉的各种变异类型，为临床医师手术提供影像学依据。

## PU-343

# 纤维板层型肝癌

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目的
报道一例患有纤维板层型肝癌的年轻患者的影像学特征以提高对该病的认识。
材料与方法

36 岁，男性，因“无明显诱因出现右上腹痛 3 月余“入院，患者无肝炎、肝硬化病史。实验室检查：乙肝表面抗原 0.01 IU/ml（参考值<0.4），乙肝表面抗体 0.5 mIU/ml（参考值<10），乙肝 e 抗原 0.01 PEIU/ml（参考值<0.5），乙肝 e 抗体 0.01 PEIU/ml（参考值<0.4），乙肝核心抗体 0.35 IU/ml（参考值<0.9）;甲胎蛋白 1.37 ng/ml（参考值 0.0-7.0），癌胚抗原 14.29 ng/ml（参考值 0.0-4.7），CA-125 268.9 U/ml（参考值 0.0-35.0），CA15-3 55.54 U/ml(参考值 0-25.0），CA19-9 >1000 U/ml（参考值 0-27.0）。各转氨酶及胆红素指标均阴性。患者先做胸部 CT 平扫（西门子，SOMATOM Difinition A）（见图 1），后患者行腹部 MR 平扫增强检查（GE,750W 3.0T）（见图 2）.

结果

36 岁无肝炎、肝硬化病史患者，AFP 正常，癌胚抗原、CA125、CA19-9 升高。胸部 CT 示肝右叶低密度肿块，内见点状钙化；腹部 MR 平扫示肿块呈不均质长 T1 信号、长 T2 信号，内见中央瘢痕及分隔，边界尚清，DWI 示病灶弥散受限，增强扫描病灶不均质强化，中央瘢痕呈渐进性强化，病灶侵犯胆囊，出现肝门、心隔角淋巴结转移及腹膜转移。患者于出院后 2 月死亡。

结论/讨论

结合患者临床、实验室检查及影像学资料，考虑肝右叶纤维板层型肝癌可能。纤维板层型肝癌（Fibrolamellar hepatocellular carcinoma，FL-HCC）是一种罕见的原发性肝细胞恶性肿瘤，发生于年轻个体的非肝硬化肝脏。FL-HCC 占原发性肝癌（hepatocellular carcinoma，HCC）的 1%，男女发病均等，常见于 10-35 岁之间。通常表现肝内较大孤立性肿块，影像学特征表现为病灶中央瘢痕及分隔，增强扫描呈渐近性强化，70%的患者在就诊时已出现淋巴结转移。该病的主要鉴别疾病：（1）肝局灶性结节性增生：肝脏第二常见良性肿瘤，女性多见。病灶中央见星状纤维瘢痕（这需与本病着重鉴别），增强扫描动脉期实质部分明显均匀/不均匀强化，而后强化逐渐下降，中央瘢痕动脉期不/弱强化，但随着增强时间的延长，可逐步强化；（2）HCC：好发于 30-60 岁，男性多见。发病与乙肝、丙肝及肝硬化密切相关，患者 AFP 常升高，瘤体常较小，增强扫描呈快进快出式强化，门静脉及延迟期可见假包膜；（3）胆管细胞癌：临床症状常表现上腹痛及腹部包块，胆管阻塞可出现黄疸。AFP 常呈阴性。胆管细胞癌好发于肝左叶外侧段，CT 表现为肝内边界不清的低密度肿块，多数动脉期强化不明显或不均匀轻度强化，而后强化程度逐渐增加，肿块内或肿块周围可见不规则的胆管扩张。

PU-344

# 阑尾粘液性肿瘤的影像学诊断价值

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目的：探讨 MSCT 及 MRI 对阑尾粘液性肿瘤的诊断与鉴别诊断的要点。方法：回顾性分析 2018 年 1 月-2020 年 10 月于本院收集的 6 例经手术病理证实的阑尾粘液性肿瘤（女 4 例，男 2 例，年龄 42～64 岁）的 CT 及 MRI 表现，结合相关文献对该病的影像学表现进行总结。结果：在本组病例中，4 例为低级别阑尾粘液性肿瘤，1 例阑尾粘液腺瘤，1 例阑尾粘液腺癌。6 例病灶均位于右下腹，呈与盲肠相连的囊性病灶，形态以类圆形或长管状为主，呈单房或多房囊性，CT 值介于 10-30 HU 之间；多平面重建示病灶呈长条状或椭圆形，边界清晰，内容物呈等密度，管壁可厚薄不一，其中 1 例低级别阑尾粘液性肿瘤及阑尾粘液腺癌可见条状分隔及弧形钙化，增强扫描后表现为包膜及分隔强化。在接受 MR 检查的 2 例病例中，图像均表现为 T1 呈等低信号，T2 呈高信号，T2 压脂呈高信号，囊壁及分隔显示不均，以 T2 显示较佳。结论：CT 显示阑尾壁不规则和软组织增厚具有高度恶性可能，MSCT 可通过多方位重组（MPR）等多种后处理方式观察病变的形态以及与周围结构的毗邻关系；MRI 多序列扫描方式，对于囊壁及囊内成分分辨更加清晰，对于病灶周围情况显示更加客观。阑尾粘液性肿瘤的影像学检查以 CT 检查为首选，结合 MR 表现，大部分能

准确术前诊断，早期诊断能预防粘液囊肿从单纯囊肿发展到恶性腺癌以及由于囊肿的破裂导致腹膜假性粘液瘤（PMP）的发生。

PU-345

# 膀胱扩张状态对 mpMRI 诊断膀胱尿路上皮癌性能的影响 及因素分析

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【目的】探讨临床实践中不同膀胱扩张状态下 mpMRI 对膀胱尿路上皮癌诊断分期准确度的差异，并探求适用于 mpMRI 检查的膀胱最佳扩张状态及充盈量，分析可能影响患者 mpMRI 检查时膀胱扩张状态的相关因素，为临床实践工作提供参考。

【方法】

回顾性分析 2016 年 1 月至 2020 年 6 月就诊的 365 例膀胱尿路上皮癌患者的 MRI 资料。由两位资历相当、经验丰富的影像科医师分别独自利用 mpMRI 图像对患者膀胱尿路上皮癌进行术前诊断分期，统一两者意见得到最终分期结果。利用我院计算机影像显示系统中的 ROI 绘制工具对患者 mpMRI 图像上的膀胱区域进行 ROI 绘制并计算出每位患者的膀胱充盈量以及男性患者的前列腺体积。由一位熟悉盆腔核磁的影像科医师利用 Likert 5 分量表对患者膀胱扩张状态进行评分。对不同 Likert 评分下膀胱充盈量的分布情况进行描述性统计，通过 Kruskal-Wallis H 秩和检验分析各评分下膀胱充盈量的构成差异，使用 Spearman 相关性分析，分析膀胱充盈量与 Likert 评分之间的相关关系。通过卡方检验比较不同 Likert 评分下 mpMRI 诊断膀胱癌准确度的差异；并通过 Fisher 精确检验比较不同 Likert 评分下 mpMRI 对膀胱癌诊断分期与病理分期不一致时，分期过高或过低的情况。最后将可能影响患者 mpMRI 检查时膀胱扩张状态的相关因素进行多因素 Logistic 回归分析及 Spearman 相关性分析。

【结果】

共纳入 365 名研究对象，其中男性 301 例，女性 64 例。各 Likert 评分下的膀胱充盈量分布差异具有统计学意义（x2=274.067，P＜0.01）；且 Likert 评分与膀胱充盈量存在显著的正相关关系（rs=0.866，P＜0.01），随着 Likert 评分值的升高，相对应的膀胱充盈量越大。在 Likert 5 个评分组中，3 分、4 分组与 1 分、2 分及 5 分组之间 mpMRI 诊断膀胱尿路上皮癌的准确率差异有统计学意义（x2=18.186，P=0.01）。膀胱扩张至 Likert 评分 3 分与 4 分时为 mpMRI 诊断膀胱尿路上皮癌准确率最高的状态，分别达 92.4%及 90.8%，其相应的膀胱充盈量为 116-348ml。各 Likert 评分组 mpMRI 对膀胱尿路上皮癌的诊断分期较病理分期过高或过低病例数差异无统计学意义（x2=7.382，P=0.112），说明不同的膀胱充盈状态下，发生 mpMRI 诊断膀胱尿路上皮癌分期过高或过低的情况并无明显差异。多因素 Logistic 回归分析表明患者性别是 Likert 评分的影响因素，在同样的 mpMRI 检查前膀胱充盈准备下，男性患者较女性患者 Likert 评分低（β=-1.052，P<0.05）；尿液镜检白细胞数亦是 Likert 评分的影响因素，且两者呈负相关（β=-0.212，P=0.013），尿液镜检白细胞数越多，Likert 评分更低。Spearman 相关性分析表明，前列腺体积不是男性患者 Likert 评分的影响因素（rs=-0.068，P=0.246）。

【结论】

行 mpMRI 检查时对患者膀胱进行 Likert 评分是评估膀胱扩张状态简单易行的方法，Likert3 分或 4 分时 mpMRI 诊断膀胱尿路上皮癌的准确率较高，影像科医师可先行对每位患者进行评分，若不满足 3 分或 4 分，可嘱患者另做准备待扩张达标后再行检查。外科医师亦应对患者 mpMRI 图像进行自主评估，对于膀胱扩张欠佳或过度的患者，应充分结合 TURBT 病理诊断结果对疾病进行综合评估。

PU-346

# Sturge-Weber 综合征影像学表现并文献复习

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目的 分析及总结 Sturge-Weber 综合征的临床及影像学表现，提高对此病的认识。 方法 搜集 2011 年 9 月-2021 年 5 月在华中科技大学同济医学院附属协和医院和武汉红十字会医院就诊的符合 Sturge-Weber 综合征诊断标准的患者共 6 名，对其临床及影像学资料进行回顾性分析。结果 本组患者Ⅰ型四例，Ⅱ型及Ⅲ型各一例，5 例患者有脑皮层的脑回状钙化，MRI 平扫显示脑皮层病变的短 T2 低信号改变，3 例患者 MRI 增强示病灶区软脑膜强化，两例患者病灶侧颜面部血管瘤强化，分别侵犯眼球及累及口内，2 例患者 SWI 显示了病变区脑皮层的极低信号影，4 例患者患侧脑沟增宽、加深，脑回变细，3 例双侧脉络膜增大，患侧颅骨板障增厚者有 5 例，且均伴有同侧额窦扩大。结论 三叉神经分布区域颜面血管瘤并同侧颅脑脑皮层钙化为 Sturge-Weber 综合征的典型影像学表现，此病有进展趋势，预后不良，应掌握该综合征的 CT 及 MRI 特征及了解各自优势，尽早诊断及干预。

PU-347

# 耻骨联合骨炎的 MRI 表现

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【摘要】目的：为进一步提高临床工作中对耻骨联合骨炎诊断正确率，探讨耻骨联合骨炎的 MRI 表现和鉴别诊断。方法：回顾性分析 4 例临床诊断为耻骨联合骨炎经随访完全治愈患者的临床及 MRI 资料。结果：耻骨联合骨炎患者有怀孕、妊娠、长期运动、外伤或强直性脊柱炎等病史。在 MR 上表现为耻骨联合间隙、阶梯征、软骨下骨侵蚀、软骨下骨骨髓水肿、耻骨联合关节间隙积液、纤维软骨盘水肿、内收肌群及肌腱损伤、关节周围软组织肿胀等。结论：耻骨联合骨炎在 MRI 上有一定特征性表现，结合临床病史能够提高诊断正确率，减少误诊，改善预后。

PU-348

# 乳腺炎性病灶诊断与鉴别

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目的:提高乳腺炎性病变 MRI 诊断价值。方法:对 30 例乳腺炎性病变 MRI 影像特征进行回顾性分析。结果:乳腺 MRI 对乳腺炎性病灶有一定特征性改变。结论:乳腺 MRI 对乳腺炎性病灶和乳腺癌有比较好的鉴别价值

PU-349

# Genetic architecture underlying differential resting-state functional connectivity of subregions within the human visual cortex

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Background: The human visual cortex is a heterogeneous entity that has multiple subregions showing substantial variability in their functions and connections. However, the molecular mechanisms underlying such variations are unclear.
Methods: Resting-state fMRI data were obtained from a discovery dataset and two independent validation datasets. Gene expression data from the Allen Human Brain Atlas were processed using a newly proposed standardized pipeline. Resting-state functional connectivity (rsFC) was calculated based on fine-grained visual subregions from the Human Brainnetome Atlas. Then, we identified genes associated with rsFC of each visual subregion using transcriptome-neuroimaging spatial correlations.
Results: rsFC of eight visual subregions were associated with expression measures of eight gene sets, which were specifically expressed in brain tissue and showed the strongest correlations with visual behavioral processes. More importantly, there was a significant divergence in these gene sets and their functional features between medial and lateral visual subregions. Relative to those associated with lateral subregions, more genes associated with medial subregions were found to be enriched for neuropsychiatric diseases and more diverse biological functions and pathways, and to be specifically expressed in multiple types of neurons and immune cells and during the middle and late stages of cortical development. In addition to shared behavioral processes, lateral subregion associated genes were uniquely correlated with high-order cognition.
Conclusion: These findings of commonalities and differences in the identified rsFC genes and their functional features across visual subregions may improve our understanding of the functional heterogeneity of the visual cortex from the perspective of underlying genetic architecture.

PU-350

# Spontaneous rupture of intraspinal dermoid cyst with central spinal canal dissemination. Computed tomography and magnetic resonance imaging findings.

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**Introduction:** Intraspinal dermoid cysts are rare, comprising 1.1% of intraspinal tumors.
**Case report:** A 28‐year‐old male patient presented to an abnormal sensation and weakness in his right lower extremity. At presentation, he was intermittent and not serious, and his neurological examination was normal.
**Methods:** MRI of cervical, thoracic and lumbosacral spine, noncontrast head MRI , CT of lumbosacral spine were performed. Parameters of spine MRI: Precontrast MRI; TSE/T2Wsequence in sagittal and axial planes; TSE/T1Wsequence in sagittal plane; T2-FS sequence in sagittal and coronal planes; Post-contrast TSE/T1W sequence in axial, coronal and sagittal planes; Post-contrast TSE/T1W-FS sequence in sagittal plane.**Results:** MRI of lumbosacral spine showed a large L1–L2 intraspinal lesion, which showed mostly hyperintense

on T1, T2 and FS sequences. A noncontrast CT showed calcification and low attenuating (fat density) and spina bifida was not found. MRI of cervical and thoracic spine revealed C2-T12 intramedullary lesion, which was uniformly hyperintense on T1 and T2 sequences, showed suppression on fat-saturation images, suggestive of a fat-containing lesion. It is located in the center of spinal cord and there was no enhancement. Findings are consistent with ruptured dermoid cyst with central spinal canal spread of its contents. With such an extensive intramedullary fat dissemination manifestation, a head MRI was performed to rule out intracranial dissemination. A noncontrast head MRI showed basically normal. No intracranial dermoid or intracranial fat dissemination were seen. Lumbar dermoid cyst resection surgery was performed and confirmed our suspicions.
**Conclusion:** Spinal dermoid cysts are benign slow-growing tumor-like lesions, and have a generally favorable prognosis. Widespread presence of T1 hyperintense droplets and no enhancement can be noted–making MRI the best imaging modality for diagnosis of this rare entity.

PU-351

# Osteochondritis Dissecans of the Knee in Children: MRI Findings of Instability

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**OBJECTIVE.** Osteochondritis dissecans (OCD) is most commonly encountered in the knee. Regardless of the cause, treatment of OCD depends on assessment of lesion stability. In children, not all of the MRI findings reflecting the instability are similar to those found in the adult. The purpose of this study was to investigate the performance of MRI criteria for predicting instability of OCD lesions of the knee in children.
**MATERIALS AND METHODS.** This retrospective study included 63 children (mean age 12.7±2.1 years) with 65 OCD lesions of the knee who underwent an MRI examination between Jan 1, 2014, and Dec 31, 2019. Two radiologists blinded to clinical outcomes reviewed MRI studies to determine the presence or absence of joint effusion, osteochondral defect, intraarticular body, surface cartilage changes, subchondral bone plate break, rim of high signal intensity on T2-weighted images which of the same signal intensity as adjacent joint fluid, perilesional cysts (number and size), marginal sclerosis and perilesional bone marrow edema. The stability of OCD lesions was determined with arthroscopy findings as reference standards.
**RESULTS.** There were 31 stable and 34 unstable OCD lesions. An osteochondral defect ($p = 0.02$), intraarticular body ($p = 0.001$), surface cartilage changes ($p = 0.01$), subchondral bone plate break ($p = 0.02$), hyperintense rim ($p < 0.001$), multiple or single but larger than 5 mm perilesional cysts ($p = 0.01$) were significantly more common in unstable than stable OCD lesions. However, only osteochondral defect, intraarticular body and hyperintense rim were 100% specific for OCD instability. There was no significant difference between stable and unstable OCD lesions in the presence of joint effusion ($p = 0.16$), single and smaller than 5mm cysts ($p = 0.52$), marginal sclerosis ($p = 0.67$), or perilesional bone marrow edema ($p = 1.00$). **CONCLUSION.** Magnetic Resonance currently represents the gold standard for the evaluation of osteochondritis dissecans focus because it enables to establish an early diagnosis. MRI fndings of OCD instability of the knee in children include an osteochondral defect, intraarticular body, surface cartilage changes, subchondral bone plate break, hyperintense rim on T2-weighted MR images and multiple or single but larger than 5 mm perilesional cysts.

PU-352

# Juxta-articular dysplasia epiphysealis hemimelica: differentiate from osteochondroma in children by CT and MR imaging

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**Background:** Dysplasia epiphysealis hemimelica (DEH) is a rare congenital epiphyseal dysplasia with the incidence less than 1/1 million. It often occurs in 2 to 14 year-old children. The main manifestation is a hard mass near the joint which was often misdiagnosed as bone tumor or other diseases, such as osteochondroma. Early differentiation is an important clinical distinction which guide different treatment plans.
**Purpose:** To evaluate the differentiating factors for DEH and osteochondroma as determined by CT and MR imaging.**Materials and methods:** This retrospective study included 9, consecutive patients with DEH and 34, consecutive children with osteochondroma. All cases were confirmed by surgery. Two radiologists retrospectively analyzed CT and conventional MRI findings, including the location, number, left/right side, medial/lateral, attenuation/signal intensity, calcification, bone and cartilage change, relationship with epiphysis, complicated deformity or not. The sensitivity and specificity were calculated for each finding using the Chi square test. Statistically significant findings were further analyzed using multivariate logistic regression analysis. The diagnostic performance was evaluated according to the area under the receiver operating characteristic curve (ROC) using specific image findings. Simple statistics were used to evaluate the inter-observer reliability.
**Results:** Statistically specific findings for DEH compared with those for osteochondroma, were lower limbs (specificity = 92.1%, sensitivity = 69.5%, $p < 0.0001$), right side (specificity = 95.8%, sensitivity = 72.3%, $p < 0.0001$), medial side (specificity = 97.2%, sensitivity = 30.7%, $p < 0.0001$), high density (specificity = 100%, sensitivity = 14.3%, $p < 0.0001$), calcification (specificity = 92.1%, sensitivity = 78.6%, $p < 0.0003$), eccentricity enlargement of epiphysis (specificity = 97.8%, sensitivity = 40.6%, $p < 0.0001$), fusion with the epiphysis partially or completely (specificity =94.3%, sensitivity = 79.6%, $p < 0.0002$) and complicated deformity (specificity =93.2%, sensitivity = 79.1%, $p < 0.0001$). Statistically specific findings for osteochondroma compared with those for DEH, were equidensity/equisignal (specificity = 97.0%, sensitivity = 56.8%, $p < 0.0001$), no exact relationship with epiphysis (specificity = 94.1%, sensitivity = 40.2%, $p < 0.0003$). Eccentricity enlargement of epiphysis and fusion with the epiphysis partially or completely were independently associated with the DEH. Equidensity/equisignal was independently associated with osteochondroma. Interobserver agreement was good to excellent for each finding ($\kappa = 0.758$-$1.000$).
**Conclusion:** Highly specific findings for DEH include lower limbs, right and medial side, high density, calcification, eccentricity enlargement of epiphysis, fusion with the epiphysis partially or completely and complicated deformity. CT and MRI are very useful for differentiating DEH from osteochondroma using these specific findings.

PU-353

# 盘源性腰痛大鼠模型的建立及椎旁肌病理改变的磁共振研究

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目的：通过 x 线引导穿刺大鼠椎间盘建立盘源性腰痛（DLBP）模型并基于此模型探讨椎旁肌病理改变与磁共振之间的关系。
方法：将 54 只雌性 SD 大鼠分为正常组、假手术组和 DLBP 组（n=18）。再将每组 SD 大鼠分为 1 月组、3 月组和 6 月组（n=6）。DLBP 组在 x 线引导下穿刺 L4/5 和 L5/6 椎间盘，并注入磷酸盐缓冲液；Sham 组仅穿刺 L4/5 和 L5/6 水平椎旁肌；正常组不做任何操作。在建模后 30、90、180 天进行磁共振 T2 加权矢状位扫描和 HE 染色观察椎间盘退变情况，椎旁肌的评估，磁共振采用 T2 mapping、BOLD 和 IDEAL-IQ 技术，组织学评估采用 HE 染色和油红染色评价椎旁肌病理变化。
结果：影像学 T2WI 矢状位显示，与正常组和假手术组相比，DLBP 组大鼠椎间盘信号明显下降；HE 染色结果显示 DLBP 组正常髓核被纤维样物质取代，同心环纤维结构消失，排列紊乱并出现裂痕。椎旁肌功能磁共振扫描发现，在第 3、6 个月，DLBP 组多裂肌 T2 值低于正常组和假手术组($P < 0.01$)，6 个月时 DLBP 组多裂肌 R2*值高于正常组和假手术组（$P < 0.001$），三组大鼠各时间点椎旁肌 PDFF 值未见明显统计学差异（$P > 0.05$）。HE 染色结果显示 DLBP 组建模后 3 月和 6 月多裂肌肌细胞间隔增宽；油红染色显示 DLBP 组建模后 6 月肌细胞间隔出现红染的脂滴。
结论：本研究通过 x 线引导下穿刺成功建立了 DLBP 大鼠模型。T2 mapping 和 BOLD 技术为观察椎旁肌微观病理改变提供了有效的影像学方法，IDEAL-IQ 技术在评估椎旁肌微量脂肪浸润上作用有限。

## PU-354
# Brain functional connectome-based prediction of individual impulsivity

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Extensive neuroimaging research has attempted to identify neural correlates and predictors of impulsivity. However, the nature and extent of impulsivity-brain association have varied substantially across studies, likely due to small sample sizes, limited image quality, different imaging measurement selections, and non-specific methodologies. The objective of this study was to develop a reliable predictive model of impulsivity-brain relationship in a large sample by applying connectome-based predictive modeling (CPM), a recently developed machine learning approach, to whole-brain functional connectivity data (“neural fingerprints”). For 810 healthy young participants from the Human Connectome Project, high-quality resting-state functional MRI data were utilized to construct brain functional connectome and delay discounting test was used to assess impulsivity. Then, CPM with leave-one-out cross-validation was conducted to predict individual impulsivity from whole-brain functional connectivity. We found that CPM successfully and reliably predicted the delay discounting scores in novel individuals. Moreover, different feature selection thresholds and parcellation strategies did not significantly influence the prediction results. At the neural level, we observed that the impulsivity-associated functional networks included brain regions within default-mode, subcortical, somato-motor, dorsal attention, and visual systems, suggesting that impulsivity emerges from highly integrated connections involving multiple intrinsic networks. Our findings not only may expand existing knowledge regarding the neural mechanism of impulsivity, but also may present a workable route towards translation of brain imaging findings into real-world economic decision-making.

## PU-355
# 胰腺导管内乳头状黏液性肿瘤胶样癌恶变的影像学特征及其与导管腺癌恶变鉴别

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**目的** 探讨胰腺导管内乳头状黏液性肿瘤（IPMN）胶样癌恶变的影像学特征及其与导管腺癌恶变鉴别，并与病理对照分析。
**方法** 回顾性分析 2013 年 11 月至 2020 年 1 月海军军医大学第一附属医院 24 例经手术病理确诊为 IPMN 恶变成分为胶样癌的患者临床、影像学和病理资料。同时收集同时期经手术病理确诊为 IPMN 恶变成分为导管腺癌患者 30 例。分析患者术前 CT 和 MRI 影像学表现，包括病灶的部位、IPMN 形态类型、最长径、成分、密度及信号、钙化、胰管扩张及胰管内径、胰腺实质萎缩、与周围器官形成瘘管等。两组影像学表现特征比较采用 χ2 检验或 Fisher 确切概率法。
**结果** IPMN 胶样癌发生于胰头部 16 例、胰体尾部 7 例、全胰腺 1 例。22 例有肿块形成，最长径 54.5（29.25）mm。囊实性 19 例、囊性 4 例、实性 1 例，囊壁和内部分隔增厚，增强后轻度强化。5 例 T1WI 有高信号。肿块内有钙化 13 例、气体 2 例。胰管扩张内径（13±5）mm。胰腺实质萎缩 21 例。8 例与周围器官形成瘘管。IPMN 胶样癌肿块最长径大于 IPMN 导管腺癌[31（16），Z=－3.758，P＜0.001]。IPMN 胶样癌以囊实性为主，IPMN 导管腺癌以实性为主（P＜0.001）。IPMN 胶样癌钙化、与周围器官形成瘘管、T1WI 点状高信号多于 IPMN 导管腺癌（P=0.001、0.031、0.034）。
**结论** 与 IPMN 导管腺癌相比，IPMN 胶样癌更倾向于囊实性肿块、伴有钙化、与周围器官形成瘘管、T1WI 呈点状高信号。

PU-356

# 胰腺常见肿瘤不典型影像学表现

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**目的** 由于胰腺解剖位置的特殊性、分泌功能的复杂性、病理学类型的多样性，使胰腺肿瘤的影像学表现纷繁复杂。对胰腺常见肿瘤的不典型影像学表现进行分析总结，旨在提高影像学和临床医师对胰腺肿瘤的全面认识。
**方法** 结合相关临床经验，归纳并分析胰腺导管腺癌（PDAC）、实性-假乳头状肿瘤（SPN）、神经内分泌肿瘤（pNEN）、导管内乳头状黏液性肿瘤（IPMN）、浆液性囊性肿瘤（SCA）和黏液性囊性肿瘤（MCN）以上六种胰腺常见肿瘤的 CT 和 MRI 不典型影像学表现。
**结果** PDAC 不典型影像学包括伴假性或潴留性囊肿、外生型、伴出血。SPN 不典型影像学包括发生于的男性 SPN、无出血。pNEN 不典型影像学包括弥漫性、生长于胰管内。IPMN 不典型影像学包括分支型 IPMN 恶变和 IPMN 胶样癌恶变。SCA 不典型影像学表现包括实体型、出血、伴胰管扩张。MCN 不典型影像学表现为单囊单房型。
**结论** 胰腺常见肿瘤不典型影像学表现多样，通过影像学预测病理，帮助诊断与治疗多学科团队成员全面、深刻地认识胰腺肿瘤，是作为胰腺肿瘤高容量医疗中心影像学医师的必备要求。

PU-357

# MR 定量技术评估伴纤维化非酒精性脂肪肝的研究

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目的 探讨纤维化的存在是否会对 MR 多回波 Dixon（ME Dixon）及 T2 校正多回波磁共振波谱（HISTO）序列定量肝脏脂肪变性的相关性及准确性产生影响。
材料与方法 27 只新西兰大白兔随机分为高脂组（22 只）和对照组（5 只），高脂组兔用高脂饲料喂养（高脂饲料配方：83%普通饲料+10%猪油+5%蔗糖+2%胆固醇），对照组用普通饲料喂养。每周行 ME Dixon 和 HISTO 序列检查，测量实验兔肝脂质密度脂肪分数（PDFF）。MR 扫描结束后处死实验兔，应用 HE 染色、Masson 染色及普鲁士蓝染色观察肝脏脂肪肝分级、纤维化分级及铁沉积分布，并经酸水解法获得肝脏脂肪含量（LFC）。采用 Pearson 或 Spearman 相关分析计算 MR 各指标与病理生化结果的相关性。用 Bland-Altman 法分析多回波 Dixon 及 HISTO 序列测得的 PDFF 两者之间的一致性。P＜0.05 为差异有统计学意义。
结果 所有实验兔 MR 测得 ME Dixon-PDFF 与 HISTO-PDFF 值间高度正相关（r=0.916，P＜0.05），且具有高度的一致性，ICC 为 0.952（95%CI，0.883~0.980）。肝脏脂肪肝分级、ME Dixon-PDFF、HISTO-PDFF 均与 LFC 呈正相关（r 值分别为 0.837，0.818,0.723，P＜0.05）。实验兔肝在无或早期纤维化阶段（F0、F1），ME Dixon-PDFF、HISTO-PDFF 与 LFC 呈高度正相关（r 值分别为 0.977、0.966，P 均＜0.05 ）；在进展期及晚期肝纤维化阶段（F2-F4），ME Dixon-PDFF、HISTO-PDFF 与 LFC 均无相关性（P＞0.05）。
结论 使用 ME Dixon 及 HISTO 序列可定量评估肝脏脂肪含量，两者具有高度一致性，纤维化的存在会使其定量准确性下降。

PU-358

# 体素内不相干运动扩散加权成像在肺癌诊断及不同病理亚型鉴别中的价值

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目的 探讨体素内不相干运动（Intravoxel incoherent motion, IVIM）扩散加权成像定量参数在肺癌诊断及不同病理亚型鉴别中的价值。
方法 87 例肺部病变（其中肺癌 66 例，良性病变 21 例）患者行 3.0T IVIM-DWI 成像。通过 IVIM 模型获取定量参数包括真扩散系数(D)、伪扩散系数(D*)、灌注分数(F)。评价并比较各参数在肺癌诊断及肺癌不同亚型鉴别中的诊断效能。
结果 肺癌的 D 值低于肺部良性病变(1.10±0.22vs 1.43±0.25, P<0.05)。肺癌和良性病变的 D*和 F 值之间无统计学差异（47.49±47.35 vs 70.1±47.72, 32.5±12.35 vs 31.12±13.26, P 均>0.05）。D 值在肺癌与良性病变鉴别时的 ROC 曲线下面积为 0.85。肺腺癌组的 D 和 D*值均高于肺鳞癌组(1.18±0.23vs0.95±0.11, 58.58±54.54 vs 26.32±27.38, P 均<0.05)，肺腺癌和鳞癌组之间的 F 值无明显差异（34.4±11.8 vs 27.06±16.53, P>0.05）。D 和 D*值在鉴别腺癌与鳞癌时诊断效能无明显差异(AUC=0.807 vs 0.728, P>0.05)。肺腺癌组的 D 和 F 值均高于小细胞肺癌(1.18±0.23 vs 1.01±0.12, 34.4±11.8 vs 24.41±7.91, P 均<0.05)，肺腺癌和小细胞肺癌两组之间的 D*无统计学差异（58.58±54.54 vs 38.14±23.35, P>0.05）。D 和 F 值在鉴别肺腺癌与小细胞肺癌时诊断效能无明显差异(AUC=0.744 vs 0.758, P>0.05)。肺鳞癌和小细胞肺癌两组之间的 D，D*和 F 值均无统计学差异（0.95±0.11 vs 1.01±0.12，26.32±27.38 vs 38.14±23.35 和 27.06±16.53 vs 24.41±7.91, P 均>0.05）。
结论 IVIM 模型定量参数 D 可作为一个可靠的影像标志物用于肺癌的诊断以及肺癌不同病理亚型的鉴别。

PU-359

# Desmoplastic Small Round Cell Tumor: cross-sectional imaging findings with histopathological association

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OBJECTIVE. The purpose of this study is to evaluate the clinical, pathologic, and multi-modality cross-sectional imaging features of a cohort of 7 patients with desmoplastic small round cell tumor (DSRCT).
MATERIALS AND METHODS. This retrospective study of 7 patients with pathologically verified DSRCT was conducted at a tertiary cancer center between 2012 and 2019. Epidemiologic, clinical, pathologic, and imaging findings were recorded. Tumor size, location, and shape and the distribution pattern of metastases at presentation were analyzed.
RESULTS. DSRCT most often occurred in young patients (median age, 24 years; range, 15–38 years), showing a marked predominance in male patients (5 male vs 2 female). Most patients had symptoms, with abdominal pain noted as the most common symptom. At initial presentation, 6 patients (85.71%) had multifocal disease, nodular disease, diffuse omental and peritoneal disease, or a combination of these conditions. One patient (14.28%) had extra-abdominal (bone) involvement. Five patients (71.43%) had liver metastases, and 4 patients (57.15%) had retroperitoneal involvement in the form of implants, tumoral extension, or nodal involvement. Two patients (28.57%) had calcified lesions.
CONCLUSION. DSRCT is a rare, multifocal peritoneal malignancy with frequently disseminated abdominal disease at presentation. In the abdomen, disease most commonly involves the omentum and peritoneum, followed by the retroperitoneum. The liver is the most common solid visceral metastatic site. A rare number of patients have bone involvement.

PU-360

# 基于 LI-RADS v2018 评估 MRI 对小肝细胞肝癌的诊断价值

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目的 基于 2018 版肝脏影像报告及数据系统（LI-RADS v2018），探讨 MRI 对乙肝肝硬化背景下≤ 3cm HCC 的诊断价值。
材料与方法 回顾性分析本院 2009 年 1 月至 2020 年 12 月间 73 例有乙肝肝硬化病史且经病理证实占位≤ 3cm HCC 的患者，并在一个月内行 CT 及 MRI 检查。依据 LI-RADS v2018，对每个病灶的 CT 及 MRI 图像的主次要征象及分级进行评估及比较。比较 CT 及 MRI 对≤ 3cm HCC 的诊断准确率。
结果 主要征象中的“包膜”表现在 MRI 中识别率高于 CT（P < .05）。次要征象中的扩散受限征象（86.3%）及马赛克征（25.0%）分别在 MRI 和 CT 中具有最高识别率。CT 及 MRI 检查的 LI-RADS v2018 分级有显著性的差异（P < .05）。MRI 在以 LR-4/5 标准诊断 HCC 的准确率优于 CT（P < .05）。
结论 基于 LI-RADS v2018，MRI 检查对≤ 3cm HCC 的部分征象的识别率及 HCC 诊断准确率均高于 CT 检查。

PU-361

# 磁共振整体护理中人性化的检查应用效果分析

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目的：研究磁共振整体护理中人性化的检查应用效果。方法：纳入我院 2019 年 1 月-2020 年 12 月期间收治的 90 例磁共振检查患者为研究对象，采取随机数表法将患者分为对照组和观察组，对照组采用磁共振整体护理，观察组运用磁共振整体护理基础上进行人性化检查干预，对比两组患者护理满意度。结果：对照组和观察组组患者临床护理满意度分别为 86.67%、97.78％，观察组 SCL-90 量表评分相对于对照组各项指标负面情绪明显下降。结论：对于磁共振整体护理中干预人性化的检查更有效提高护理满意度，减轻患者抑郁及焦虑等不良心态。

PU-362

# 多参数磁共振成像对前列腺外周带良性增生结节的诊断价值

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【摘要】 目的 探讨基于多参数磁共振成像（mpMRI）观察前列腺外周带（PZ）良性增生结节的影像特征。方法 本研究为回顾性资料分析，搜集 2019 年 9 月至 2020 年 12 月解放军总医院 MRI 影像表现为外周带局灶性结节样病变，通过超声引导下经阴穿刺活检或手术切除大病理证实为非前列腺癌（包括前列腺增生和前列腺炎）的患者 27 例，回顾性分析其 MRI 影像特征，包括位置、大小、形态、信号特征、包膜等。结果 根据 27 例患者的影像资料，共发现非癌局灶性结节 31 个，将外周带增生结节大致分为三种类型：Ⅰ型经典型增生结节，Ⅱ型间质为主型增生结节，Ⅲ型移行带突向外周带的增生结节，分别为 9、10、12 个。经典型增生结节与移行带增生结节相类似，呈类圆形短 T2 信号，根据包膜状况分为包膜完整型和包膜不完整型；间质为主增生结节表现为小结节样短 T2 信号，DWI 高信号，ADC 低信号，这类结节与前列腺癌鉴别困难；移行带突向外周带增生结节常常可以从矢状位和冠状位观察到其与移行带关系密切，部分表现为基底部附着与移行带，部分表现带蒂样结构与移行带相连。结论 前列腺外周带增生结节认识不足，临床工作中容易将其误诊为前列腺癌，并进行穿刺或手术切除。本研究旨在提高对前列腺外周带增生结节影像特征的认识，避免过度穿刺诊疗。

PU-363

# 胃肠肿瘤影像新进展

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胃肠道属于空腔型器官，其解剖特点与肝脏、肾脏等实体型器官有所不同，这也造成胃肠道影像学上的一些特殊性。主要体现于以下几方面：胃肠壁为层状结构，上皮来源恶性肿瘤发生于管腔内表面，依靠内镜进行筛查和诊断极为方便且可靠，这就相对弱化了影像学在胃肠道肿瘤诊断中的地位；上皮恶性肿瘤常沿着管壁呈面片状生长，早期不形成明显肿块，也会增加影像学在对其观察难度；此外，胃肠道蠕动频繁、位置多变，且腔内常有气体留存，更是限制了功能影像尤其是磁共振新技术的应用。因此，单纯在影像技术方面，胃肠道影像学进展相对缓慢，已经在脑、肝、肾等脏

器得到较好应用新技术并不能很快地推广到胃肠道。不过从临床应用角度/场景来看，胃肠道影像学仍有诸多新进展，本文将选择学界关注较多的几点做一介绍。

PU-364

# Identification of a specific functional network altered in type2 diabetes without mild cognitive impairment patients

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Objective
Type 2 diabetes mellitus (T2DM) is a significant risk factor for mild cognitive impairment (MCI) and the acceleration of MCI to dementia [1]. Thus, it is essential to identify the specific mechanism before MCI occurs. Resting-state fMRI (rs-fMRI) appears promising since previous studies showed that T2DM is associated with a global disorganization of the whole functional network, compared to healthy controls (HC). Moreover, specific functional connections belonging to default network and to dorsal attentional network have notably been shown to be associated with memory dysfunction following MCI. Our main hypothesis was that T2DM without MCI patients would have specific disruptions in network connectivity when compared with HC.
Methods
T2DM patients with disease durations of less than 18 years and without any signs of MCI (n = 30) were compared with healthy control subjects (n = 30). Whole brain region-based functional connectivity was analyzed with network-based statistics (NBS), and graph theory was examined to study the functional network organization. Dynamic functional connectivity was also estimated. In addition, a battery of psychological assessment was conducted for all subjects.
Results
The overall topological organization of the functional network was not altered in T2DM patients, who had the same mean node degree, average clustering coefficient, and global efficiency as HC. Network-based statistics analysis showed that T2DM was associated with dysfunction of a whole-brain network composed of 13 regions and 14 connections, and functional disconnections between Visual_Network, SomMot_Network, DorsAttn_Network, Limbic_Network and Default_Network (Figure 1). Dynamic analysis suggested three distinct connectivity 'States' across the two groups: a more frequent, segregated brain state characterized by the low-strength functional connections, State I, a less frequent, integrated state with strongly connected functional internetwork components, State II, and a rare frequent, integrated state with medium connections, State Ⅲ. These regions had connections that were specifically and positively correlated with cognitive domain scores. No intergroup differences in overall gray matter thickness. To assess the deleterious effect of hyperglycemia to white matter integrity on connectivity, we conducted whiter matter network or a second network-based analysis. No significant difference was found.
Conclusions
The observed functional network alterations suggest that the appearance of a cognitive impairment following T2DM may be associated with a particular functional alteration, shared specifically between cognitive domains.

PU-365

# 自身免疫性胰腺炎假包膜征的影像表现研究

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[摘 要] 目的 总结自身免疫性胰腺炎（AIP）假包膜征的影像特点，探讨其形成机制。方法 回顾性分析 48 例 AIP 患者的影像资料，观察胰周是否出现假包膜，对其进行定性、定量分析及随访观察。结果 48 例 AIP 病人中，34 例（34/48，70.83%）胰周见假包膜。CT 及 MRI 显示假包膜的中位厚度分别为 0.5 cm 和 0.4 cm。33 例 CT 检查中，平扫 CT 假包膜呈等或稍低密度，检出率为 6.06%（2/33）。增强 CT 假包膜强化程度较胰腺实质低，其检出率[57.58%（19/33）]高于 CT 平扫（c2=20.18，P＜0.05）。与平扫 CT 比较，假包膜增强 CT 动脉期明显强化（t=-3.970，P=0.003），静脉期强化更显著（t=-11.471，P=0.0001）。35 例 MR 检查中，平扫及增强 MRI 假包膜检出率为 77.14%（27/35）。27 例假包膜 T1WI 均呈低信号；7 例 T2WI 呈稍高信号，20 例呈低信号；扩散加权成像（DWI）信号无明显增高。接受类固醇治疗的 21 例患者中，18 例假包膜完全消失（随访时间 10～12 个月），3 例变薄（随访时间 2～3 个月）。结论 AIP 假包膜的影像表现具有一定特征，可随胰腺炎症的消散而完全吸收，提示其形成是一种慢性炎症伴纤维化过程。

# PU-366

# Large-scale Functional Connectivity Predicts Cognitive Impairment Related to Type 2 Diabetes Mellitus

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**Objective**
Large-scale functional connectivity (LSFC) patterns within each individual are both highly unique and reliable, similarly to a fingerprint, serving to underlie individual differences in personality traits or cognitive functions. The present study examined whether machine learning techniques could utilize LSFC patterns to predicts cognitive impairment related to Type 2 diabetes mellitus (T2DM) with a high degree of accuracy.
**Materials and methods**
Resting-state fMRI data were acquired from 102 individuals with T2DM and their degree of cognition was assessed by the Montreal cognitive assessment (MoCA). A new technique, connectome-based predictive modeling (CPM) was used to identify LSFC biomarkers to predicting the MoCA scores related to T2DM. We computed FC patterns using a functional brain atlas that comprised 264 nodes covering the whole brain. Then, we constructed a 264 × 264 connectivity matrix for each subject. Finally, predictive accuracy was assessed via the pearson's correlation between predicted and actual scores (r predicted- actual).
**Results**
We found that CPM successfully predicted the MoCA scores from T2DM (positive network: r=0.40, *p*=0.0038; negative network: r=0.36, *p*=0.0066).
**Conclusions**
Our study provides promising evidence that LSFC might provide potential neuroimaging-based information for clinically predicting the MoCA scores from T2DM and can reveal cognitive impairment related to T2DM, although more development is needed for clinical application.

# PU-367

# 自身免疫性胰腺炎继发囊性病变的影像特征分析

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目的 探讨自身免疫性胰腺炎（AIP）继发囊性病变的影像特征。方法 回顾性分析 9 例 AIP 合并胰腺实质内囊性病变病人的 CT 和 MRI 表现，逐一对囊性病变的数目、发生部位、形态、密度/信号特点，强化方式以及大小等影像特征进行分析，并进行随访观察。结果 9 例 AIP 病人继发的囊性病变中，4 例为多发，5 例为单发，在胰腺实质中共发现 16 个囊性病变。其中，7 个病变位于胰头，2 个位于胰颈，7 个位于胰尾。16 个囊性病变均表现为单房，其中 2 个形态不规则，14 个呈形态规则的类圆形；在 CT 平扫中囊性病变呈低密度；在 MRI 脂肪抑制 FSPGR T1WI 中囊性病变呈明显低信号，在脂肪抑制 FSE /SSFSET2WI 中 4 个囊性病变邻近的胰腺周围脂肪间隙模糊，MRI 脂肪抑制 T2WI 显示呈囊液呈不均匀高信号，邻近的胰腺周围脂肪间隙模糊，余余 12 个囊性病变呈均匀高信号；CT 和 MRI 增强扫描显示 16 个囊性病变均无强化。囊性病变最大者为 5.0 cm×2.5 cm，最小者为 0.8 cm×0.6 cm。经过激素治疗的 13 个囊性病变中，11 个完全消失，2 个明显缩小，其中 1 个由 5.0 cm×2.5 cm 缩小至 0.8 cm×0.6 cm，另 1 个由 1.2 cm×0.8 cm 缩小至 0.5 cm×0.5 cm。结论 AIP 继发胰腺实质内囊性病变可发生在胰头、胰颈或胰尾部，其大小不一，单发或多发。，病变在 CT 平扫呈低密度，在 MRI 脂肪抑制 FSPGR T1WI 中呈明显低信号，在脂肪抑制 FSE /SSFSE 其内囊液成分 T2WI 中可为均匀或不均匀的高信号，CT 和 MRI 增强扫描病变无强化。激素治疗后囊性病变可减小或完全消失。

## PU-368

# ADC 值联合纹理分析术前预测Ⅰ型与Ⅱ型子宫内膜癌的价值

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目的 探讨表观扩散系数（apparent diffusion coefficient，ADC）值联合纹理分析预测Ⅰ型与Ⅱ型子宫内膜癌的价值。方法 回顾性分析术后病理证实的 103 例子宫内膜癌患者的资料，所有患者术前均行常规 3.0T MRI 及扩散加权成像（diffusion weighted imaging，DWI）（b 值取 0 mm2/s、1000 mm2/s）扫描。测量原发病灶 ADC 值，在轴位 T2WI 图像上逐层勾画子宫内膜癌全病灶感兴趣区（region of interest，ROI），导入 GE Analysis Kit（AK）软件提取纹理参数，采用独立样本 t 检验或 Mann-Whitney U 检验、LASSO 及 Logistic 回归分析对纹理参数进行筛选，绘制受试者工作特征（receiver operating characteristics，ROC）曲线获得 ADC 值及纹理参数术前预测Ⅰ型与Ⅱ型子宫内膜癌的效能。结果 ADC 值在Ⅰ型与Ⅱ型子宫内膜癌之间有统计学差异。AK 软件共提取 680 个纹理参数，经两组间比较，再经 LASSO 降维、Logistic 回归分析得到 4 个对Ⅰ型与Ⅱ型子宫内膜癌有独立预测作用的参数，分别为 firstorder_10Percentile、glcm_DifferenceEntropy、glszm_LargeAreaEmphasis、shape_Maximum2DDiameterSlice。Ⅰ型子宫内膜癌的 ADC 值、纹理参数 glcm_DifferenceEntropy、shape_Maximum2DDiameterSlice 值明显高于Ⅱ型（P<0.05），firstorder_10Percentile、glszm_LargeAreaEmphasis 值明显低于Ⅱ型（P<0.05）。ADC 值联合纹理参数预测Ⅰ型与Ⅱ型子宫内膜癌的效能高于各参数单独预测效能。结论 ADC 值联合纹理分析可提高 MRI 在术前对子宫内膜癌类型的预测效能，弥补病理活检的不足，为个体化治疗提供定量与客观的依据。

## PU-369

# 囊性胸腺瘤的临床及 MRI 特征

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目的:探讨囊性胸腺瘤的 MRI 特征,以提高其 MRI 诊断及鉴别诊断水平。方法:回顾性分析经组织病理学证实的 17 例囊性胸腺瘤的临床及 MRI 影像资料,其中男 9 例,女 8 例,年龄 19～72 岁,平均 46 岁。分析常规 MRI 特征（包括大小、形态、囊腔分隔、实性成分、包膜完整度、瘤周水肿等）及表观扩散系数（ADC）值。结果:组织病理学分型:A 型胸腺瘤 2 例（11.8%）,AB 型胸腺瘤 2 例（11.8%）,B1 型胸腺瘤 2 例（11.8%）,B2 型胸腺瘤 8 例（47.0%）,B3 型胸腺瘤 3 例（17.6%）。肿瘤大小 2.3～13.6 cm,平均 7.1 cm;囊液呈 T1WI 低信号、T2WI 高信号 12 例（70.6%）,T1WI 高信号、T2WI 高信号 5 例（29.4%）;囊壁或分隔均含有不同程度实性成分,其中单发附壁结节/肿块 9 例（52.9%）,多发附壁结节/肿块 5 例（29.4%）,弥漫性增厚伴结节/肿块 3 例（17.7%）;肿瘤实性成分 ADC 平均值 1.32×10-3mm2/s。结论:囊性胸腺瘤多为 B2 型胸腺瘤,肿瘤多伴有不同程度实性成分。MRI 对囊性胸腺瘤的诊断及鉴别诊断具有重要价值。

PU-370

# The most Cited Articles in Neuroimaging of Epilepsy：A Bibliometric Analysis of the Top 50 Most Highly Cited Articles

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**Objective**: To analyze the research hotspots and development courses of neuroimaging on epilepsy and provide guidance for future research.
**Methods**: Web of Science All Databases were used to search the literatures in epilepsy. The articles were arranged in a descending order according to yearly citation counts, the top 10% of all included articles were regarded as highly cited articles. Information including publication year, contributing affiliation and country of the first author, study design, study purpose, citation count, yearly citation, imaging modality, epilepsy type, journal and journal impact factor（IF） were extracted and analyzed. Collaboration analyses in co-occurrence analysis between keywords and citation reference were also carried out in neuroimaging on epilepsy from 2011 to 2020.
**Results**: The literature search identified 155,782 articles. In total, the top 50 most highly cited articles ranked by yearly citation (from 11.36 to 32.60, 1990-2014) were included in this research. Most articles were published in 2010-2011 (n=15). The citation count of the selected articles varied from 114 to 681. For different study purposes, these studies were divided into three aspects: mechanism studies (n=13; 2004-2012; median: 2010), prognosis studies (n=3; 2008-2010, median: 2010) and diagnosis studies (n=34; 1990-2014, median: 2004.5). Temporal lobe epilepsy (TLE) (n=29) was the most common type in all of these three categories. Case control study design was easily found (n=28). Regarding mechanism studies, eleven studies used single modality and 2 used multi-modalities. Functional MRI (fMRI) was frequently used in studying epilepsy mechanism (n=12). These researches mainly focus on the change of epilepsy-related brain network. For diagnosis studies, nearly 85% of the researches were single modality studies. Most of these researches concentrated on structural magnetic resonance imaging (sMRI) and diffusion tensor imaging (DTI) applications in epilepsy. Meanwhile, fMRI is widely used to replace Wada test in lateralizing language dominance. For prognosis studies, the ratio between single and multi-modality was 2:1, and all of the researches concentrated on the role of neuroimaging in preoperative evaluation. The five hot topics in neuroimaging on epilepsy were children, epilepsy, seizure, MRI and TLE.
**Conclusion**: Study using MRI involving diagnosis, mechanism and prognosis of TLE and children with epilepsy is a hot issue in this field.

PU-371

# 多巴胺 D4 受体基因多态性与多动症患儿视觉网络的相关性研究

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目的：探讨多巴胺 D4 受体（DRD4）基因第 3 外显子 48 bp 的 2 次重复等位基因型（2R）影响注意缺陷多动障碍（ADHD）患儿视觉功能网络的变化与临床症状相关性。
方法：根据 DRD4 基因型分为 62 例 2R 基因型非携带者和 41 例 2R 基因型携带者，以视听整合持续性操作测验评估患儿的持续注意和反应控制的视觉水平，以 SNAP-IV 评定量表评估患儿的症状严重程度。并运用数据驱动的全脑分析方法--独立成分分析方法分离出三个视觉功能相关的脑网络，进行组内分析和组间分析。
结果：2R 携带者的外侧视觉网络右侧颞枕叶表现为功能连接增强，而右侧中央前回及扣带回前部连接下降；2R 携带者的内侧视觉网络右侧枕上回连接增强，左侧小脑上部连接下降。在右侧颞枕叶，SNAP 注意不集中评分与 2R 携带者的功能连接强度呈正相关，与 2R 非携带者呈负相关。
结论：从基因-脑-行为的研究过程中发现 DRD4 2R 基因可能通过介导视觉网络变化模式促进 ADHD 注意缺陷症状的发展。

PU-372

# 微小肝细胞癌在钆塞酸二钠增强 MRI 的表现

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目的：分析钆塞酸二钠（Gd-EOB-DTPA）动态增强 MRI 对于微小肝细胞癌（≤1cm）临床诊断的应用价值。方法：回顾性分析 2019 年 8 月至 2021 年 5 月在我院诊治的 38 例微小肝细胞癌（男性 28 例，其中 7 例≥2 个病灶；女性 10 例，其中 2 例≥2 个病灶）共 46 个病灶在钆塞酸二钠增强 MRI 中的影像特征及临床资料，并采用 McNemar 检验比较不同序列对微小肝细胞癌的检出率是否有统计学差异（$P$<0.05)。结果：46 个微小肝细胞癌病灶中，29 个（63.0%）$T_1$WI 呈低信号，28 个（60.8%）$T_2$WI 呈高信号，29 个（63.0%）抑脂序列呈高信号，38 个（82.6%）DWI 呈高信号，34 个（73.9%）在动脉期强化，22 个（47.8%）门脉期呈低信号，28 个（60.8%）移行期呈低信号，43 个（93.4%）肝胆特异期呈低信号，23 个（50.0%）呈快进快出的增强模式。肝胆特异期的检出率高于 $T_1$WI（P≤0.01）、$T_2$WI（$P$≤0.01）、抑脂序列（$P$≤0.01）、动脉期（$P$=0.02）、门脉期（$P$≤0.01）、移行期（$P$≤0.01）和快进快出增强模式（$P$≤0.01），而与 DWI 序列（$P$=0.227）的检出率的差异没有统计学意义。结论：相比于常规 MRI 序列，钆塞酸二钠增强 MRI 肝胆特异期低信号有助于微小肝细胞癌的诊断。

PU-373

# The Impact of Late Gadolinium Enhancement on the Heart of Multiple Myeloma Patients: A Preliminary Study from Strain and Histogram Analysis Perspective.

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Objective: Late gadolinium enhancement (LGE) was significant in the diagnosis and prognosis of multiple myeloma (MM). It is still unkown how the presence of LGE would impact cardiac structure and function of MM patients. Our study aimed to explore that impact.
Materials and mehtods: Twenty-two MM patients and 11 healthy controls were retrospectively recruitted. Among MM patients, LGE was present in 12 patients and absent in another 10 patients. Basical clinical data were collected, as well as morphological and tradiontal functional parameters, including left ventricular ejection fraction (LVEF) . Strain analysis was perfomed in order to reflect functional difference between LGE+ and LGE- patients. In addition, histogram parameters were acquired for noninvasive evaluation of structural alterations. After the delination of endocardium and epicardium, all the myocardium of left ventricle were included as region of interest (ROI) for histogram analysis.
Results: There was no significant difference of clinical data between MM patients and healthy controls, LGE+ patients and LGE- patients. Compared with healthy controls, MM patients had larger left atrial antero-posterior diameter (LAAP-d) , left mass index (LVMI) , and left ventricular wall thickness (LVWT) (all $p < 0.05$). LGE+ patients were with significantly increased LVWT and right ventricular end-systole volume index (RVESVI) but decreased left ventricular stroke volume index (LVSVI) , right ventricular ejection fraction (RVEF) compared to LGE- patients (all $p<0.05$). Global circumferential strain (GCS), global radial strain (GRS), global circumferential diastolic strain rate (GCSDr), and global radial diastolic strain rate (GRSDr) in LGE+ patients were statistically different from LGE- patients. Multivariate analyses indicated GCSDr was the only independent predictor of positive LGE in MM patients. Hitogram parameters showed LGE+ patients were with lower entropy, variance, and higher uniformity, which indicated a more homogeneous structure in LGE+ patients.
Conclusions: Among MM patients, LGE+ patients exhibited worse cardiac function compared with LGE- patients. GCSDr is the independent predictor of positive LGE in MM patients. Histogram analysis indicated that heart structure in LGE- patients were more heterogeneous than that in LGE+ patients.

## PU-374

# 坐骨结节滑囊炎的 MRI 诊断价值

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目的 探讨坐骨结节滑囊炎的 MRI 诊断价值。
方法 回顾性分析经手术病理确诊的 20 例坐骨结节滑囊炎的 MRI 表现，分析其影像特征。
结果 本组病例男 8 例，女 12 例；共 23 个病灶，其中 3 例两侧发病。病灶均位于坐骨结节与臀大肌之间，可达皮下。病灶为单个或多个囊性液体样信号影；囊内为单纯滑液或伴有少量纤维素 T1WI 呈低信号，T2W 呈高信号，信号均匀；囊内纤维素分泌较多或合并出血者 T1WI 呈等或高信号，T2W 呈高信号，信号多不均匀，可见液-液平面。增强扫描囊壁、间隔轻度或中等度强化，囊壁厚，内壁不光滑，囊液无强化；合并周围软组织感染时呈环形强化。部分病灶可见蒂或宽基底与坐骨结节相连。1 例病灶因坐骨结节滑囊炎合并感染，穿通皮肤形成瘘道，并出现临近骨髓水肿。
结论 坐骨结节滑囊炎 MRI 表现具有特征性，MRI 平扫及增强检察诊断坐骨结节滑囊炎能提供准确的解剖信息及了解并发症，为手术提供帮助。

## PU-375

# IVIM 预测脑胶质瘤 IDH 和 1p/19q 分子分型的价值

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目的：
探讨体素内不相干运动(intravoxel incoherent motion，IVIM)成像对 WHO Ⅱ级和Ⅲ级脑胶质瘤异柠檬酸脱氢酶(isocitrate dehydrogenase，IDH)和 1p/19q 分子分型的预测价值。
方法：
回顾性分析山西医科大学第一医院经病理确诊的 32 例 WHO Ⅱ级和Ⅲ级脑胶质瘤患者临床信息及影像学表现。分别测量脑胶质瘤肿瘤实质区及对侧正常脑白质区表观扩散系数(apparent diffusion coefficient，ADC)、慢扩散系数(slow diffusion coefficient，D)、快扩散系数(fast diffusion coefficient，D*)和灌注分数 (perfusion fraction，f)值，然后得到各校正参数值：相对 ADC(relative ADC)、相对 D (relative D)、相对 D* (relative D*)和相对 f (relative f) 值。应用卡方检验、两独立样本 t 检验及秩和检验分析 IDH 和 1p/19q 不同分型时各参数的差异，对有统计学意义的 IVIM 参数绘制受试者工作特征(receiver operating characteristic，ROC)曲线。
结果：
1、IDH 野生组患者年龄高于突变组 (P＜0.05)，性别在 IDH 两组中无统计学意义(P＞0.05)。IVIM 各参数中，IDH 突变组 ADC、rADC、D 值高于野生组，D*、rf 值低于野生组，差异有统计学意义(P＜0.05)，余参数值在两组中无统计学意义。ADC 值 ROC 分析中 AUC、阈值、敏感性及特异性分别为 0.802、0.00100、77.80%、85.70%，rADC 值分别为 0.762、1.406、61.10%、85.70%，D 值分别为 0.738、0.000745、66.70%、92.90%，D*值分别为 0.784、0.00245、72.20%、78.60%，rf 值分别为 0.718、1.964、94.40%、50%。
2、年龄和性别在 1p/19q 两组中均无统计学意义(P＞0.05)。1p/19q 共缺失组 D*值高于非共缺失组(P＜0.05)，余参数值在两组中无统计学意义。D*值 ROC 分析中 AUC、阈值、敏感性及特异性分别为 0.877、0.00234、100%、76.90%。
结论：
IVIM 可以无创预测脑胶质瘤 IDH 突变和 1p/19q 共缺失状态，在预测 IDH 突变时，ADC 值 AUC 最大，rf 值敏感性最高，D 值特异性最高，D*值在预测 1p/19q 共缺失时具有最大 AUC。因此，该技术有望成为预测脑胶质瘤 IDH 和 1p/19q 分子分型的手段之一，为患者临床治疗提供更多指导，从而显著改善患者预后。

# PU-376
# 基于偏头痛患者功能连接的激活似然估计研究：一项 meta 分析

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背景：静息态功能磁共振在神经影像研究方面有其独特的优势，无创，重复性高，患者接受程度高。近年来，脑功能连接研究在阐明脑功能神经生理机制方面，发挥了重要作用。偏头痛的脑功能连接的研究，已发表的文献选取的种子点不同，采用研究方法差异较大，因此，我们采取了基于坐标的 meta 分析，对偏头痛脑功能连接报道的坐标，进行归纳分析，为探究偏头痛共同的生物学及神经病理机制提供支持。
方法：我们检索了 Pubmed，web of science，Cochrane library 和 medline 等 4 个数据库 1978 年至 2021 年 6 月的关于偏头痛功能连接研究的英文文献，排除感兴趣区之间的功能连接研究，动物研究等，并提取坐标，共检索得到符合要求的 26 篇文献。其中，偏头痛患者 770 人，健康对照 768 人。采用 Ginger3.0.2 软件进行激活似然估计运算，使用的校正方法为 family wise error (FWE)校正，p＜0.001，cluster level threshold 为 0.05。
结果：采用置换检验 5000 次，激活似然估计结果显示，相较于健康对照组，偏头痛患者双侧额叶额中回功能连接减低；左侧颞叶及右侧小脑前叶近中央导水管周围脑组织功能增强。

结论：功能连接的改变，可能反应偏头痛患者疼痛的病理机制与脑功能活动之间的关系。额叶与人脑高级认知功能密切相关，其功能连接减低可能造成偏头痛患者对疼痛调节功能的紊乱，可能使患者更易患疼痛相关疾病，。而中脑导水管附近激活区，则可能表明偏头痛患者对疼痛的传导较健康对照组增强，同时对疼痛的耐受减低；颞叶的功能连接激活提示，偏头痛患者对声音、光等刺激较健康对照组敏感，这与患者先兆症状可能有较大的关系。激活似然估计分析表明，偏头痛患者额叶、颞叶及小脑区功能连接的改变与疼痛所导致的功能激活区域相似，这可能意味着偏头痛患者在疼痛处理的过程中，逐步累积导致了脑功能的改变，这有可能进一步导致脑结构的损伤。这些功能变化的表现可能有助于监测疾病进展以及治疗干预。

PU-377

# Intravoxel Incoherent Motion (IVIM) DiffusionWeighted imaging in quantitatively evaluation of WT-1 expression in Ovarian Cancer

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**Purpose**
To explore the value of Intravoxel incoherent motion (IVIM) quantitative parameters for difference WT-1 positive and negative OC.

**Methods**
A total of 31 patients of ovarian cancer confirmed by surgery and pathology from 2015 to 2020 were retrospectively collected. Including 15 WT-1 positive OC (age(51.71±11.08) years old) and 16 WT-1 negative OC (age, (60.82±8.65) years old). All patients underwent abdominal MR examinations (Signa HDxt, GE Medical Systems, USA) included T2WI, IVIM and LAVA(Scan parameters show in table 1). The original axial digital images from the IVIM sequence were transmitted to the GE SDC-ADW 4.6 workstation (Sun Microsystems, Santa Clara, Calif) and the post-processing was performed by Functool software. Referring to the anatomical location of lesion obtained on T2-weighted or DWI images, The stand ADC, D, D* and f maps were automatically constructed, and were reviewed by two observers who were blinded to clinical information and histopathologic results with 10 and 15 years of experience in pelvic imaging, respectively. The manual regions of interest (ROIs) were drawn along the edge of tumors on the slice with maximal solid area (we choose the solid in tumors), according to fatsuppression T2WI and T1WI (Fig. 1). The measurement was repeated for three times, and the averages of three measurements were calculated. The stand ADC, D, D* and f were recorded. Intra-group correlation coefficient (ICC) was used to test the measurement consistency between the two observers. Difference between above values and the expression of WT-1 in OC was compared by Mann-Whitney U test. Receiver operating characteristic (ROC) analysis was performed to evaluate diagnostic performance.

**Results**
The D value of WT-1 positive group was higher than WT-1 negative group, and P value=0.011(table 2). The stand ADC, D* and f were not significantly different between the two groups (P values, 0.097, 0.635 and 0.118). The area under the curve (AUC) of D value for discriminating WT-1 positive group and WT-1 negative group was 0.767, the sensitivity was 73.3%, and the specificity was 87.5% (Figure 2).

**Conclusion**

D value of IVIM image could be a promising imaging biomarker in evaluation of WT-1 expression in ovarian cancer.

# PU-378

# Lack of consistent brain changes in patients with type 2 diabetes mellitus: A new coordinate based meta-analysis in different methods of brain function analysis

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**OBJECTIVE:** Whether there are abnormal activities of brain functional in type 2 diabetes mellitus and whether the changes of different methods of brain function are consistent.
**MATERIALS AND METHODS:** A meta-analysis of neuroimaging of whole-brain resting-state functional magnetic resonance imaging (rs-fMRI) studies that measured differences in the kind of different methods of brain function T2DM patients and healthy controls were conducted using the Seed-based d Mapping software package by the permutation of subject images (PSI-SDM). We will search the following electronic databases: Void MEDLINE, PubMed, Web of Science, Cochrane Library, Elsevier ScienceDirect. All databases will be searched from Jan 1, 2007 to Apr 1, 2021, using the keywords "Diabetes Mellitus, Type 2" OR "T2DM" AND "functional magnetic resonance imaging" OR "fMRI" AND "Cognitive Dysfunction" OR "Mild Cognitive Impairment" OR "MCI". According to the characteristics of brain function in neuroimaging, different methods of brain function analysis were divided into two groups. The group one was the regional homogeneity (ReHo), degree centrality (DC) and independent component analysis (ICA) while the group two was the amplitude of low-frequency fluctuation (ALFF), positron emission tomography (PET) and cerebral blood flow (CBF). Twenty-three studies reporting 27 datasets were included in the meta-analysis. The protocol for this neuroimaging review was registered with PROSPERO (CRD42021247071).
**RESULTS:** We initially identified 1,094 records and eliminated 1,023 by deleting duplicate records and reading titles and summaries. We found 7 references from the remaining studies that met the inclusion criteria. We excluded 53 studies after reading the full text because 5 had serious complications, 6 had no healthy controls, 24 had ROI analyses only, and 7 were methods of brain structural, seven papers did not report coordinates (sent to author for help, no results), two studies were the same, and four papers had a quality score of less than 17. The final meta-analysis included 23 eligible trials with 27 data sets. Compared to healthy controls, the indexes of brain function in the group one of patients with T2DM were decreased primarily in the right rolandic operculum, right supramarginal gyrus, right postcentral gyrus, and right superior temporal gyrus ( full width at half maximum [FWHM] = 20 mm, threshold Free Cluster Enhancement-based [TFCE], family wise error rate [FWER]< 0.05 corrected, peak height Z > 1, cluster extent > 10 voxels). In group two, there is no significant difference after correction. When the meta-analysis is limited to data sets in each subgroup ( [FWHM] = 20 mm, p < 0.0005 uncorrected, peak height Z > 1, cluster extent > 50 voxels), we find that the results were consistent to a certain extent.
**CONCLUSIONS:** Our comprehensive meta-analysis shows that T2DM has a wide range of abnormal spontaneous brain activity, mainly involving visual, auditory and sensorimotor networks, which will help to understand the neuropathophysiological mechanisms of T2DM. In addition, the analysis of different indexes of brain function showed that the abnormal areas of activity of different indexes had certain coincidence. Therefore, we suggest that the results of a meta-analysis of a single index may be more explicable when the studies are sufficient. Conversely, when the studies are insufficient, we can use similar imaging principles to synthesize meta-analysis indexes, but the results should be treated with caution.

PU-379

# Structural and functional changes in narcolepsy

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Structural and functional changes in narcolepsy

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introduction:
Idiopathic rapid eye movement (REM) sleep behavior disorder (iRBD) is a potentially injurious parasomnia characterized by violent dream-enacting behaviors and loss of normal muscle atonia during REM sleep. iRBD is now recognized as a prodromal stage of neurodegenerative disease because most iRBD patients will eventually develop synucleinopathies such as Parkinson's disease (PD), dementia with Lewy bodies (DLB) or multiple system atrophy (MSA). Thus, the investigation of pathophysiological changes in iRBD could be an opportunity to identify biomarkers of early neurodegeneration and its progression, which might, in turn, contribute to the development of new therapeutic agents in neuroprotective trials. Based on resting-state functional magnetic resonance imaging (fMRI) and functional connectivity (FC) analysis, previous static FC studies revealed different patterns of FC abnormalities in iRBD. Taken together, these findings highlight the potential of fMRI to provide important information on the underlying pathophysiology of iRBD.
Methods:
Resting-state fMRI data from 12 iRBD patients and 18 matched healthy controls were analyzed using an independent component analysis, sliding window correlation and k-means clustering. Relationships between clinical symptoms and abnormal dFC were evaluated using Spearman's correlation analysis. In addition, we also used automatic fiber quantification techniques to treat the white matter fiber bundles of narcolepsy.
Results:
Two distinct connectivity states were identified to characterize and compare dFC patterns. We demonstrated that iRBD had fewer occurrences and a shorter dwell time in the infrequent and strongly connected State 1, but with more occurrences and a longer dwell time in the frequent and sparsely connected State 2. In addition, iRBD patients showed significantly decreased FC in certain dFC states compared to healthy controls. More importantly, the impairments in the temporal properties of State 2 were found to be associated manifest anxiety scale scores in the patient group.However, no significant difference was found in the white matter fiber bundles, which may be due to the small sample size.
Conclusions:
This study detected dFC impairments in iRBD patients and provided new insights into the pathophysiology of iRBD, which might contribute to the development of disease-modifying drugs in future clinical trials.

Key words:
Narcolepsy, Fmri, Structural,functional

PU-380

# Alterations of structural-functional coupling in type 2 diabetes mellitus patients with mild cognitive impairment

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**Objective：** To investigate structural-functional coupling pattern of Type 2 diabetes (T2DM) patients with Mild Cognitive Impairment (MCI) and their role in cognitive performance.
**Materials and Methods：** Sixteen T2DM patients with MCI (T2DM-MCI group) of the Department of Endocrinology of our hospital were enrolled as the research subjects, and 16 normal healthy people admitted for physical examination in the same period were selected as the control group (HC group). We assessed structural (using diffusion tensor imaging) and functional (using resting-state functional magnetic resonance imaging (fMRI) ) brain network metrics and cognitive scores at each group. Structural–functional coupling, calculated as the correlation coefficient between strengths of structural and functional networks, was used to assess structure–function relationships.
**Results:** In T2DM-MCI group, the integrity of white matter was extensively damaged, especially in corpus callosum. Structural clustering coefficient and characteristic path length were significantly decreased. Functional connections in hippocampus and the global efficiency were decreased. Structural–functional coupling had decreased significantly. This structural–functional coupling was associated with cognition, with stronger coupling associated with a decline cognitive performance.
**Conclusion:** Our findings provide novel biological evidence that T2DM leads to MCI. The collapse of these networks seems to lead to cognitive worsening.

PU-381

# Predictive value of logistic regression model based on MR characteristics for subtypes of growth hormone pituitary adenoma

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Purpose: The subtypes of growth hormone (GH) pituitary adenomas (PA) are closely related to the choice of surgical approach and scope of resection for GH adenomas, and may affect the outcome of surgery. Therefore, it is essential to investigate the value of MR characteristics in differentiating the subtypes of GH pituitary adenomas.
Materials and Methods: The clinical and MRI data of 70 patients with growth hormone pituitary adenoma confirmed by surgery and pathology were retrospectively analyzed. The tumors were divided into dense granular (DG, 36 cases) and sparse granular type (SG, 34 cases). The tumors' MR features were analyzed, including the mean and maximum diameter, T2 signal intensity, T2 relative signal intensity (rSI), homogeneity, enhancement degree, and invasiveness (Knosp grade). The quantitative data were expressed as mean ± standard deviation and the qualitative data were expressed as rate or percentage. Mann-Whitney U test and chi-square test was used to analyze MR characteristics between the two groups. Taking the score corresponding to the statistically significant features as the independent variable, and group of the DG or SG adenomas as the dependent variable, the binary logistic regression analysis was conducted, and the regression model was established. The receiver operating characteristic (ROC) curve

analysis was carried out for each single factor parameter, and the predicted probability value of the regression model, and the area under the curve (AUC), sensitivity, and specificity were calculated.
Results: The mean and maximum diameter of growth hormone adenoma in DG and SG were 1.77 vs. 2.45 and 1.95 vs. 3.00 cm (median, P<0.05), respectively. There was a significant difference between the two groups in T2 signal intensity and rSI (P-value was 0.020 and 0.001, respectively). Most DG adenomas (86.1%) appeared as hypointense on T2 images, and 72.2% of SG adenomas were hyperintense. There was no significant difference in tumor homogeneity (P=0.622). A significant difference was found in the Knosp grade between the two subtypes (P=0.004). Besides, the enhancement degree of SG adenomas was significantly higher than that of DG adenomas (P=0.001). Logistic regression analysis showed that T2 rSI and enhancement degree were independent predictors of the two subtypes, and the odds ratio was 4.811 and 0.215, respectively. The multivariate logistic model obtained relatively high predicting efficacy, and the AUC, sensitivity, and specificity are 0.765, 0.882, and 0.500, respectively.
Conclusions: There are significant differences in tumor size, T2 signal intensity, T2 rSI, enhancement degree, and invasiveness between DG and SG adenomas. The logistic model based on the enhancement degree and T2 rSI has important value in predicting the subtype of GH adenoma.

# PU-382

# 炎症及低灌注在脑白质高信号认知障碍中研究

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背景和目的：血管源性脑白质高信号（WMH）是脑小血管病的重要影像学标志物之一，与认知功能障碍等临床表现密切相关。炎症应激及缺血低灌注是 WMH 的潜在发病机制，目前研究多从单机制角度进行探讨，且部分结果相互矛盾。本文从多机制角度研究炎症及低灌注在 WMH 发生发展中的作用机制，有助于针对潜在的可改变因素进行认知障碍的预防和治疗。
方法：基于影像学表现，共纳入 65 名 WMH 患者及 65 名健康对照，所有受试者均进行临床资料收集、炎症指标化验、认知功能评定及影像学数据采集。炎症指标主要包括超敏 C 反应蛋白（hsCRP）及脂蛋白相关磷脂酶 A2（Lp-PLA2）；认知评定主要为总体认知、记忆、语言、注意执行功能测定；影像学通过动脉自旋标记磁共振（ASL）技术进行脑血流量（CBF）获取。
结果：研究发现高血压、饮酒史及 Lp-PLA2 存在组间差异，Logistic 回归分析显示高血压及 LP-PLA2 可作为 WMH 的独立危险因素。病例组全脑、灰质、白质、左侧眶内额上回、左侧颞中回、右侧丘脑 CBF 较对照组低，左侧三角部额下回 CBF 较对照组高。Lp-PLA2 与全脑($r=-0.417, P<0.001$)及灰质($r=-0.278, P=0.025$)CBF 间存在显著相关，而与白质($r=-0.184, p=0.142$)CBF 无显著相关。此外，病例组总体认知、记忆、语言、注意执行功能评分均较对照组显著降低，左侧眶内额上回 CBF 与剑桥认知评定中文版（CAMCOG-C）总分($r=0.414, p<0.001$)，CAMCOG-C 执行功能 ($r=0.444, p<0.001$)，连线实验 A($r=-0.437, p<0.001$)，连线实验 B($r=-0.431, p<0.001$)，右侧丘脑 CBF 与 Stroop-C($r=-0.426, p<0.001$)显著相关；左侧三角部额下回 CBF 与 CAMCOG-C 注意功能($r=-0.288, p=0.020$)存在相关性。
结论:本研究从炎症及低灌注多角度探讨 WMH 发病机制，结果表明血管炎症指标 Lp-PLA2 作为 WMH 的独立危险因素，可引起全脑、灰质 CBF 下降；而不同脑区脑区的 CBF 改变可引起不同领域认知功能损害。

PU-383

# Cerebral cortex abnormality in type 2 diabetes mellitus patients with cognitive dysfunction: A systemic review and meta-analysis

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Abstract
Objective Cerebral cortex alterations in Type 2 diabetes mellitus (T2DM) with cognitive dysfunction has been reported in variable regions of the brain. This meta-analysis aims to explore the most significant and consistent abnormality regions in T2DM patients with cognition dysfunction.
Materials and Methods Studies from PubMed, MEDLINE, Cochrane library and Web of Science until April, 15, 2021 had been searched, original studies that compare the cortical alteration between health control and T2DM patients with cognitive impairment by magnetic resonance imaging (MRI) will meet the inclusion criteria. The coordinates(x, y, z) and effect sizes (such as t value) from 10 included studies (1301 participants) were extracted to be meta-analyzed by anisotropic effect size-signed differential mapping (AES-SDM) software.
Results Cerebral cortex of left superior temporal gyrus (BA 48) and right superior frontal gyrus, medial orbital (BA 11) were significant decrease in the T2DM patients, and the Asia population showed most significant decrease area in the left superior temporal gyrus (BA 48). The ratio of female patients showed negative relationship with the cerebral cortex decrease in Left postcentral gyrus and the disease duration showed positive relationship with the cerebral cortex decrease in Left middle temporal gyrus.
Conclusion Left superior temporal gyrus and right superior frontal gyrus, medial orbital could be the main brain areas impaired by T2DM to cause cognitive dysfunction. The population distribution, gender ratio and disease duration could be very important effecting factors in T2DM patients with cognitive dysfunction.

PU-384

# Fat Fraction Quantified via Magnetic Resonance Spectroscopy in the Diagnosis of Osteoporosis: A Meta-analysis

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Purpose Given the global prevalence of osteoporosis and its associations with morbidity, mortality and deterioration in overall quality of life, significant research has been devoted to the diagnosis of this bone disease. This paper presents a meta-analysis of published research regarding one emerging diagnostic technique: magnetic resonance spectroscopy (MRS), a non-invasive method of determining the concentrations of various chemical components in tissues.
Methods Previous studies investigating the pathology of osteoporosis have established a statistically significant link between increases in the bone marrow fat fraction (FF%), measured via MRS, and decreases in bone mineral density, the primary predictor of bone strength. Relevant literature was reviewed, and over 1,000 data points were collected from past studies on osteoporotic, osteopenic, and/or healthy control subjects. Data points were then grouped based on MRS location (lumbar spine, femoral neck, calcaneus, and femur). Analysis of variance tests,

followed by Tukey's post-hoc tests, were performed to evaluate the ability of MRS FF% scores to differentiate between osteoporotic, osteopenic, and healthy subjects. Welch's t-tests were performed to further validate these findings, accounting for the inconsistencies in variation between subject groups.

Results Results demonstrated the existence of statistically significant differences between osteoporotic, osteopenic, and healthy groups for measurements of the lumbar spine ($P<0.0001$), as well as between osteoporotic and healthy groups at the femoral neck. No such differences were found in measurements at the femur and calcaneus, potentially due to the low number of studies and subjects reported for the latter two categories.
Conclusion MRS FF% scores appear to hold great potential clinically as a non-invasive, early diagnostic tool for osteoporosis; however, further research is required before these findings can be generalized beyond well-studied bone areas.

# PU-385

# 康复运动降低盘源性腰痛椎旁肌肉 TNF-α 改善脂肪浸润的多模态磁共振研究

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目的
本研究探讨康复训练对盘源性腰痛（discogenic low back pain，DLBP）大鼠椎旁肌及椎间盘的影响机制，并通过多模态磁共振评估康复运动后一个月 DLBP 椎旁肌脂肪浸润和炎性分子的表达情况，为临床保守治疗 DLBP 提供新的思路和实验支持。
材料与方法
1. X 线透视引导，利用 25G 针头侧后路入穿刺 SD 大鼠 L4/L5、L5/L6 腰椎椎间盘，髓核内注射 PBS 2.5μl，构建 SD 大鼠盘源性腰痛模型。
2.术后 1 天开始进行游泳康复运动，持续进行 5 天，每天 30 分钟。每天每只大鼠在直径 17cm；高度 40cm；水深 30cm 的圆柱形容器中进行游泳。水温在 34°C～36°C 之间。
3.术后 1 天、1 周、2 周、1 月进行行为学评价。步态分析评价大鼠行走步态和后肢使用情况，热板试验评价大鼠对热刺激的反应阈值，丙酮试验评价大鼠对冷刺激的反应阈值，悬尾试验评价大鼠腰部肌肉力量，握力试验评价大鼠腰部和四肢力量。
4.术后通过多模态磁共振评估大鼠椎旁肌功能障碍和脂肪浸润，有 T2WI、T2-mapping、BOLD 和 IDEAL-IQ 序列。
5.术后通过 HE 染色、藩红固绿染色评价大鼠髓核和纤维环结构退变及细胞外基质变化。
6.术后通过 Elisa 实验评价康复运动后椎间盘、椎旁肌及血清中 TNF-α 含量的表达变化。
结果
1.行为学试验显示：游泳组步态评分高于腰痛组（$P<0.05$）。相比腰痛组，游泳组的冷热刺激阈值更高。悬尾试验显示游泳组弯腰挣扎时间多于腰痛组。握力试验发现游泳组腰部及四肢力量更强
2. 影像学结果显示三组大鼠 T2 值、R2*值及脂肪分数值均具有显著性差异（$P＜0.05$）。伪彩图显示游泳组 T2、R2*值及脂肪分数值较腰痛组相比均有下降。
3. 组织学染色结果显示腰痛组椎间盘形态不规则，髓核固缩，纤维环排列紊乱及软骨边缘不整，游泳组椎间盘形态有明显改善。
4. Elisa 实验显示：腰痛组血清及椎旁肌 TNF-α 表达增强，而游泳组表达含量显著下降（$P<0.05$）。
结论

该研究结果提示椎间盘退变会导致 TNF-α 增高，椎旁肌脂肪浸润，脊柱失去稳定性，从而加重椎间盘退变。且研究结果发现康复运动后，大鼠行为学评分升高，椎旁肌脂肪浸润改善，血清及椎旁肌中 TNF-α 含量降低。提示康复运动可通过降低 TNF-α 含量来改善椎旁肌脂肪浸润，从而缓解腰部疼痛。因此康复运动可以有效改善 DLBP 症状，为康复运动理论的构建提供参考价值。

PU-386

# 2 型糖尿病伴认知障碍大鼠的 DTI 及结构 MRI 成像研究

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目的：通过对 2 型糖尿病（Type2 diabetes，T2DM）大鼠模型进行纵向 DTI 及结构 MRI 扫描，检测其与认知功能相关脑区的微观结构损害及部分脑区体积的变化，探讨 DTI 及结构 MRI 成像早期检测 T2DM 大鼠认知功能障碍的作用。
材料与方法: 45 只 Sprague Dawley（SD）大鼠随机分为 T2DM 组（25 只）和对照（Control，Con）组（20 只），采用高脂高糖饲料喂养一个月和两次注射低剂量链尿佐菌素（Streptozotocin,STZ）的方法建立 T2DM 动物模型。于造模前、造模后一个月、造模后三个月进行 Morris 水迷宫试验，评估大鼠的学习和记忆能力。于造模后一个月、三个月进行 T2 加权成像（T2-weighted imaging,T2WI）及扩散张量成像（Diffusion tensor imaging, DTI）扫描。利用基于体素 (Voxel-based analysis,VBA)的方法分析两组大鼠全脑 FA 值的变化；利用基于感兴趣区(Region of interest,ROI)的分析方法在 DTI 图像上手动画出代表海马、纹状体面积的 ROI，分析海马、纹状体 DTI 参数的变化；利用 ROI 的方法在 T2WI 上手动勾画出大鼠海马、纹状体轮廓，分析其面积是否有改变；最后取大鼠脑组织切片进行苏木精-伊红染色(Hematoxylin-eosin,HE)、尼氏染色，观察大鼠神经细胞受损情况。大鼠血糖、体重数据采用独立样本 T 检验和单因素方差分析，以 P＜0.05 为差异有统计学意义。水迷宫数据采用双因素重复测量方差分析和简单效应检验，以 P＜0.05 为差异有统计学意义。MRI 数据采用双样本 T 检验，以 P＜0.05 为差异有意义。
结果：①行为学实验：逃避潜伏期的重复测量方差分析结果显示两组的时间主效应、时间与分组的交互作用有统计学意义（P<0.05），分组主效应无统计学意义（P>0.05）。简单效应结果显示，随着训练次数的增多，两组大鼠的逃避潜伏期均逐渐缩短（P<0.05）。造模前，两组逃避潜伏期差异无统计学意义（P>0.05）。造模后一个月，T2DM 组逃避潜伏期较 Con 组缩短（P<0.05）。造模后三个月 T2DM 组逃避潜伏期较 Con 组延长（P<0.05）。②大鼠全脑纤维束分析：造模后三个月 T2DM 大鼠的右侧海马、右侧大脑皮质、双侧伏隔核（腹侧纹状体）、双侧尾壳核（背侧纹状体）、右侧胼胝体小钳的 FA 值减低。③大鼠认知相关脑区的 FA 值变化：造模后一个月、三个月，T2DM 组大鼠双侧海马的平均 FA 值较 Con 组减低（P<0.05）。造模后三个月，T2DM 组大鼠双侧纹状体平均 FA 值较 Con 组减低（P<0.05）。④大鼠认知相关脑区体积的变化：造模后一个月、三个月时，两组大鼠海马、纹状体面积差异无统计学意义（P<0.05）。⑤ 病理学：海马 C1、C3 区锥体细胞核变小，细胞固缩浓染、尼氏小体减少；纹状体区神经细胞变性、固缩，胶质细胞反应性增生，尼氏小体减少。
结论：DTI 可以早期检测 2 型糖尿病大鼠海马、纹状体微观结构损害，而结构 MRI 成像未检测到该区域脑组织体积的变化，提示海马、纹状体 FA 值的减低有助于 2 型糖尿病大鼠认知障碍的早期检测。

PU-387

# MRI 诊断儿童眼眶间叶性软骨肉瘤 1 例

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摘要：软骨肉瘤常起源于软骨样组织或软骨样骨，也可起源于不含软骨的其他组织。以四肢骨和扁骨多见，发生于眼眶极为罕见[1]。此瘤平均年龄 25 岁，范围在 18-84 岁之间，眼部表现多以进行性突眼伴眼球运动障碍、复视、视力下降、头痛为主要临床表现。

PU-388

# 基于轴位 T1WI 图像大腿肌肉脂肪浸润量化方法的可靠性验证

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**目的：**探索使用 ImageJ 在 MRI T1WI 图像上分割量化大腿皮下脂肪组织、肌内脂肪(IntraMF)及肌间脂肪(InterMF)的可行性。**材料和方法：**对 28 名志愿者（包括 14 名 2 型糖尿病患者）行大腿中部 MRI 扫描，在轴位 T1 图像上对肌肉脂肪浸润程度进行 Goutallier 分级；通过 ImageJ 分割测量大腿 SAT、IntraMF 及 InterMF 面积；通过 IDEAL-IQ 脂肪分数以计算大腿肌肉内的脂肪面积。分析 ImageJ 分割方法和 Goutallier 分级与 IDEAL-IQ 脂肪定量方法的相关性。检测 ImageJ 分割方法的观察者内和观察者间可靠性。**结果：**ImageJ 分割方法和 IDEAL-IQ 脂肪定量之间有很强的相关性（r=0.998，p=0.000）；ImageJ 分割大腿 Sth 的观察者间及观察者内 ICC 均为 0.999，*p*=0.000；大腿 Sinter 观察者间 ICC 为 0.941，*p*=0.003，观察者内 ICC 为 0.992，*p*=0.000；大腿 Sintra 观察者间 ICC 为 1.000，*p*=0.000，观察者内 ICC 为 0.997，*p*=0.000。**结论：**ImageJ 在 MR T1 序列上分割量化大腿 SAT、IntraMF 及 InterMF 具有良好的可靠性，且与 IDEAL-IQ 脂肪定量方法有很强的相关性。ImageJ 分割是半定量 Goutallier 分级的一种可行替代方法。

PU-389

# Abnormal Intrinsic Brain Functional Network Dynamics in Patients with Cervical Spondylotic Myelopathy

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**Background:** Resting-state functional connectivity between whole brain regions exists time threshold changes, at a time scale of tens of seconds to minutes. However, the specific topological changes in dynamic functional networks and its role in cervical spondylotic myelopathy (CSM) brain function reorganization remain unclear. This study aimed to investigate the dynamic functional connection (dFC) of CSM patients, focusing on the temporal characteristics of the functional connection state patterns and the variability of network topological organization .

**Methods:** Eighty eight patients with CSM and 77 healthy controls (HCs) were recruited for rs-fMRI scans. First, we applied the sliding time window analysis method and K-mean clustering analysis to capture the dFC variability patterns of the two groups. Next, we discussed the dFC characteristics of CSM patients in each state and compared the differences between the two groups in the same state(all corrected by NBS correction(Edge p<0.001, component p<0.05, literation=1000). Then, we extracted the brain networks under all sliding windows of all subjects. Finally, we combined graph-theoretical approaches to comprehensively investigate the variance of the topological organization of whole-brain functional networks.
**Results:** All participants showed 4 kinds of dynamic functional connection states by K-mean clustering analysis. As a result, the mean dwell time in state 2 was significantly different between two groups(mean ± SD for healthy controls: 7.5 ± 13.6; for CSM patients: 13.4 ± 20.8, p<0.05). Particularly, the mean dwell time in state 2 was significantly longer in CSM group compared to healthy control group. In state 1, compared with HC, CSM patients showed the positive coupling between LECN(left executive control network) and PSN(posterior salience network), whereas the vDMN(ventral default mode network) showed decrease functional connectivity. In state 2, patients with CSM showed the decrease functional connectivity in the LECN, wheras the positive coupling exsisted in LN(language network) and VN(visuospatial network). In state 3, CSM patients showed the negtive coupling between RECN(right executive control network) and SMN(sensorimotor network), while the LECN, PSN and VN showed positive coupling. In state 4, PN(precuneus network) and PVN(primary visual network) showed negtive coupling but LN, LECN and PSN showed positive coupling. Additionally, there was a higher variability in the nodal local efficiency(Heschl_R, Temporal_Sup_L, Temporal_Sup_R, Temporal_Mid_L), nodal cluster coefficient(Rolandic_Oper_L, Heschl_R, Temporal_Sup_R, Temporal_Pole_Sup_L)and small-worldness(Bonferroni correction, p<0.05).
**Conclusions:** Dynamic functional connection states may offer new insight of the physiopathological mechanisms of CSM. The variance of topological organization of whole-brain functional networks may suggest instability of the brain network in CSM patients.
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# PU-390

# 胰腺实性假乳头状肿瘤与无功能性胰腺神经内分泌瘤的 MRI 鉴别

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目的 探讨能用于鉴别胰腺实性假乳头状肿瘤（pancreatic solid pseudopapillary neoplasms，pSPN）与无功能性胰腺神经内分泌瘤（non-functional pancreaticneuroendocrine tumors，NF-pNET）的 MRI 特征； 方法 回顾性分析复旦大学附属中山医院 2010 年 01 月至 2021 年 01 月经手术病理证实的 pSPN 53 例和 NF-pNET 81 例患者临床信息、病理及影像学资料，对两组病例的肿瘤部位、长径、形态、边界、是否位于胰腺轮廓外、磁共振平扫各序列信号、DWI、病灶与胰腺的 ADC 比值（rADC）、T1WI 平扫信号强度是否均匀、强化程度、强化特点、强化峰值、强化趋势、有无囊变（以及囊实性比例）、出血、主胰管扩张、胰周脂肪侵犯、淋巴结转移及肝转移等，采用独立样本 t 检验。将单因素分析具有统计学意义的变量均纳入二元 Logistic 回归模型，筛选出 pSPN 和 NF-pNET 的独立预测因素，并采用 ROC 曲线进一步分析。 结果 pSPN 与 NF-pNET 的性别、年龄、部位、长径、T1WI 平扫信号强度、rADC、囊变（囊实性比例）、出血、淋巴结转移及肝转移、环形强化、浮云征、肿瘤内血管影、强化程度、强化峰值及强化趋势等差异有统计学意义（P<0.05），诊断 pSPN 和 NF-pNET 的独立预测因素包括年龄、T1WI 平扫信号强度、强化程

度、强化趋势、浮云征，据此构建的联合诊断模型有较好的诊断效能；结论 MRI 特征包括 T1WI 平扫信号强度、强化程度、强化趋势、浮云征结合患者年龄可以用于鉴别 pSPN 和 NF-pNET。

## PU-391

# 常规 MRI 阴性难治性癫痫儿童的脑静息态 fMRI 研究

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目的：利用静息态功能磁共振（resting-state functional MRI，rs-fMRI）技术研究常规 MRI 阴性儿童难治性癫痫（intractable epilepsy，ITE）功能连接强度（functional connectivity strength，FCS），对比分析难治性组、非难治性组 FCS 是否存在差异，分析 FCS 变化与病程及智商（intelligence quotient，IQ）相关性。
方法：纳入儿童 ITE 患者 15 例、非难治性癫痫 24 例及性别、年龄、教育程度相匹配的健康志愿者 25 例，ITE 患儿采用中国-韦氏儿童智力量表进行智力测试。所有受试者均采用美国 GE3.0T HDx 型超导磁共振扫描仪行 rs-fMRI 数据采集。rs-fMRI 数据基于 DPARSF V4.2 进行数据预处理，首先评估三组之间的 FCS 值差异，利用 SPM8 软件对全脑体素进行方差分析得到有统计学差异的脑区，同时以年龄、性别、受教育程度作为协变量输入软件进行分析，然后三组间两两比较，采用 $p<0.05$ 阈值并行 Bonferroni 校正以比较三组间的 FCS 值差异，分析评估难治性癫痫组异常脑区的 FCS 值与病程、IQ 的相关性。
结果：难治性组、非难治性组与对照组间年龄、性别、教育程度无统计学差异（$p>0.05$）。三组间静息态 FCS 方差分析有统计学差异($p<0.05$)。与正常对照组相比，难治性组 FCS 值降低的脑区有右侧颞上回颞极、右侧颞中回、右侧颞中回颞极、双侧楔前叶；FCS 值增高的脑区有左侧额下回三角部、左侧海马旁回、左侧尾状核、左侧辅助运动区、右侧中央后回、右侧距状裂及周围皮层。相关性分析显示左侧尾状核 FCS 值与言语智商(verbal intelligence quotient，VIQ)呈正相关。与非难治性组比较，难治性组 FCS 降低的脑区有右侧内侧额上回、左侧颞下回；FCS 值增高的脑区有右侧颞中回、右侧颞下回、右侧距状裂及周围皮层。与对照组相比，非难治性组 FCS 值降低的脑区有右侧内侧眶部额上回、右侧辅助运动区、右侧额上回、右侧楔前叶；FCS 值增高的脑区有双侧梭状回、海马旁回、尾状核、左侧颞中回颞极、左侧丘脑、左侧舌回、右侧额下回三角部、右侧额中回。
结论：儿童难治性癫痫 FCS 异常主要位于颞叶皮层及前额叶皮质，这可能是儿童 ITE 耐药的病理基础，且左侧尾状核 FCS 与 VIQ 呈正相关，为了解 ITE 的神经病理生理机制提供了影像学依据。

## PU-392

# 可逆性后部脑病综合征诊断标准制定的研究

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目的：
根据循证医学文献回顾原则明确可逆性后部脑病综合征（PRES）的诊断指标，在文献研究的基础上通过德尔菲问卷调查法制定出 PRES 的诊断标准，为临床中诊断 PRES 提供参考。
方法：
本研究主要分四步进行，第一步基于循证医学的文献回顾，全面搜集 Pubmed、Cochrane Library、Embase、Web of science 4 大英文医学数据库中与 PRES 相关的文献，筛选并提取出与制定 PRES 诊断标准相关的指标。第二步设计问卷调查表，基于文献研究初步形成的指标采用 5-Likert scale 量表法设计问卷内容。第三步德尔菲问卷调查法，在国内外遴选出本领域专家共 16 位，以电子邮件或微信的方式发放问卷。总共进行 3-4 轮问卷调查，对每轮问卷的反馈结果进行专

家积极系数、均数、等级和、不重要百分比、变异系数、肯德尔和谐系数的统计分析，当专家的反馈意见逐渐趋同时，不再进行新一轮问卷调查。根据最后一轮问卷结果进行权重分析，结合专家意见归纳出 PRES 的诊断标准。第四步，将新制定的诊断标准通过临床病例进行配对卡方检验和 Kappa 一致性分析，验证诊断标准的临床意义。
结果：
（1）检索到符合纳入标准的文献共 5020 篇，经过题目及摘要、全文阅读依次筛选后最终纳入文献 15 篇，共包括 PRES 病例 944 例，提取的诊断指标主要分为 6 个一级指标（危险因素、临床症状、影像学、实验室检查、鉴别诊断、随访复查），多个二级指标。（2）根据遴选专家的情况分析，16 位专家中 12 位来自中国，另外 4 位来自美国、法国、意大利；其中学历博士 68.75%, 硕士 18.75%，学士 12.5%。三轮问卷专家回复的积极系数均为 100%，参与本研究的专家具有较高的积极性。肯德尔和谐系数分别为 0.718、0.764、0.842，专家意见逐渐趋近一致。（3）根据三轮专家问卷调查的数据结果，通过统计分析及结合专家意见最终形成了具有高度专家共识的 PRES 诊断标准。（4）验证新制定的 PRES 诊断标准与原诊断结果无差异，P 值均大于 0.05。Kappa 值为 0.746，诊断具有较高程度一致性。
结论：
（1）通过德尔菲问卷调查法制定的 PRES 诊断标准主要分为五个一级指标，分别是Ⅰ危险因素、Ⅱ临床症状、Ⅲ影像学、Ⅳ随访复查、Ⅴ排除其他。当满足Ⅰ+Ⅱ+Ⅲ+Ⅳ/Ⅴ时，诊断为肯定 PRES；当满足Ⅲ+Ⅰ/Ⅱ+Ⅳ/Ⅴ或Ⅱ+Ⅲ+Ⅰ/Ⅳ/Ⅴ时，诊断为很可能 PRES；当满足Ⅲ+Ⅰ/Ⅱ/Ⅳ/Ⅴ时，诊断为可能 PRES。（2）新制定的 PRES 诊断标准可用于临床病例的诊断。
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# PU-393

# 妊娠及产褥期脑血管病高危因素及影像学多中心研究

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目的：
妊娠及产褥期脑血管病对母婴伤害很大。本研究旨在回顾性分析妊娠及产褥期脑血管病的危险因素，生化指标及病灶累及部位，以期对高危人群的早期筛查及风险防治提供帮助。
方法：
回顾性收集贵州医科大学附属医院、杭州市第一人民医院及泰安市中心医院在 2010 年 1 月至 2019 年 12 月期间的 231 例患脑血管病的孕产妇临床及影像学资料，同时在三家医院筛选出同期住院、无脑血管并发症的健康孕产妇，按随机数字表法抽取 231 例作为健康对照组，比较病例组与对照组的一般资料，妊娠资料及生化指标，并绘制模型受试者工作特征分析(ROC)曲线，比较其诊断效能。随后将病例组进行分层分析，按照疾病类型分为两个亚组，即脑卒中组及可逆性后部脑病综合征(PRES)组，比较亚组之间的一般资料，妊娠资料及生化指标。最后分析脑血管病变类型与妊娠时期之间的关系及脑血管病变累及部位分布情况。
结果：
本研究共纳入 231 例妊娠及产褥期脑血管病患者，多数发生在妊娠期(197 例, 85.2％)，以单纯 PRES 多见(121 例, 52.4%)。脑卒中患者(108 例, 46.8%）病死率较高(7/108, 6.5%)，以 ICH 破入脑室为主要原因(3/7, 42.9%)。通过比较病例组与对照组发现：脑血管病的危险因素包括分娩次数(OR, 2.22; 95%CI, 1.07-4.58), 非子痫先兆子痫类高血压(OR, 21.03; 95%CI, 2.36-187.41)和子痫/先兆子痫类高血压(OR, 20.11; 95%CI, 6.99-57.83)；纤维蛋白原(OR, 1.68; 95%CI, 0.48-0.98)及白细胞计数(OR, 1.20; 95%CI, 1.07-1.35)水平的增高增加了患脑血管病的风险，钙离子浓度的增加降低了患脑血管病的风(OR, 0.06; 95%CI, 0.00-0.71)，构建的生化指标模型曲线下面积(AUC)为 0.83，特异性及敏感性分别 82.3%，71.6%；构建综合预测模型 AUC 为 0.899，敏感性及特异性分别为 80.77%、90.50%。3.通过比较脑卒中组与 PRES 组发现: 与 PRES 组相比，患子痫/先兆子

痫类高血压的患者，最终发生脑卒中的风险减低 99.96% (OR, 0.00; 95%CI,0.00-0.05)，是脑卒中的相对保护因素。4.通过对 4 种疾病的发生时期及影像部位分布发现: IS 多发生于妊娠晚期，以单部位受累多见(29 例, 67.4%)，多发生于 M5 及 M6 区(10 例, 23.3%)；ICH 多发生于妊娠晚期，以单部位受累多见(49 例, 84.5%)，病灶多发生于额叶(17 例, 29.3%)；CVT 多发生于妊娠早期及产褥期，以多部位受累多见(14 例, 60.9%)，多累及上矢状窦(15 例, 65.2%)；PRES 多发发生于妊娠晚期，以多部位受累多见(89 例, 72.4%)，以枕叶(69 例, 56.1%)、顶叶(67 例, 54.5%)常见，呈完全或不完全对称分布。
结论：
妊娠及产褥期脑血管病多发生于妊娠晚期；分娩次数及妊娠高血压病会增加妊娠及产褥期脑血管病的风险，相比于脑卒中，子痫/先兆子痫更会增加 PRES 的发病风险；血钙浓度减低可能是妊娠及产褥期脑血管病的潜在危险因素，基于临床资料及生化指标构建的综合临床预测模型对妊娠及产褥期脑血管病的发生有较好的预测价值。2.妊娠及产褥期脑梗死好发于前循环 M5 及 M6 区，脑出血好发于额叶，颅内静脉窦血栓好发于上矢状窦，PRES 以顶枕型为主。

# PU-394

## Value of conventional MRI texture analysis in the differential diagnosis of phyllodes tumors and fibroadenomas of the breast

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Abstract
Background: There is substantial overlap in MRI findings between PTs (phyllodes tumors) and FAs (fibroadenomas). Our study was performed to investigate the value of conventional MRI (magnetic resonance imaging) TA (texture analysis) in the differential diagnosis of PTs and FAs. Methods: Preoperative MRI data, including axial T1WI, T2WIFS (T2WI with fat suppression), DCE-T1WI2min and DCE-T1WI7min (T1WI post-strengthened for 2 min and 7 min, respectively, on dynamic contrast-enhanced MRI), of 45 patients with PTs and 67 patients with FAs were retrospectively analyzed. MaZda 4.7 software was used to manually draw the maximum ROIs at the same lesion level of above MRI images, the optimized feature selection methods included Fisher’s coefficient, probability of classification error and average correction coefficient (POE+ACC), mutual information (MI) as well as combination of the above three methods (MI+PA+F, MPF), respectively. The misclassification rates of PTs and FAs were compared between texture analysis and subjective diagnosis by radiologist. Results: The DCE-T1WI7min images had the lowest misclassification rate of 10.71% (12/112). The misclassification rate for the radiologists' analysis (31.25%, 35/112) was higher than that of all the texture analysis, and there was a statistically significant difference between radiologists' misclassification rates and those from the FPM method in terms of the T2WIFS and DCE-T1WI2min images (all P<0.05), and for the DCE-T1WI7min images by using the Fisher and FPM methods (all P<0.05). Conclusion: Texture analysis of conventional MRI can be used as an assistant tool in providing a certain objective basis for differentiating PTs from FAs.

# PU-395

## 前列腺癌根治术后发生早期尿失禁患者的盆底 MRI 研究

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目的：对比研究腹腔镜前列腺癌根治术（LRP）术后早期不同控尿状态患者与同年龄段未手术男性的盆底 MRI 表现，探讨动静态盆底 MRI 检查对术后早期尿控恢复的评估作用。
方法：前瞻性地于我院收集 LRP 手术患者的临床及 MRI 资料，根据术后三个月的尿控情况将患者分为尿失禁组（31 例）、尿控组（24 例），同时收集同年龄段未行手术治疗的前列腺增生患者作为对照组（26 例）。行 LRP 手术患者 MRI 测量参数包括尿控参数：前列腺体积（PV）、手术前后膜性尿道长度（MUL1、MUL2）、MUL 丢失率、是否存在尿道内尿池、静息期及力排期 BN 至耻骨长轴中线的距离（n1）、BN 至耻骨联合下缘水平线的距离（n2），以及盆底功能参数：静息期及力排期膀胱颈（BN）到耻骨尾骨线（PCL）的距离（BN-PCL）、H 线、M 线、肛管直肠角（ANA）、肛提肌板角度 （LPA）的大小。对照组测量参数包括 PV、BN-PCL、H 线、M 线、ANA、LPA。使用独立样本 t 检验、秩和检验或卡方检验比较 LRP 术后两组尿控参数的差异。使用单因素方差分析或 K-W 检验比较尿失禁组、尿控组及对照组三组间 PV 及盆底功能参数的差异，如差异有统计学意义进行成对比较。
结果：1.尿失禁组及尿控组两组间 MUL1、MUL2、MUL 丢失率、存在尿道内尿池、静息期及力排期 n2 的差异均有统计学意义（P＜0.05）。2.尿失禁组、尿控组及对照组三组间静息期及力排期 BN-PCL、力排期 H 线、静息期及力排期 ANA 的差异有统计学意义（P＜0.05），两两对比：静息期及力排期 BN-PCL：对照组＞尿控组＞尿失禁组；力排期 H 线：尿失禁组＞尿控组；静息期 ANA：尿失禁组＞对照组；力排期 ANA：尿失禁组＞尿控组/对照组（P＜0.05）。
结论：动静态盆底 MRI 可以观察到尿控组手术前后 MUL 较长，MUL 丢失率较低，BN 位置较高、与耻骨联合下缘距离较远且较少存在尿道内尿池；与对照组相比，LRP 术后患者 BN 下降，尿失禁组为著，此外，尿失禁组患者还有盆膈裂孔扩大及 ANA 扩大的表现。因此盆底 MRI 检查可预测 LRP 术后早期尿失禁的恢复情况，为临床评估尿失禁的发生及康复提供客观依据。

PU-396

# Post-pandemic era: how should radiology department deal with a resurgence of COVID-19?

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Objectives: Although the novel coronavirus (COVID-19) had been under control nationwide, some areas are still confronted with a resurgence of the epidemic, such as Anhui, Guangdong, Liaoning and so on. As long as the epidemic is not eliminated for a day, hospitals are still the first line of epidemic prevention. Therefore, in order to ensure the safety of patients, the hospital epidemic prevention cannot be a little slack, to minimize the risk of cross infection between doctors and patients, and among patients. Considering imaging examination has been an indispensable diagnostic method for COVID-19, the preventive measures of radiology department are of paramount importance. Last October, there was a quick outbreak of COVID-19 in Qingdao, which originated from a shared CT examination room and finally became a major public health challenge for the radiology department. Considering that a great number of patients do examination in the same room and thus are exposed to high risks of cross infection, it is necessary to perfect the infection control and prevention, and ensure the cleanliness of CT room during COVID-19. Hence, nowadays we should promote the epidemic prevention in the radiology department to prevent cross infection and another outbreak. The radiology department of our hospital has formulated a set of effective prevention policies and measures during the treatment of COVID-19 patients, which resulted in no nosocomial cross infection or infected doctor. Therefore, this article aims to share the experience and protocols of the radiology department of our hospital so as to help more hospitals and their radiology medical staff in epidemic prevention.

Methods: The radiology department of our hospital has formulated a series of effective epidemic prevention measures after practice and improvement. We firstly summarized the three phases of

epidemic prevention policies formulated by the radiology department since the outbreak, and then drew the schematic diagrams of patients' treatment routes in each phase. We also explored three aspects of each phase, including 1.the emergency management and infection control team and its responsibilities, 2.the reconfiguration of the radiology department and 3.examination procedures for suspected, confirmed, or reexamine patients with COVID-19. After three phases, we concluded that the radiology department ought to provide a separate examination machine for patients with COVID-19.
Results : As of June 23, 2021, our hospital has received 120 patients with COVID-19, among which 112 patients were discharged and 1 were dead. The total number of outpatients with fever-CT examinations was 2870, that of inpatients was 477. The number of DR exposures was 87, and that of MRI examinations was 148. Because appropriate measures were taken in time, no medical workers in the radiology department were diagnosed with COVID-19.

Conclusions: In order to avoid a large-scale outbreak caused by cross infection, the radiology department of the hospital needs to continuously improve the inspection processes and formulate comprehensive and reasonable epidemic prevention and control measures. These measures mainly focus on controlling the source of infection, cutting off the route of transmission and protecting the susceptible population.

# PU-397

## 儿童高级别胶质瘤

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目的
报道一例儿童高级别胶质瘤影像学特征以提高对该病的认识。
材料与方法
13 岁，男性，因“后颈部疼痛，左上肢疼痛、无力“入院，患者既往体健。脑脊液实验室检查：白细胞 10x106/L(参考范围 0-8x106/L)，蛋白 687mg/L(参考范围 150-450 mg/L)，葡萄糖正常，脑脊液细菌培养及抗酸染色阴性。患者行头部 MR 平扫+增强检查（GE,750W 3.0T）（见图 1-2），患者行右侧侧脑室引流术后行头部 CT 平扫（西门子，SOMATOM Difinition A）（见图 3）.
结果
MR 检查示胼胝体膝部稍长 T1、稍长 T2 信号病灶，边界欠清晰，信号欠均匀，增强扫描病灶呈不均质明显强化，双侧侧脑室扩张并积水，透明隔间腔增大；CT 平扫示病灶呈不均质稍低密度，边缘见点状钙化。后患者行病灶切除手术，免疫组化结果：肿瘤细胞呈 Vim(+)，Olig-2(+),GFAP(+),P53(局灶+)，S100(+)，Syn(+),NSE(部分+)，IDH1(部分+),D2-40(+),CK（-）,EMA（-）,NeuN（-）,Ki-67(约 30%+)，符合高级别胶质瘤，建议做儿童胶质瘤基因检测明确分型。
结论/讨论
该患者病灶位于胼胝体膝部，呈不均质稍长 T1 稍长 T2 信号，病灶内未见明显坏死、囊变及出血，增强扫描呈明显不均质强化，CT 示病灶边缘钙化，因该患者双侧侧脑室扩张积水，所以病灶水肿程度不易判断。该病灶手术病理证实为高级别胶质瘤。儿童高级别胶质瘤是儿童神经肿瘤死亡的主要原因，其组织学特征与成人相似，但生物学上却有所不同。儿童高级别胶质瘤大多为原发，并从低级别胶质瘤向高级别胶质瘤的转化率不到 10%。高级别胶质瘤包括胶质母细胞瘤 IDH 野生型和 IDH 突变型、弥漫性中线胶质瘤 H3K27M 突变型及其他基因突变或基因重组的高级别胶质瘤等。弥漫性中线胶质瘤 H3K27M 突变型好发于儿童，也可见于成人，为弥漫性、浸润性中线区高级别胶质瘤，好发于脑干、丘脑和脊髓，易坏死、囊变、出血，位于中线区病灶瘤周水肿较轻，存在 H3K27M 基因突变。胶质母细胞瘤好发于 50 岁以后患者，好发部位为幕上深部白质区，额顶颞叶多见，典型者呈“花环样”强化，瘤周水肿明显，出血较常见，病灶可沿着胼胝体膝部横跨大脑半

球，呈“蝶翼征”表现，病灶还可沿前联合、后联合横跨大脑半球，亦可沿蛛网膜下腔脑脊液进行播散种植。高级别胶质瘤的诊断及分型需要病理及基因结果支持。

PU-398

# MRI 盆底动态检查前的护理干预

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目的：MRI 是临床诊断的重要手段，它具有无放射性、无创、快捷、全面、高分辨率检查,软组织对比性强,可同时了解盆腔多组织器官的状况，通过动态 MRI 影像检查前的护理干预更能准确的定量观测盆底功能障碍性疾病患者膀胱、子宫、直肠等脱垂程度，以及肛提肌裂孔的解剖和形态的改变，为女性盆底功能障碍性疾病的治疗前评价提供影像学依据，同时可使患者更好的配合检查，从而达到缩短检查时间，提高检查效率，提高图像质量的目的。
方法：1.1 盆底检查前的护理干预要点
（1）心理护理
（2）检查前半小时将膀胱排空，并嘱其饮 200-300ML 水(尿储留患者不必饮水),使其动态 MIR 检查时膀肤处于半充盈状态。
（3）训练患者在屏气状态模拟用力排便技巧，学会在屏气时尽最大力量似乎排空她们的直肠和膀胱。
1.2 收集我院 2018-2020 年采用 GE1.5T（型号）进行 MRI 盆底动态检查的盆底功能障碍性疾病（包括盆底坠胀、盆底疼痛、排便困难、排便频率改变、尿失禁、性功能障碍及盆腔器官脱垂等）患者 104 名。其中 45 名（年龄 38-72 岁，平均年龄 55.8 岁）给予磁共振的常规准备；59 名（年龄 43-75 岁，平均年龄 57.3 岁）除磁共振的常规准备外，还进行盆底检查前的护理干预。分析比较两组检查的图像质量以及所用时间。
结果：45 名常规准备患者图像质量优 28 例、良 13 例、差 4 例，优片率 62.2%；护理干预后图像质量优 51 例、良 8 例、差 0 例，优片率 86.4%。相比具有显著统计学差异（P＜0.01）。常规准备患者检查平均时间为 21.3min；护理干预后患者检查平均时间为 17.7min，相比具有显著统计学意义（P＜0.01）。检查后 104 名受检者均未发生过敏反应及渗漏现象。
结论：在进行 MRI 盆底动态检查前进行护理干预，不但在无创性，无辐射性条件下顺利完成扫描，提高了图像质量和诊断效果，而且保证了患者安全，提高了患者及家属对医疗护理满意度，从而缩短了检查时间，保证一次性检查的成功率。

PU-399

# DTI 在评估不同形态血肿患者行早期微创血肿清除术预后中的研究

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目的:探讨不同形态血肿患者行早期微创血肿清除术预后的差异；探讨 DTI 对评估早期微创血肿清除术改善患者预后的价值。方法:行 CT 立体定向血肿穿刺引流术 50 例高血压脑出血患者,分为规则血肿组 25 例，不规则血肿组 25 例，于发病 24 h 内和治疗 2 周后进行磁共振弥散张量成像（DTI）和弥散张量纤维束示踪成像（DTT）检查,同时评估患者的神经功能及瘫痪情况,根据入院时 DTT 图像评估皮质脊髓束（CST）损伤级别,分析 CST 损伤级别与术后神经功能和瘫痪情况的相关性。结果:25 例规则血肿组患者中 CST 损伤分级Ⅰ级 3 例,Ⅱ级 16 例,Ⅲ级 6 例；25 例不规则血肿

组患者中 CST 损伤分级Ⅰ级 2 例,Ⅱ级 13 例,Ⅲ级 10 例。血肿越不规则，CST 损伤级别越高,患者 FA 值越低,NIHSS 评分和 PG 分数越高,不同 CST 损伤级别间比较差异均具有统计学意义（P<0.05）。治疗 2 周后患者各项指标均较入院时有所改善,但不同 CST 损伤级别间 FA 值、NIHSS 评分及 PG 分数的差异仍具有统计学意义（P<0.05）。CST 损伤级别与 FA 值呈负相关,与 NIHSS 分数、PG 分数呈正相关（P<0.05）。结论:HICH 患者发病后 24 h 内行磁共振检查获取的 DTI、DTT,对预测术后神经功能及肢体运动功能有一定价值,血肿越不规则，CST 损伤程度越高,患者术后恢复越差。

# PU-400

## 幼儿眼眶滑膜肉瘤 1 例

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**病例** 女，14 月，因“发现右眼眶外上方包块 20 余天”入院。查体：右眼眶外上方触及一质韧包块，伴轻度压痛，直径约 3cm，边界欠清，无红肿热，眼球运动无明显受限。眼底镜示角膜透明、虹膜纹理清，瞳孔圆，玻璃体及晶状体清晰。

影像学检查：CT 平扫示右眼眶外上方一混杂密度占位灶（图 1），边界不清，向眼眶外突出，向内下推挤眼球，病灶大小约 1.5cm×2.6cm，内可见小条状钙化，右眼眶侧壁及上壁骨质吸收破坏（图 2）。MRI（图 3-7）示右眼眶外上方不规则软组织占位灶，呈等 T1、T2 信号为主，其内见小片状短 T2 信号，DWI 呈等/稍低信号，病灶大小约 2.3cm×2.5cm×3.0cm，右眼眶外侧壁近顶壁骨质破坏，右侧泪腺显示不清，右眼球受压内移。术前诊断为右眼眶外上方肿块，考虑为肿瘤，请结合病理检查。

手术及病理：行眼眶肿瘤切除术，术中见肿瘤呈灰白色鱼肉样，质脆，血供丰富，肿瘤边界不清，与周围组织轻度粘连，眼眶上缘骨质及外侧壁骨质吸收破坏，有肿物突出。切除病变送病理学检查，镜下所见：肿瘤组织主要由梭形细胞构成，呈束状或片状紧密排列，细胞异型性明显，见病理性核分裂象（图 8）。免疫组化：bcl-2（+），CD99（+），Vimentin（+），FN（+），EMA（+），S-100(-),CD31(-)，CD34(-)。诊断：（右眼眶肿物）恶性间叶源性肿瘤，考虑纤维型滑膜肉瘤（SS，单相型）。

**讨论**

SS 是恶性程度较高、预后较差的软组织肿瘤，发病机制尚不明确，它不来源于滑膜[1]，而可能来源于未分化的间叶细胞。SS 以 20～40 岁青壮年发病多见，男性多于女性，常发生在四肢大关节周围深部软组织，发生在头颈部者低于该病的 10%[2]，发生于眼眶者更为罕见[3]。临床表现可为触及无痛性软组织包块，通常无明显功能障碍。WHO 根据 SS 的组织学特征将其分为单相纤维型、单相上皮型、双相型和低分化型，发生在头颈部者以单相型多见。大体标本通常呈灰白、灰黄色，有或无完整薄膜，质韧。镜下一般由梭形细胞构成，呈束状分布，有/无异型细胞，可见核分裂象。SS 病灶形态多不规则，可呈分叶状。本例为 14 月龄女婴，年龄、性别及发病部位均非典型，诊断需结合病理及免疫组织化学检查明确。Vimentin、bcl-2、CD99、CK 及 EMA 是表达最为稳定的标记物，SS 一般不表达 CD31、CD34 及 S-100。

（全文见附件）

# PU-401

## 唾液腺粘液表皮样癌 MRI 特征与病理等级相关性研究初探

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**目的** 总结唾液腺粘液表皮样癌 MRI 特征，探讨其与其病理等级相关性。
**方法** 回顾性分析经手术病理证实的 30 例头颈部粘液表皮样癌 MRI 表现，重点观察 T2 压脂上信号强度及囊变情况，并与组织病理特征对照分析。采用 Fisher 确切概率法进行分析粘液表皮样癌是否囊变及囊变占肿瘤比例与肿瘤等级之间关系。结果:高级别 MEC 4 例，T2 压脂上均呈不均匀低-中信号，无囊变；中等级 MEC 18 例，T2 压脂上均呈不均匀中-高信号，16 例（88.9%）有囊变，1 例（11.1%）无囊变；低级别 MEC 8 例，T2 压脂上均呈不均匀中-高信号，8 例（100%）均有囊变，其中 1 例(12.5%)合并淋巴结转移。低级别 MEC、中等级别 MEC 与高级别 MEC 内部有无囊变有统计学差异（P<0.05），低级别 MEC 与中等级别 MEC 内部无有囊变无统计学差异（P>0.05）。低级别 MEC 与中等级别 MEC 内部囊性结构所占肿瘤比例（是否超过 50%）有统计学意义（P=0.001）。随访复查 12-60 月，中位复查时间为 36 月，30 例患者均未局部复发及转移。
**结论** 唾液腺粘液表皮样癌 MRI 表现具有一定特征性，MRI 表现能反映组织病理学性质，为肿瘤分级提供帮助。

PU-402

# A comparison of the diagnostic efficiency of retrospective PI-RADS score based on mpMRI and the prostate CAD system with the previous imaging report

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OBJECTIVE: To compare the retrospective PI-RADS score based on mpMRI images combined with PCa prediction results of a prostate CAD system with the PI-RADS score of previous formal imaging reports, and to explore ways to integrate prostate artificial intelligence with radiologists.
DATA AND METHODS: Cases with suspected PCa for qualitative diagnosis, complete clinical data, puncture within 1 month after MR scan were screened from the mpMRI follow-up database of our hospital from February 2015 to January 2018. All enrolled cases underwent 3.0T prostate mpMRI: T2WI (axial + coronal + sagittal), DWI (0/1000/1400 s/mm2), and DCE (temporal resolution=15s). The highest PI-RADS scores(based on PI-RADS V2) in the initial imaging reports were recorded. Unknown of pathological and clinical information, a retrospective review was performed by a radiologist(5 years' experience in prostate MR), who read both mpMRI images and PCa prediction results based on the deep learning prostate CAD system and gave PI-RADS scores(based on PI-RADS V2.1). The patients' puncture biopsy and surgical pathology results with Gleason score were used as the gold standard (Gleason score ≥3+4 or ≥T3 stage as clinically significant PCa). Statistical analysis was performed using SPSS 23.0 software, and ROC curves were used to compare the diagnostic efficacy of the two scores for the clinically significant PCa(CSPCa).
RESULTS: A total of 403 cases(age=69.41±7.90 years, tPSA=30.78±37.02 ng/ml) were included, 118 in CSPCa group, 285 in the Non-CSPCa group(CISPCa and Non-PCa). The area under the ROC curve (AUC), sensitivity, specificity, PPV, NPV, and accuracy of the PI-RADS score of previous reports/( retrospective readings + CAD) were 0.803/0.872,0.949/0.924,0.656/0.821,0.533/0.681,0.969/0.963,0.742/0.851, respectively, according to the Youden index, taking ≥4 as the cut-off value. And the diagnostic efficacy of the PI-RADS score of retrospective review + CAD was higher than that of previous reports(P=0.000).
CONCLUSIONS: The combined PI-RADS score based on mpMRI and PCa prediction results by prostate CAD system has higher diagnostic efficacy of CSPCa than PI-RADS score alone, which

reduces 3 points, improves the diagnostic specificity and PPV and avoids unnecessary clinical punctures.The diagnostic mode of integrating prostate AI prediction results as a reference into the PI-RADS score is an effective human-machine collaboration that improves diagnostic specificity, reduces false positives, and avoids over-penetration.
Case example of application of PI-RADS V2.1+AI and the ROC curves.

## PU-403

# 结合卷积神经网络与图神经网络的乳腺癌淋巴结转移预测研究

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目的：卷积神经网络（Convolutional neural network，CNN）具有良好的局部特征提取能力，但无法有效捕捉特征间的空间关系。为了有效利用这种空间关系，本文提出一种新的结合 CNN 与图神经网络（Graph neural network, GCN）的 DCE-MRI 图像分类框架，应用于乳腺癌淋巴结转移的预测。
方法: 回顾性分析 2016 年 10 月-2020 年 10 月在烟台毓璜顶医院就诊的乳腺癌患者 1048 名，分为训练集（n=839）和测试集（n=209），2019 年 10 月-2020 年 10 月在复旦大学附属肿瘤医院就诊的在 320 名乳腺癌患者为外部测试集。在 DCE-MRI 图像上，利用 ITK-SNAP 手动分割乳腺癌区域作为 ROI。然后对 ROI 进行卷积及下采样得到一组特征图，然后将特征图上每个像素位置的特征向量表示为 1 个节点，构建具有空间结构的图，并通过 GCN 学习图中蕴含的空间结构特征。最后，将基于 GCN 的空间结构特征与基于 CNN 的全局特征融合，并同时对整个网络进行优化，实现基于融合特征的 MRI 图像分类，使用传统的 CNN 模型及影像组学模型与该模型对比。在训练集中，通过受试者操作特征（Receiver operating characteristic, ROC）曲线、准确率评估模型的预测能力，并用独立测试集和外部测试集数据测试模型的效能。
结果：在外部测试集中，本研究提出的 CNN-GCN 模型预测乳腺癌淋巴结转移的 AUC 为 0.93，准确率为 0.92，高于传统的 CNN 模型（AUC=0.85，准确率=0.82），也高于传统的影像组学模型（AUC=0.79，准确率=0.76）。
结论：与传统基于 CNN 的算法相比，本文提出的结合 CNN 与 GCN 的算法有效融合了 DCE-MRI 图像的全局特征与空间结构特征，从而提升了乳腺癌淋巴结转移的预测效能，具有潜在的应用可行性。

## PU-404

# 基于 CNN 和 LSTM 深度神经网络的乳腺癌淋巴结状态精准预测研究

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目的：探讨基于 CNN 和 LSTM 深度神经网络在乳腺癌淋巴结状态精准预测研究的价值。
方法: 回顾性分析 2016 年 10 月-2020 年 10 月在烟台毓璜顶医院就诊的乳腺癌患者 1048 名，分为训练集（n=839）和测试集（n=209），2019 年 10 月-2020 年 10 月在复旦大学附属肿瘤医院就诊的在 320 名乳腺癌患者为外部测试集。基于 U-net 对 DCE-MRI 图像进行自动分隔，然后通过 CNN 提取 DCE-MRI 图像的深度网络特征，将深度网络特征及临床特征输入 LSTM 网络构建基于时间序列的深度学习模型。使用传统的 CNN 模型及影像组学模型与该模型对比。在训练集中，通过受试者操作特征（Receiver operating characteristic, ROC）曲线、准确率评估模型的预测能力，并用独立测试集和外部测试集数据测试模型的效能。

结果：在外部测试集中，本研究提出的 CNN-LSTM 模型预测乳腺癌淋巴结转移的 AUC 为 0.92，准确率为 0.91，高于传统的 CNN 模型（AUC=0.85，准确率=0.82），也高于传统的影像组学模型（AUC=0.79，准确率=0.76）。
结论：与传统基于 CNN 的算法相比，本文提出的结合 CNN 与 LSTM 的算法有效融合了 DCE-MRI 多期图像的信息，有助于对乳腺癌淋巴结转移的分层预测，指导临床治疗决策。

# PU-405
# 基于深度学习的多参数 MRI 肾脏病变全自动分割研究

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**目的：**
构建基于多参数 MR 图像的肾脏病变全自动分割模型。
**材料和方法：**
本研究回顾性连续入组了 236 例具备病理结果的肾脏病变。所有患者均在术前进行肾脏 MRI 平扫及增强检查（包括 T2WI，T1WI，DWI，ADC，皮髓质期，实质期及排泄期序列）。所有图像均由两位放射科医生采用 ITK-SNAP 软件（v3.6）分开、独立地对病变进行人工分割，选取其中较为准确的分割结果作为标注。依据较为前沿的医学图像分割深度学习理论，本研究采用基于深监督注意力机制的多尺度编解码网络（multi-scale codec network with deep supervision attention）训练模型。分别对 7 个序列（T2WI [n=200]，T1WI [n=199]，DWI [n=151]，ADC [n=153]，皮髓质期[n=201]，实质期[n=198]及排泄期[n=198]）进行训练。针对不同的序列，分别随机抽取相应训练集的十分之一作为验证集并采用十倍交叉验证法对该序列进行验证。测试集由不与训练集和验证集有任何重叠的独立数据集构成（T1WI [n=33]，T2WI [n=34]，DWI [n=34]，ADC [n=32]，皮髓质期[n=35]，实质期[n=35]，排泄期[n=35]）。最终，采用 Dice 系数（0~1）评估模型的性能。
**结果：**
共对 236 个肾脏病变进行全自动分割。Dice 系数为评估模型准确性的指标。在测试集中，T2WI, T1WI, DWI, ADC,皮髓质期，实质期及排泄期序列图像的 Dice 系数分别为 0.8256±0.0088，0.7034±0.0100，0.4578±0.0164，0.5992±0.0109，0.7642±0.0085，0.7262±0.0086 及 0.7752±0.0112。
**结论：**
基于深度学习的全自动分割模型可有效地在 T2WI、T1WI 及增强序列（皮髓质期，实质期及排泄期）上对肾脏病变实现全自动分割，该项技术有望在消除阅片者间不一致性的情况下显著减轻临床工作负担并能极大改善大数据图像分析提取效率。

# PU-406
# 眼眶孤立性纤维瘤与神经鞘瘤 MRI 纹理分析的定量研究

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目的：探讨 MRI 纹理分析（Texture Analysis,TA）对眼眶孤立性纤维瘤（Solitary Fibrous Tumor ,SFT）与神经鞘瘤（Orbital Neurilemmoma,ON）的鉴别诊断价值。材料与方法：回顾性分析经术后病理证实的 9 例 SFT 和 13 例 ON 患者。使用 MaZda 软件在 MR 常规序列轴位图像上勾

画 ROI 获得 TA 结果，计算观察者间及观察者组内相关系数，应用 LASSO 算法进行特征降维，得到可以鉴别两种病变的 TA 特征参数，绘制其 ROC 曲线评价其对鉴别 SFT 与 ON 的诊断效能。结果：在平扫 $T_1$WI、$T_2$WI、DWI 及 $T_1$WI 轴位增强四个序列分别提取的 15 个纹理特征性参数中，对 ICC 均＞0.75 的特征进行 LASSO 选择，获得第 90 百分位数、偏度、峰度、Z 轴游程不均匀性、Z 轴行程比 5 个特征参数，其中在 $T_2$WI 序列 Z 轴行程比鉴别诊断价值较大，AUC 为 0.906，最佳临界值为 0.437，敏感性为 88.89%，特异性为 100%；在 DWI 序列峰度鉴别诊断价值较大，其 AUC 为 0.786，最佳临界值为-0.207，敏感性为 66.66%，特异性为 84.62%；在增强 $T_1$WI 序列偏度鉴别诊断价值较大，AUC 为 0.896，最佳临界值为-0.253，敏感性为 100%，特异性为 66.67%。结论：常规 MR 不同序列图像纹理特征参数有助于区分眼眶 SFT 与 ON。

# PU-407

## 基于 MRI 影像组学术前预测子宫内膜癌淋巴结转移的研究

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目的：探究 MRI 多序列图像影像组学特征术前预测子宫内膜癌淋巴结转移的价值。
方法：回顾性分析 2014 年 10 月-2020 年 8 月天津市第一中心医院与天津市中心妇产科医院经手术病理证实的 180 例子宫内膜癌病人资料。根据有无淋巴结转移分为两组，淋巴结转移（LNM）阳性组和阴性组。将天津市第一中心医院的病例作为训练集（LNM 阴性 90 例，阳性 16 例），天津市中心妇产科医院的病例作为独立测试集（LNM 阴性 54 例，阳性 20 例）。分析的 MRI 序列包括轴位 T2WI、DWI（b=1000 s/mm2）与 ADC 序列。采用 ITK-SNAP 软件在轴位 T2WI 序列手动逐层勾画、全体积分割病灶，之后所有图像做 Z-score 归一化、重采样预处理，将 DWI 与 ADC 序列与 T2WI 序列配准，分别提取三个序列的影像组学特征。随机选择 50 例病灶由两位医师分别分割，计算 ICC 评估观察者间提取特征一致性。对所有特征进行 SMOTE 算法、Z-score 归一化预处理。采用 PCC 进行特征降维，两两特征计算皮尔森相关系数，大于阈值 0.9 时随机去除一个。采用 ANOVA 法选择与淋巴结转移最相关的 10 个特征，依次加入 Logistic 回归模型训练并进行 5 折交叉验证与独立测试集验证选择性能最优模型，即影像组学模型。纳入术前可获取的临床特征，包括：年龄、月经情况、术前 CA125、MRI 报告的肌层浸润深度、MRI 报告宫颈状态、MRI 报告的淋巴结状态。统计分析临床特征，计量资料若满足正态性分布采用独立样本 t 检验，否则采用 Mann-Whitney U 检验，计数资料采用卡方检验，筛选与淋巴结转移显著相关的临床特征，采用 Logistic 回归联合影像组学特征构建临床综合预测模型，以列线图形式展示。绘制受试者工作特性曲线，计算准确性、曲线下面积、95%置信区间、阴性预测值、阳性预测值、敏感性及特异性评价影像组学与临床综合预测模型的诊断效能，并采用 DeLong 检验比较两种模型的诊断效能。
结果：1.术前 CA125、MRI 报告的淋巴结状态两项临床特征是与子宫内膜癌的淋巴结转移相关的独立风险因素。2.共提取三个序列（轴位 T2WI、DWI、ADC）共 2586 个特征，两位医师勾画的 50 例所有特征 ICC≥0.75，经特征降维、筛选、模型训练、内部、外部验证后选择 6 个影像组学特征构建影像组学模型，包括 2 个形状特征，2 个 GLCM 特征和 2 个 GLRLM 特征。3.影像组学模型在训练集与测试集的 AUC 分别为 0.899、0.831。联合临床特征构建的临床综合模型在训练集与测试集的 AUC 分别为 0.969、0.882。4.训练集、测试集中影像组学模型与临床综合模型诊断效能均存在差异（P=0.039、0.045）。
结论：基于 MRI 多序列图像构建的影像组学模型能够在术前预测子宫内膜癌淋巴结转移，联合术前 CA125、MRI 报告的淋巴结状态两项临床特征构建的临床综合模型诊断效能表现更优，为临床提供了一种无创评估淋巴结状态的新方法。

# PU-408

# 基于多参数 MRI 影像组学模型预测 PI-RADS 3 病变的良恶性及侵袭性

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目的：探讨双参数 MRI（T2WI、DWI）和多参数 MRI（T2WI、DWI、DCE）影像组学特征在不同机器学习模型中预测 PI-RADS 3 前列腺病变的良恶性及侵袭性的价值。
材料与方法：回顾性分析 2015 年 1 月至 2020 年 7 月于本院进行前列腺 3.0T 多参数 MRI 检查的患者 702 例，经纳入标准和排除标准，最终纳入 296 例被诊断为 PI-RADS 3 的患者进行分析，采用随机抽样方法将患者以 7：3 的比例划分为训练组和验证组。使用开源软件 3D Slicer 分别对轴向 T2WI、DWI 图像和 DCE 图像进行逐层手动勾画提取感兴趣区（ROI），“Pyradiomics”提取影像组学特征。采用组间相关性系数（ICC）评价观察者间及观察者内提取影像组学特征的一致性。为消除冗余特征，首先使用 ANOVA 检验、Kruskal-Wallis 检验筛选出具有差异性的特征，随后分别使用基于随机森林递归特征消除法（RFE-RF）、支持向量机递归特征消除法（RFE-SVM）和逻辑回归递归特征消除法（RFE-LR）三种特征筛选方法筛选出 10 个最具有预测价值的特征，并分别构建 RF、SVM 和 LR 三种机器学习预测模型。由于高级别前列腺癌（PCa）与低级别 PCa 的样本分类不平衡，会降低机器学习模型对 PI-RADS 3 病变侵袭性的预测效能，所以本研究采用少数样本合成过采样技术（SMOTE）解决样本分类不平衡问题，并比较使用 SMOTE 和不使用 SMOTE 在各模型中的价值。受试者操作特征曲线（ROC）、准确率（ACC）、特异性（SPE）及敏感性（SEN）用于评估机器学习模型的预测效能。Python v3.8 软件用于统计分析和模型构建。$P<0.05$ 为差异有统计学意义。
结果：从每个序列中提取了 851 个特征（7 大类特征：形状、一阶、灰度相关矩阵、灰度共生矩阵、灰度游程矩阵、灰度区域大小矩阵和邻域灰度差矩阵）。观察者间具有良好的可重复性（ICC > 0.75）。在 PI-RADS 3 病变的良恶性预测中，对比 T2WI、DWI 序列，基于 T2WI、DWI 结合 DCE 序列能够提高模型的预测效能，其构建的最佳预测模型为 RFE-RF 模型，该模型在训练集中的曲线下面积（AUC）为 0.876、ACC 为 0.792、SPE 为 0.769、SEN 为 0.816，在验证组中分别为 0.840、0.764、0.745、0.789。在 PI-RADS 3 病变的侵袭性预测中，使用 SMOTE 技术能够有效提高模型在不平衡分类数据中的预测效能，其基于 T2WI、DWI 结合 DCE 序列构建的最佳 RFE-RF 模型在训练集中的 AUC 为 0.988、ACC 为 0.931、SPE 为 0.923、SEN 为 0.938，在验证组中分别为 0.893、0.837、0.500、0.914。
结论：基于多参数 MRI 影像组学机器学习模型能够有效预测 PI-RADS 3 病变的良恶性及侵袭性，可以辅助临床对 PI-RADS 3 病变进行诊断。

PU-409

# 应用 IVIM 对孕中、晚期孤立性侧脑室增宽胎儿脑发育的研究

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目的 应用 IVIM 研究孕中、晚期孤立性侧脑室增宽胎儿不同脑区 D 值、D*值及 f 值的变化规律，为产前胎儿中枢神经系统疾病筛查提供依据。
方法 应用西门子 MAGNETOM Aera 1.5T MR 对孕中晚期胎儿进行头颅 MR 常规序列 IVIM 扫描；TR/TE =5300/78ms, phase resolution=112*112 ，b 值：0， 50，100，150，200，300，500，700，800 s/mm2；根据胎儿脑室增宽程度分为轻度组（轴位丘脑水平侧脑室宽度 1.0cm＜1.2cm），中度组（轴位丘脑水平侧脑室宽度 1.2cm＜1.4cm），重度组（轴位丘脑水平侧脑室宽

度＞1.4cm），并设立正常对照组。经 1 名放射科医师在以下区域手动画取 ROI，其大小取决于胎儿头颅大小及所选定脑区的形状，范围约 2-6 个像素块,测量的 IVIM 参数值包括 D 值，D*值和 f 值，所选脑区如下：1）小脑半球（CH）；2）额叶（FWM）； 3）顶叶（PWM）；4）枕叶（OWM）；5）颞叶（TWM）；6）基底节区（BGR）；7）丘脑（TH）；然后在 8）桥脑（PONM ）划取一个单一感兴趣区域，1 个月后经同另一名医师进行第二次 ROI 的画取。不同脑区及不同组间 D 值和 D*值 f 值比较采用方差分析。胎龄和不同脑区 D 值和 D*值、f 值相关性分析采用直线回归分析。结果：中度组与重度组侧脑室增宽一侧不同脑区 D 值和 f 值有显著差异，以额叶为著，其次是丘脑，然后是颞叶、顶叶，D 值和 f 值均高于中度组对应脑区(P < 0.05)，轻度组与中度组各脑区未见明显统计学差异，脑干及双侧小脑半球没有统计学差异；重度组双侧大脑半球对应脑区 D 值及 f 值有显著性差异(P < 0.05)；轻度度与中度双侧大脑半球对应脑区 D 值及 f 值没有显著性差异。结论 当胎儿一侧脑室宽度大于 1.4cm，需要高度重视其潜在疾病的发生，侧脑室宽度小于 1.4cm 潜在风险较低，这种变化的规律性能对胎儿脑部病变的早期诊断及疾病筛查做出重要贡献。

PU-410

# Comparison of Automated and Manual DWI-ASPECTS in Acute Ischemic Stroke: Total and Region-specific Assessment

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Objective: To compare the DWI-Alberta Stroke Program Early Computed Tomography Score calculated by a deep-learning based automatic software tool (eDWI-ASPECTS) with the neuroradiologists' evaluation for the acute stroke, with emphasis on its performance on 10 individual ASPECTS regions, and to determine the reasons for inconsistencies between eDWI-ASPECTS and neuroradiologists' evaluation.
Methods: This retrospective study included patients with middle cerebral artery stroke who underwent MRI from 2010 to 2019. All scans were evaluated by eDWI-ASPECTS and two independent neuroradiologists, respectively. Inter-rater agreement and agreement between manual vs. automated methods for total and each region were evaluated by calculating Kendall's tau-b, intraclass correlation coefficient (ICC), and kappa coefficient.
Results: In total, 309 patients met our study criteria. For total ASPECTS, eDWI-ASPECTS and manual raters had a strong positive correlation (Kendall's tau-b =0.827 for junior raters vs. eDWI-ASPECTS; Kendall's tau-b=0.870 for inter-raters; Kendall's tau-b=0.848 for senior raters vs. eDWI-ASPECTS) and excellent agreement (ICC=0.923 for junior raters and automated scores; ICC=0.954 for inter-raters; ICC=0.939 for senior raters and automated scores). Agreement was different for individual ASPECTS regions. All regions except for M5 region (κ=0.216 for junior raters and automated scores), internal capsule (κ=0.525 for junior raters and automated scores), and caudate (κ=0.586 for senior raters and automated scores) showed good to excellent concordance.
Conclusion: The eDWI-ASPECTS performed equally well as senior neuroradiologists' evaluation, although interference by uncertain scoring rules and midline shift resulted in poor to moderate consistency in the M5, internal capsule, and caudate nucleus regions.

PU-411

# 基于 MRI 的影像组学在直肠癌术前 T 分期的应用研究

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**目的：**
准确的术前肿瘤分期对直肠癌的治疗和预后至关重要，本研究旨在使用基于 MRI 的影像组学技术开发并验证一种影像组学预测模型，用于直肠癌患者术前准确评估 T 分期。
**材料和方法：**
本研究根据纳入及排除标准，最终纳入 346 例直肠癌患者，其中 T1 期 48 例；T2 期 79 例；T3 期 155 例；T4 期 64 例，所有患者被随机分为训练组（n = 243）和验证组（n = 103）。从训练组患者术前的高分辨率 T2 加权图像（HR-T2WI）和弥散加权图像（DWI）中提取影像组学特征，然后，通过最小绝对收缩和选择算子（LASSO）回归选择关键特征来开发影像组学标签。使用多变量逻辑回归构建了影像组学预测模型，该模型纳入了影像组学标签和临床独立危险因素，并将构建的影像组学标签及影像组学预测模型分别应用于训练组和验证组，使用 ROC 曲线评估分别其泛化效能。
**结果：**
训练组及验证组的一般临床资料差异没有统计学意义（P＞0.05），为了对直肠癌患者术前进行详细的 T 分期评估，本研究构建了三个影像组学标签，分别用于区分高期（T3-T4）和低期（T1-T2）、T1 和 T2 期、T3 和 T4 期，结果显示影像组学标签与直肠癌 T 分期显著相关（p < 0.01），使用 ROC 曲线验证其泛化效能，训练组曲线下面积（AUC）分别为 0.848、0.732、0.834，验证组分别为 0.802、0.683、0.733。而后在纳入相应的临床独立危险因素后建立了三个影像组学预测模型，这些预测模型在区分高期和低期、T1 期和 T2 期、T3 期和 T4 期时表现出了更好的预测能力，训练组 AUC 分别为 0.852、0.792、0.888；而验证组中的 AUC 分别为 0.841、0.782 和 0.767，其中高-低期影像组学预测模型在训练组中区分高期和低期的敏感度为 69.23%、特异度 86.21%、准确度为 75.31%，在验证组中敏感度为 76.19%、特异度 80.00%、准确度为 76.70%；T1-T2 期预测模型在训练组中区分 T1 期和 T2 期敏感度为 86.79%、特异度 61.11%、准确度为 76.40%，在验证组中敏感度为 84.62%、特异度 66.67%、准确度为 73.68%；T3-T4 预测模型在训练组中区分 T3 期和 T4 期敏感度为 71.74%、特异度 92.59%、准确度为 86.36%，在验证组中敏感度为 72.22%、特异度 78.72%、准确度为 76.92%；结果显示本研究所构建的三个预测模型对直肠癌详细的 T 分期有较高的预测能力。
**结论：**
1.本研究显示，通过影像组学的方法可以从直肠癌患者 MRI（HR-T2WI 及 DWI）图像中提取高通量的影像组学特征，择选最相关的影像组学特征后所构建的影像组学标签在术前直肠癌 T 分期中表现良好；它们可以提高直肠癌术前 T 分期的准确性，为预测 T 分期提供了一种非侵入性和相对低成本的影像组学方法。
2.本研究通过结合临床独立危险因素和影像组学标签构建了影像组学预测模型，通过 ROC 曲线验证了这些模型可以进一步提高直肠癌术前 T 分期准确性，为个体化治疗方案的决策提供可靠依据。

PU-412

# Automated glioma segmentation using full-scale connected 3D convolutional neural network

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A growing number of studies have recently focused on accurate and reproducible quantitative assessment of glioma based on structural information in Magnetic Resonance Imaging (MRI). Segmentation of glioma in multimodel MRI scans plays a central role in the assessments of progression, many methods have been proposed to perform an automatic segmentation of glioma. However, the previously reported methods could not detect and segment gliomas precisely on account of the heterogeneous shape, size, and location of glioma. In this study, we present a novel approach based on convolutional neural network (CNN) to improve automatic segmentation of glioma in MRI scans. This approach enables the segmentation of glioma from the background and subdividing it into different subregions by combining multimodel MRI volumes. The architecture consists of two parts, encoder and decoder. The encoder is used to extract semantic features and the decoder is used to get the spatial feature. Both of them are full-scale connected. In addition, we used generalized 3D operations to extend the computation of the 3D spatial context along Z axis in MRI volumes. We validated our approach on both BRATS 2020 dataset and a dataset acquired in our hospital. The results show thar our approach perform well and exhibits superior performance for glioma segmentation to the existing approaches. Our approach is freely available and will be helpful in the analysis of glioma in MRI scans.

PU-413

# 基于 IDEAL-IQ 序列 MR 纹理分析评价慢性腰痛患者椎旁脂肪浸润

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【摘要】目的 采用非对称采集与迭代最小二乘估算法迭代水脂分离方法（Iterative decomposition of water and fat with echo asymmetrical and least-squares estimation quantitation sequence, IDEAL-IQ）定量评价慢性下腰痛患者椎旁肌肉脂肪浸润程度与 Goutallier 分级的相关性，同时探讨基于 IDEAL-IQ 脂肪分数图像 MR 纹理分析评价椎旁肌肉脂肪浸润的可行性。材料与方法 慢性下腰痛就诊患者 97 例（男 50 例、女 47 例），行腰椎常规扫描序列横断位、矢状位 T2WI 及轴位 IDEAL-IQ 序列，获取 L1～S1 椎间盘层面椎旁腰大肌（psoas major ,PS）、竖脊肌（ erector spinae , ES）及多裂肌（multifidus muscle , MF）基于 T2WI 序列的 Goutallier 脂肪浸润程度分级，IDEAL-IQ 序列脂肪分数（fat fraction , FF）值、横截面积(cross sectional area , CSA)值和基于 FF 图像的纹理特征参数。椎旁肌肉 Goutallier 分级组间 FF 值及 CSA 值的差异性比较运用单因素方差分析；采用 Spearman 秩相关检验评价椎旁肌肉 Goutallier 分级与 FF 值及 CSA 值的相关性；利用受试者工作特征曲线（ROC）评估纹理分析参数的诊断效能，并采用 Spearman 相关性分析纹理参数特征值与 FF 值的相关性。结果 不同腰椎间盘层面椎旁肌肉脂肪 Goutallier 分级组间 CSA 值及 FF 值的差异均有统计学意义；ES、MF 和 PS 的 Goutallier 分级与 CSA 值均存在相关性(相关系数分别为﹣0.512、﹣0.338、﹣0.082，P 值均小于 0.001)；MF、ES 和 PS 的 Goutallier 分级与 FF 值均存在相关性(相关系数分别为 0.819、0.753、0.136，P 值均小于 0.001)；纹理特征参数对椎旁肌肉 Goutallier 分级的诊断效能良好，其中 MeanValue、Quantile0.975、Variance 与椎旁肌肉 FF 值呈显著相关（相关系数分别为 0.887、0.777、0.776），VoxelValueSum、kurtosis、skewness、uniformity、HaralickCorrelation_angle135_offset7、HaralickCorrelation_angle90_offset4、InverseDifferenceMoment_AllDirection_offset4 与椎旁肌肉 FF 值呈强相关（相关系数分别为 0.609、﹣0.687、﹣0.569、0.601、0.633、0.714、﹣0.604）、ClusterShade_AllDirection_offset7 与椎旁肌肉 FF 值呈中等相关（相关系数为 0.497）。结论 慢性下腰痛患者腰椎旁腰大肌、竖脊肌、多裂肌的 Goutallier 分级与 FF 值及 CSA 值均存在相关性，而且基于 IDEAL-IQ 序列脂肪分数图的纹理分析评价椎旁脂肪浸润是可行的。

PU-414

# Diagnosis of Breast Cancer Using Radiomics Models Built Based on DCE-MRI Combined with Mammography

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Objectives: To build radiomics models using features extracted from DCE-MRI and mammography for diagnosis of breast cancer.
Methods: 200 patients receiving MRI and mammography from 2017 to 2019, who had well-enhanced lesions on MRI and histologically confirmed as malignant (N=146) and benign (N=56) lesions were analyzed. Fuzzy-C-means clustering algorithm was used to segment the enhanced lesion on subtraction MRI maps. Two radiologists manually outlined the corresponding lesion on mammography by consensus, with the guidance of MRI maximum intensity projection. Features were extracted using PyRadiomics from the lesion on three DCE-MRI parametric maps, and from the lesion and a 2-cm bandshell margin on mammography. The support vector machine (SVM) was applied for feature selection and model building, using 5 datasets: DCE-MRI, mammography lesion-ROI, mammography margin-ROI, mammography lesion+margin, and all combined.
Results: The majority of malignant lesions had BI-RADS scores of 4B, 4C, 5 on MRI (132/146=90.4%) and mammography (120/146=82.2%). However, a substantial number of benign lesions also had high BI-RADS ³4B diagnosed by MRI (20/56=35.7%) and mammography (16/56=28.6%). The diagnostic accuracy of the individual radiomics model was 83.2% for DCE-MRI, 75.7% for mammography lesion, 68% for mammography margin, and 77.2% for lesion+margin. When all features were combined, the accuracy was improved to 89.6%. By adding mammography features to MRI, the specificity was significantly improved from 69.6% (39/56) to 82.1% (46/56), $p<0.01$.
Conclusion: The radiomics model built from the combined MRI and mammography has the potential to provide a machine learning-based diagnostic tool, and decrease the false positive diagnosis of MRI.

PU-415

# 磁共振成像与人工智能技术结合的临床应用现状与展望

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目的：人工智能在医学影像诊断方面的作用日益突出且应用逐渐广泛，本文通过综述医学人工智能在影像资料分析中的应用现状与挑战，来展望 MRI 与人工智能结合的未来。
材料与方法：由本文作者于近日以“医学人工智能、影像诊断、图像识别”为关键词，检索近 5 年来中国知网(CNKI)、PubMed 数据库发表的相关文献，并对 28 篇文献进行分析。

结果：随着信息化时代的发展及人们对医疗诊断、治疗水平要求的提高，人工智能技术在医学方面进行了多种尝试，其中在影像诊断方面的应用进展迅速。目前人工智能在 CT 方面的应用较 MRI 更广泛且较成熟，尤其是在冠脉斑块检测、肺结节识别已经历较长时间的临床实践。当前用于 MRI 影像分析的深度学习方法主要有三类： Patch-Wise CNN 模型， Semantic-Wise CNN 模型和 Cascade CNN 模型。已有多项研究将计算机深度学习算法应用于神经系统疾病、乳腺疾病、肝纤维化、肝硬化、前列腺癌等疾病的 MRI 诊断当中，结果发现深度学习网络在病灶分割和定性分析上均显示出较大的优势,具有一定的临床实用性。众所周知，MRI 需要进行多序列扫描进行诊断，扫描速度慢，且不同序列的疾病信号表现也不同，对患者配合度和诊断医师水平都有较高的要求，如何在保证诊断准确性的同时减少 MRI 扫描时间是 MRI 技术面临的一个重要问题，人工智能技术有望对这一问题给出解决方案，人工智能技术可以通过对某一序列的 MRI 图像信息进行提取，自动进行定性分析，给出客观的诊断依据，因此可以避免某些序列的扫描而减少扫描时间，也为建立临床决策支持系统提供有力支持。
结论：人工智能与 MRI 的结合具有广泛的应用前景和临床应用价值，人工智能技术有望改变当前的放射医师的诊断模式，人与计算机的配合将有效提高 MRI 诊断准确性。

## PU-416

# 基于磁共振 DKI 序列 3D 纹理参数鉴别直肠癌术后患者骶前占位良恶性

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目的：探讨基于磁共振 DKI 序列的 3D 纹理参数鉴别直肠癌术后患者骶前占位良恶性的价值
方法：回顾性分析经病理或随访证实的直肠癌术后合并骶前肿物的 76 例患者，其中恶性复发组 43 例，术后纤维化组 33 例。收集其磁共振 DKI 数据、临床资料、术后病理。利用 O.K(Omni Dynamics, GE Healthcare, China)软件，在 DKI 图上沿占位边界逐层勾画感兴趣区(regions of interest, ROIs)，得到 3D ROI 的各序列图像纹理特征(29 个)。利用 SPSS 12.0 版软件及 R 语言(RStudio Version 1.0.143–© 2009-2016 RStudio, Inc.)软件进行测量者一致性、两组纹理差异性分析、绘制 ROC 曲线评价诊断效能及建模分析。
结果:两组测量者的一致性较好（各参数 ICC 值均>0.68）。两组患者年龄及性别的差异均为统计学意义（P=0.08, 0.06）。恶性复发组的标准偏差、方差、值域、第 5、10 百分位数均高于术后纤维化组（P=0.02~0.04）。以标准偏差 0.69 为阈值，其预测诊断能力最佳，曲线下面积(the area under the curve，AUC)为 0.869，敏感性及特异性为 85.7%、83.3%。使用多元逻辑回归进行建模，建模公式如下: fDKI=5.71-0.29×标准偏差+0.003×方差-0.95×第 5 百分位数。模型以 0.647 为临界点，AUC 最大为 0.881，敏感度及特异度分别为 85.9%、84.5%。
结论：基于磁共振 DKI 序列 3D 纹理参数鉴别直肠癌术后患者骶前占位良恶性有一定价值，通过建立 DKI 序列纹理模型能够提高鉴别骶前占位良恶性的诊断效能。

## PU-417

# 磁共振影像组学列线图术前预测前列腺癌神经周围侵犯的价值评估

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目的:基于 MRI 构建和验证一个临床-影像组学联合模型（列线图），包括影像组学特征、临床因素及相关特征，以预测 PCa 患者的术前 PNI 状态。
方法：回顾性分析 2015 年 3 月至 2020 年 9 月本院经机器人辅助前列腺根治术后手术病理证实的前列腺癌患者 338 例，并记录患者的 PNI 状态（212 例阳性、126 例阴性），其中 246 名患者经 GE750 MR 采集图像,92 例患者经 Siemens Skyra MR 扫描，从 T1WI、T2WI、DWI 中提取的影像组学特征用于建立影像组学模型。收集患者的临床特征及病理变量并建立临床模型,最终将影像组学模型和临床模型进一步整合，建立临床影像组学列线图。经 GE750 MR 扫描的患者按 7:3 的比例随机分为训练组(174 例)和内部验证组(72 例)，将经 Siemens SkyraMR 扫描的 92 例患者作为外部验证组。采用最小绝对收缩和选择算子回归（LASSO）算法建立影像组学模型。通过计算曲线下面积（AUC）来评估不同模型的诊断性能，并使用 Delong 检验比较模型间 AUC 的差异。校准曲线和决策曲线分析用于评估模型的校准和临床实用性。
结果：影像组学模型在训练组和内部验证组中的 AUC 值分别为 0.82 和 0.60，临床模型在训练组和内部验证组中的 AUC 值分别为 0.75 和 0.71，临床影像组学联合模型（列线图）在训练组和内部验证组中的 AUC 值分别为 0.84 和 0.66。决策曲线分析（decision curve analysis ，DCA）显示了临床模型和临床影像组学联合模型（列线图）的临床实用性。影像组学模型在内部验证组的准确度、敏感度和特异度分别为 59.7%、62.5%和 54.2%。临床模型在内部验证组的准确度、敏感度和特异度分别为 70.8%、77.1%和 58.3%。临床影像组学联合模型（列线图）在内部验证组的准确度、敏感度和特异度分别为 63.9%、76.2%和 46.7%。外部验证时，临床模型优于联合模型(AUC：0.82vs.0.69，P＜0.001)，准确度、敏感度和特异度分别为 77.2%、98.0%和 53.5%。
结论:基于磁共振成像的临床-影像组学联合模型（列线图）可以区分有无 PNI 病变，能够预测前列腺切除术前的 PNI 状态，其效能并不优于临床模型， PI-RADS 评分和临床 T 分期是 PNI 的独立预测因素。

## PU-418

# 基于多模态磁共振成像的人格特质预测研究

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人格特质是决定个体行为的基本特性，与人类的精神状态密切相关。本课题研究旨在用不同方法对大脑分区，分析多模态核磁共振图像数据和人格特质的相关性，从而利用神经网络算法对人格特质进行预测，进一步为精神疾病的诊疗提供重要的参考价值。本研究拟采集志愿者的三维人格数据，并使用 3.0T 采集磁共振扫描仪采集志愿者的多模态磁共振图像数据（包括 T1、DTI 数据）。预处理之后，使用 SVM 和 Xgboost 神经网络建立各脑区分区指标与三维人格指标的相关性模型。 本次研究表明，Brodmann 分区方式在预测躲避伤害性维度时得分较高，相对其他分区方式来说与躲避伤害性这一人格特质联系紧密；基于白质分割的两种图谱预测猎奇性人格时得分很高，由此说明猎奇性人格的形成和发展与大脑中白质束处的神经元连接密不可分。此外 T1 和 DTI 图像的处理后的数据对于预测脑区与奖赏依赖性人格的相关性较为局限。

## PU-419

# 增强 MRI 深度学习卷积神经网络在评估肝细胞癌病理分级中的应用

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目的：
探讨基于增强 MRI 图像的三维卷积神经网络（3D-CNN）对肝细胞癌（HCC）病理分级的鉴别诊断价值。
方法：
回顾性分析进行上腹 MRI 检查且经术后病理证实的 113 例 HCC 患者，其中低分化 60 例，非低分化 53 例，按照 8:2 随机分为训练集（n=90）和测试集（n=23）。在动脉期、门脉期和延迟期 MRI 图像上，沿着肿瘤边缘手动勾勒感兴趣区（ROI）。将 HCC 切片裁剪成 224×224 输入网络，通过 ResNet-50 网络对每个期相图像进行高级语义特征的提取。ResNet-50 网络包含一个 64 维的 7×7 卷积层、一个 3×3 的最大池化层、四个瓶颈结构、一个平均池化层和一个含有 1000 个神经元的全连接层。在 ImageNet 数据集上将训练好的 ResNet-50 的模型参数用来初始化我们模型中的 3 个 ResNet-50。为了使不同模态上的 ResNet-50 网络更好学习到表达 HCC 分化程度的特征，删除每个 ResNet-50 的最后一个全连接层，添加了两个全连接层。最后，在 3 个增强期相模型的后面添加两个全连接层，这两个全连接层用来融合 3 个模型提取到的不同模态 MRI 图像的高级语义特征，用于最后的肝癌病理分级任务。采用曲线下面积（AUC）、准确性、敏感度和特异度评价 HCC 病理分级的诊断价值。
结果：
多模态融合模型的效能（AUC：0.889，敏感度：100.0%，特异度：77.8%）比单一模态模型（动脉期：AUC：0.579，敏感度：78.1%，特异度：37.7%；门脉期：AUC：0.793，敏感度：80.0%，特异度：78.6%；延迟期：AUC：0.681，敏感度：46.4%，特异度：89.8%）更高。
结论：
3D-CNN 模型在术前无创评估 HCC 病理分级中具有一定的价值。

PU-420

# 基于多模态 MRI 影像组学模型术前预测宫颈癌淋巴血管间隙浸润的价值

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目的 建立基于多参数 MRI 及相关临床因素的融合模型，探讨其在术前对宫颈癌淋巴血管间隙浸润状态的预测价值。
材料与方法 回顾性分析皖南医学院弋矶山医院 2016 年 12 月~2021 年 3 月经术后病理证实为宫颈癌并于术前完善 MRI 检查的 123 例患者完整资料。按照 7：3 的比例，采用完全随机法将所有患者分为训练组 87 例和验证组 36 例。所有病灶，分别由两名具有丰富盆腔 MRI 诊断经验多高年资影像科医师在 MRI 图像上进行全层手动勾画，融合成三维容积感兴趣区（VOI），并进行一致性分析。基于每例患者的 T2WI 和增强 T1WI(cT1WI）序列图像，采用 AK 软件共提取 2632 个影像组学特征；采用以最大相关最小冗余（mRMR）和最小绝对收缩与选择（LASSO）回归进行特征筛选和影像组学标签的构建。利用临床资料、病理结果及影像组学标签构建影像组学模型，纳入与淋巴血管间隙浸润密切相关的临床因素，包括淋巴结转移状态、肿瘤最大径（MTD）、宫颈浸润深度等，并对模型绘制诺莫图。使用受试者工作曲线（ROC 曲线）、校正曲线及决策分析曲线（DCA 曲线）评估模型预测效能及临床效益。

结果 基于 T2WI 及 cT1WI 合并特征降维后得到 13 个价值较大的特征，建立影像组学标签。联合序列影像组学标签在训练组和验证组中 ROC 曲线下面积分别为 0.79、0.79，而结合临床因素的影像组学模型在训练组和验证组中 ROC 曲线下面积分别为 0.88、0.83，影像组学模型预测效能更胜一筹。
结论 基于多参数 MRI 的影像组学融合模型在术前预测宫颈癌淋巴血管间隙浸润状态具有较高的价值。人工智能的出现为临床医生提供了一种新型的无创检查方式，可作为术前评估及个体化治疗策略制定的一种有效辅助手段。

## PU-421

# Radiomics models based on conventional MRI for distinguishing solitary brain inflammation from atypical glioma

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**Objectives:** The conventional MRI features of solitary brain inflammation and atypical glioma (non-mass type) are similar, so it is difficult to differentiate them manually. In this study, radiomics based on non-enhanced MRI was adopted to distinguish encephalitis from atypical glioma. **Materials and Methods:** 85 patients (55 cases of atypical gliomas and 30 cases of brain inflammations) pathologically confirmed by surgery, biopsy or follow-up were enrolled retrospectively. They were randomly assigned to training set and validation set according to the ratio of 7:3. Two neuroradiologists segmented three-dimensional volume area of interest (VOI) based on T2WI. Radiomics features of VOI were extracted from T1WI and T2WI. Two-sample t-test and least absolute shrinkage and selection operator (LASSO) regression were adopted to select features and build radiomics signature models for discriminating inflammation from atypical glioma. The predictive performance of the models was evaluated via receiver operating characteristic curve (ROC) and compared with the radiologists' assessments. **Results:** Based on the training cohort, model 1, 2 and 3 were constructed by T1WI, T2WI and combination (T1WI + T2WI) with 3, 5, and 4 radiomics features, respectively. Among these models, model 2 and 3 achieved better diagnostic efficacy, with AUC of 0.921, 0.943 in training cohort and that of 0.894, 0.908 in validation cohort, respectively. The AUCs of radiologist 1's and 2's assessments were 0.735 and 0.846, respectively. **Conclusion:** The radiomics features based on non-contrasted MRI were useful in differentiating brain inflammation from atypical glioma.

## PU-422

# 结合多模态 MRI 影像组学特征与临床特征的眼眶淋巴增生性疾病鉴别诊断研究

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目的 评估结合多模态 MRI 影像组学特征与临床特征对两类眼眶淋巴增生性疾病（淋巴瘤、炎性假瘤）的鉴别诊断性能。
方法 选取 2014 年 7 月至 2021 年 4 月在西安市第四医院经手术或穿刺病理证实的眼眶淋巴瘤及炎性假瘤，采用 GE Signa 3.0T MR 扫描仪，头颅 8 通道相控阵线圈，行常规轴位 T1WI1、T2WI 扫

描，斜矢状位 T2WI，冠状位 T2WI 扫描及轴位动态增强扫描 T1WI+C，造影剂使用 GD-DTPA，注射剂量为 0.2ml/kg。通过 MITK 2015.5.0（Medical Imaging Interaction Toolkit）软件对轴位 T1WI、T2WI 及 T1WI+C 扫描序列进行感兴趣区域分割，包括病灶感兴趣区域以及眼眶锥三角感兴趣区域。确定感兴趣区域后，在切片级别上采用深度卷积神经网络对不同模态感兴趣区域提取影像组学特征，并利用多项变量分布（Multinomial Variables Distribution）随机选择每个模态中的部分特征进行融合，得到多模态 MRI 影像组学特征。然后利用多层感知机对临床特征提取有效表征，并与多模态 MRI 影像组学特征进行拼接作为最终分类特征，结合眼眶淋巴增生性疾病类型来完成最终的鉴别诊断。最后采用多数投票的方法完成切片级诊断结果到病人级诊断结果的决策。评估结合多模态 MRI 影像组学特征与临床特征的鉴别诊断性能，并与不同感兴趣区域性能进行对比分析。采用五倍交叉验证、接受者特性曲线及曲线下的面积（AUC）、敏感度、特异度、准确度完成性能评估。
结果 本研究共纳入 89 例患者，包含眼眶淋巴瘤 39 例，平均年龄为 63.4113.38；炎性假瘤 50 例，平均年龄为 51.3016.94。基于眼部三角区感兴趣区域的多模态 MRI 影像组学特征结合临床特征的方法在测试集上达到最佳性能，AUC、准确度、敏感度、特异度分别为 0.955（95% CI，0.896-1.000）、91.1%（95% CI，81.9%-100%）、92.5%（95% CI，78.6%-100%）、90.0%（95% CI，81.2%-98.8%）；眶锥三角区感兴趣区域的多模态 MRI 影像组学特征诊断性能为 0.843（95% CI，0.787-0.898）、84.4%（95% CI，81.4%-87.5%）、85.0%（95% CI，69.9%-100%）、84.0%（95% CI，67.3%-100%）。眼眶锥三角感兴趣区域结合临床特征的诊断模型在 AUC 和准确度上明显优于单独 MRI 影像组学特征（眶锥三角感兴趣区域）的分析结果（$p<0.05$），在 AUC、准确度、敏感度上明显优于单独 MRI 影像组学特征（病灶感兴趣区域）的分析结果（$p<0.05$）。
结论 多模态 MRI 影像组学特征在鉴别诊断两类眼眶淋巴增生性疾病（眼眶淋巴瘤、炎性假瘤）上取得了较好的结果，结合临床特征可以进一步提高诊断性能；包含病灶及周围组织的眶锥三角感兴趣区域的鉴别诊断性能优于仅包含病灶感兴趣区域的鉴别诊断性能。

## PU-423

# 基于自动化结构分析对颞叶癫痫脑结构改变的初步研究

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目的 采用 FreeSurfer 软件基于脑表面形态学的分析方法，通过测量颞叶癫痫(TLE)患者和正常人颞叶灰质体积，探讨 TLE 患者颞叶灰质体积的变化。材料与方法 回顾性收集临床上诊断为 TLE 患者 61 例（其中左侧 TLE 组 33 例，右侧 TLE 组 28 例）以及正常组 35 例，所有受试对象均行 3D 结构像扫描，采用 FreeSurfer 软件分析其数据，计算和比较病例组与正常组之间颞叶灰质体积。结果 左侧 TLE 组左侧颞叶灰质体积及右侧 TLE 组右侧颞叶灰质体积较正常组均缩小（$P<0.05$），且左、右侧 TLE 患者组自身对比，病侧颞叶灰质体积较对侧均缩小（$P<0.05$），左侧 TLE 患者组中，左侧颞中回、颞下回灰质体积较对侧缩小，差异有统计学意义（$P<0.05$），右侧 TLE 患者组中，右侧颞上回、颞下回灰质体积较对侧缩小，差异有统计学意义（$P<0.05$）。结论 TLE 患者颞叶灰质体积较正常组存在差异，这一发现可能为临床诊断颞叶癫痫患者提供脑组织结构改变的依据。

## PU-424

# Automatic segmentation model of intercondylar fossa based on deep learning: evaluating the correlation between intercondylar fossa volume and anterior cruciate ligament injury

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Purpose: In this study, we aim to develop an MRI segmentation model of intercondylar fossa based on deep learning, which can be simple, fast, and automatic to measure the volume of intercondylar fossa. To explore the correlation between the volume of intercondylar fossa and anterior cruciate ligament (ACL) injury has application value in predicting and preventing ACL injury, as well as guiding the design of operation plan after the ACL injury.
Materials and Methods: The MRI data sets of 363 subjects with non-contact sports ACL injuries (311 male and 52 female) and 232 subjects with intact ACL (147 male and 85 female) were retrospectively analyzed from January 2016 to October 2020 on picture archiving and communication system of the Third Affiliated Hospital of Southern Medical University. All ACL injury diagnoses were confirmed by arthroscopic pathology. Each layer of intercondylar fossa was manually traced by radiologists on axial MRI images using ITK-SNAP software, then the notch volumes were calculated. An Unpaired t-test was performed to determine the differences in notch volume between the ACL-injured and the control groups, and the gender differences were also compared. Based on the architecture of Res-UNet, we constructed an automatic segmentation system for the intercondylar fossa. We split our dataset into 415, 119, and 61 volumes for training, validation, and test sets, respectively. During the training phase, a 5-fold cross-validation paradigm was used where 70% of the data were randomly assigned into the training cohort while the remaining 20% and 10% of the data were used for validation and testing, respectively. The quantitative index of automatic segmentation accuracy is calculated using dice similarity coefficient (DSC) to compare the performance of segmentation systems based on different networks. Pearson correlation and Bland Altman analysis were used to evaluate the ability of automatic segmentation and manual segmentation.
Results: The notch volume was extremely smaller in the ACL-injured group than that in the control group (6.64 ± 1.47 vs 7.23 ± 1.83 cm3, P＜0.001). Females tend to have smaller notch volumes than males (5.69 ± 1.31 vs 7.23 ± 1.57 cm3, P＜0.001). Both males and females who had ACL injuries showed a smaller size of the notch than the ACL-intact ones ($p < 0.001$ and $p < 0.005$). The DSCs of the intercondylar fossa based on different networks were all more than 0.90, and Res-UNet showed the best performance. The volume of data sets between manual and automatic segmentations showed strong linear relationships and correlation across intercondylar notch, indicating that the automatic segmentation method proposed in this study can accurately segment the intercondylar fossa. When processing the data of each patient's intercondylar fossa, it only took 3-5 seconds for automatic segmentation to generate a single subject volume, which is very time-saving.
Conclusion: The knees with smaller notch volumes tended to have a higher risk of ACL injury. Using the deep neural network to segment intercondylar fossa automatically provides technical support for clinical prediction and prevention of ACL injury, and evaluates the necessity of notchplasty before ACL reconstruction, to prevent ACL injury again.

PU-425

# MR-T2WI 影像组学区分不同病理亚型子宫肌瘤的诊断价值

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目的 探讨 MR-T2WI 影像组学区分不同病理亚型子宫肌瘤的诊断价值。方法 回顾性分析 63 例 65 个不同病理亚型子宫肌瘤（其中普通型肌瘤 20 例 21 个，富细胞型肌瘤 22 例 23 个，退变型肌瘤 21 例 21 个）的 T2WI 信号特点及构成比。然后使用图像分割软件（ITK-SNAP）在 T2WI 图像上对子宫肌瘤进行三维分割和 A.K 软件进行特征提取，对提取的影像组学特征应用 Pearson、rfSBF（随机森林函数）和 10 重交叉验证抽样方法进行特征选择；再利用 R 语言 Caret 包中 train 函数对筛选后的训练集进行训练，建立条件推理树模型，采用 ROC 曲线和混淆矩阵计算模型总体的诊断性能，Delong 检验比较模型训练组和验证组 ROC 曲线下面积（AUC）。结果 三种病理亚型的子宫肌瘤 T2WI 信号构成比存在统计差异（P<0.001），其中富细胞型子宫肌瘤呈 T2WI 均匀高信号的比率最多（65.2 %），退变型子宫肌瘤在 T2WI 呈混杂高信号最多（61.9 %），普通型子宫肌瘤在 T2WI 上均呈低信号。每个子宫肌瘤共提取 828 项影像组学特征，共筛选出 12 项在三类子宫肌瘤间最具有鉴别诊断价值的特征。以这些特征建立起来的条件推理树模型鉴别普通型、富细胞型和退变型子宫肌瘤训练组的 AUC 分别为 0.97，0.82，0.91，敏感性分别为 100 %，70.6 %，80 %，特异性分别为 93.8 %，90 %，90.6 %，阳性预测值 88.2 %，80 %，80 %，阴性预测值分别为 100 %，84.4 %，90.6 %。验证组的 AUC 分别为 0.92，0.73，0.78，敏感性分别为 85.3 %，50 %、66.7 %，特异性分别为 100 %，75 %，75 %，阳性预测值 100 %，50 %，57.1 %，阴性预测值分别为 92.3 %，75 %，82 %。Delong 检验显示模型训练组和验证组 ROC-AUC 无统计学差异（P> 0.05）。
结论 富细胞、退变型及普通型三类子宫肌瘤具有不同的 T2WI 信号特点，但存在一定交叉重叠。条件推理树三分类模型可以有效区分子宫肌瘤的三种病理学亚型，为子宫肌瘤病理分型提供了一种全新的技术手段。

# PU-426

# Radiogenomics of Cervical Cancer Associated with Human Papillomavirus Infection Status and Molecular Features

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Objectives: To identify features extracted from magnetic resonance imaging (MRI) associated with human papillomavirus (HPV) infection status and its corresponding gene and microRNA phenotypes in cervical cancer.
Method: This study included gene, miRNA sequencing data, radiomic characteristics and clinical parameters of 52 patients with cervical cancer with confirmed HPV infection status. Then, the radiomic features are filtered out by using the least absolute shrinkage and selection operator (LASSO) to reduce dimensionality. By using logistic regression analysis, random forest and support vector machine (SVM), the HPV status signature based on radiological characteristics was further constructed. Genes and miRNAs associated to radiomic HPV status were identified through Multi-block partial least squares discriminant analysis (PLS-DA) and functional enrichment analysis.
Results: Radiomics, miRNA, gene omics features significantly divide cervical cancer patients into negative and positive groups in terms of HPV infection status. Interestingly, although HPV-negative related signatures, GLSZM Size Zone Non Uniformity can characterize the 4 HPV-positive miRNAs (hsa-mir-129-1, hsa-mir-129-2, hsa-mir-204, hsa-mir-3622a) and 3 negative genes (PDE1C, LRRC4B, ABCC11). HPV-positive signature, wavelet-HLL GLDM Large

Dependence High Gray Level Emphasis was associated to 3 HPV positive gene features(ADRA1A, ADAMTS8, NPY5R) and 1 HPV-MAGEL2. GLCM Cluster Prominence is negatively related to HPV-negative has-mir-381.Functional enrichment analysis shows that the radiomic features could reflect the angiogenesis of cervical cancer, TP53-mediated inhibition of chemotherapy toxicity, cell proliferation, and transformation.
Conclusion The multi-omics which combining MRI radiomics, gene and miRNA could classify the HPV infection status of cervical cancer, especially for HPV-negative patients. These features have the potential to assist precise treatment strategies for individual patients with cervical cancer because they exhibit molecular pathways related to HPV infection status.

PU-427

# Preoperative Prediction of Lymph Node Metastasis in Patients With Rectal Cancer Using A Multi-Modality Radiomics Model

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Aims: To investigate the clinical value of multi-modality radiomics model based on high resolution T2-weighted imaging (HR-T2WI), diffusion weighted imaging (DWI) and venous phase computed tomography (CT) imaging features to predict lymph node (LN) metastasis in patients with rectal cancer.
Materials and Methods: We enrolled 82 patients with pathologically confirmed rectal cancer (57 in the training cohort and 25 in the testing cohort). A total of 4227 radiomics features were extracted from high resolution T2-weighted imaging (HR-T2WI), diffusion weighted imaging (DWI), and venous phase CT images for each patient. We used a variance threshold, Select_K_Best and the least absolute shrinkage and selection operator (LASSO) logistic regression algorithm for feature selection and dimension reduction. Based on multivariate logistic regression analysis, we selected two significant clinical risk factors (T stage and proportion of the tumor occupied lumen circumferential). According to clinical experience, MRI-reported LN status was also included in clinical risk factors. Seven support vector machine (SVM) classification models were respectively built using selected single sequence radiomics features, multi-modality (HR-T2WI, DWI and venous phase CT) radiomics features, MRI-reported LN status feature, clinical features, and the combination of multi-modality and clinical features. Model performance was assessed by receiver operating characteristic (ROC) derived area under curve (AUC) analysis. Finally, decision curve analysis (DCA) and nomogram were applied to assess the clinical usefulness.
Results: The radiomics features derived from multi-modality (including HR-T2WI,DWI and CT images) with an AUC of 0.782 in testing cohort, was significantly associated with LN metastasis and showed more robust predictive performance than from each data type alone (AUCs: 0.615 for HR-T2WI,0.583 for DWI and 0.737 for CT). Compared with MRI discriminatory criterion of LN involvement(MRI-reported LN status,which is often used by clinicians) with an AUC of 0.760 in testing cohort,the AUC of multi-modality radiomics model (0.782) is only a little higher than it, which indicates that using multi-modality radiomics model to predict LN metastasis can reach the height of manual reporting of lymph node metastasis, and just a little better than it. Radiomics nomogram that incorporated multi-modality radiomics features and three clinical risk factors of T stage, proportion of the tumor occupied lumen circumferential and MRI-reported LN status also showed good calibration and discrimination in both training and testing cohort, with AUCs of 0.972 (95% CI: 0.936–0.996) and 0.840 (95% CI: 0.603–0.885) respectively. Decision curve analysis confirmed its clinical usefulness.
Conclusions: Multi-modality radiomics model based on HR -T2WI, DWI and venous phase CT imaging features has the potential to predict the rectal cancer LN metastasis. Incorporating the

clinical risk factors with it has been demonstrated to provide a non-invasive and convenient tool to guide individual treatment strategies for patients with rectal cancer.

## PU-428

# Prediction of minimal hepatic encephalopathy by using an radiomics nomogram in chronic hepatic schistosomiasis patients

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Objective: To construct an MR-radiomics nomogram to predict minimal hepatic encephalopathy (MHE) in patients with chronic hepatic schistosomiasis (CHS).
Methods: From July 2017 to July 2020, 236 CHS patients with non-HE (n = 140) and MHE (n = 96) were retrospective collected and randomly divided into training group and testing group. Radiomics features were extracted from substantia nigra-striatum system of a brain diffusion weighted images (DWI) and combined with clinical predictors to build a radiomics nomogram for predicting MHE in CHS patients. The ROC curve was used to evaluate the predicting performance in training group and testing group. The clinical decisive curve (CDC) was used to assess the clinical net benefit of using radiomics nomogram in predicting MHE.
Results: Low seralbumin (P < 0.05), low platelet count (P < 0.05) and high plasma ammonia (P < 0.05) was the significant clinical predictors for MHE in CHS patients. The AUC, specificity and sensitivity of the radiomics nomogram were 0.89, 0.90 and 0.86 in the training group, and were 0.83, 0.85 and 0.75 in the training group. The CDC analysis showed clinical net benefits for the radiomics nomogram in predicting MHE.
Conclusions: The radiomics nomogram combining DWI radiomics features and clinical predictors could be useful tool to predict MHE in CHS patients.

## PU-429

# 不同病理类型肺癌脑转移瘤纹理特征及其联合 NSE 诊断效能的初步研究

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目的：通过分析不同病理类型肺癌脑转移瘤的肿瘤实性成分及瘤周水肿区的常规 MR 图像纹理特征，探讨不同病理类型肺癌脑转移瘤纹理特征的差异，并评估纹理特征联合 NSE 的诊断效能，从而为肺癌脑转移瘤的个体化治疗提供重要信息。
材料与方法：本实验共纳入符合标准的肺癌脑转移瘤患者 74 例，收集一般临床资料包括性别、年龄和血清学肿瘤标志物（CEA 及 NSE）以及常规 MR 图像资料。MR 采集图像使用 ITK-SNAP 软件及 A.K.软件分析处理，经过纹理特征提取、筛选后建立模型，并评估所建立模型的诊断效能，选择最优模型构建影像组学标签。使用 SPSS 软件对非小细胞肺癌及小细胞肺癌组的一般临床资料进行统计学分析，并使用 MedCalc 软件评估 NSE 联合影像组学标签的诊断效能。
结果：通过对常规 MR 图像纹理特征进行分析，仅肿瘤实性成分的增强 T1WI 图像纹理特征在非小细胞肺癌与小细胞肺癌脑转移瘤间存在差异，建立的 SVM、K-NN、NB 以及 Logistic 回归模型评估效能良好，其中 Logistic 回归模型效能最佳，AUC 值为 0.84，准确度为 0.79，敏感度为 0.75，特异度为 0.81。在联合血清学肿瘤标志物 NSE 时诊断效能进一步提高。

结论：肿瘤实性成分增强 T1WI 图像纹理特征可以用来表征非小细胞肺癌与小细胞肺癌脑转移瘤病理类型的差异，且诊断性能良好，在联合 NSE 时可能有助于提高诊断效能，可以为肺癌脑转移瘤的个体化治疗提供重要信息。

## PU-430

# Multi-sequence MRI Findings Help Predict The Prognosis of Autoimmune Encephalitis Using Deep Learning

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Purpose: Autoimmune encephalitis (AE) is a noninfectious emergency with severe clinical attacks. Predicting the outcome of autoimmune encephalitis (AE) is critical for clinical treatment. We aimed to determine if deep learning, specifically convolutional neural network (CNN) could predict the prognosis of AE using 3D multi-sequence magnetic resonance imaging (MRI).
Materials and Methods: Deep convolutional neural network (DCNN) models were trained and tested using multi-sequences of MRI scans from 165 patients with AE and 194 health controls (HC). Two experienced neurologists independently assessed the patients' disease severity at 1 year and the last follow-up based on the modified Rankin scale (mRS) (good outcome defined as mRS 0-2; bad outcome defined as mRS 3-5). To classify patients with different prognosis outcome, we first extracted features from AE patients based on binary classification model in differentiation AE and HC. These AE features were subsequently applied to prognosis model for mRS score prediction. This grouped model performance was compared to single prediction model using AE patients alone. The area under the receiver operating characteristic curve (AUC) was calculated to compare models performance.
Results: The testing cohort composed of 33 AE (26 with mRS score >2, 7 with mRS score £ 2). The grouped prognosis model achieved acceptable clinical accuracy with the AUC of 0.786 (95%CI: 0.702~0.901) compared to that of 0.602 (95%CI: 0.597~0.818) in the single model.
Conclusion: The preliminary results demonstrated the ability of DCNN in the prognosis of AE patients in the clinical process with a clinical acceptable accuracy. Further investigation including enlarged sample size is needed to improve model performance. Deep learning technique using 3D multi-sequence MRI can be useful in the prediction of clinical prognosis of AE, potentially influencing future treatment decisions.

## PU-431

# 基于增强 MRI 的影像组学术前预测肝细胞癌微血管侵犯的价值

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目的 探讨基于增强 MRI 的影像组学方法术前预测肝细胞癌（hepatocellular carcinoma，HCC）微血管侵犯（microvascular invasion，MVI）的价值。资料与方法 回顾性收集行 1.5T MRI 检查且术后病理证实的 116 例 HCC 患者，其中 MVI（+）51 例，MVI（-）65 例，按 7:3 比例随机分为训练集 80 例（MVI（+）35 例，MVI（-）45 例）和测试集 36 例（MVI（+）16 例，MVI（-）20 例）。由两名放射科医师分别在动脉期、门静脉期及延迟期 MRI 图像上手动勾画病灶轮廓并生成三维感兴趣区，各个期相分别提取 107 个影像组学特征。利用组内相关系数（interclass

correlation coefficient，ICC）、Spearman 相关性检验及梯度提升决策树（Gradient Boosting Decision Tree，GBDT）筛选特征，利用筛选后的特征建立相应影像组学模型，并从中选择最优模型进行后续分析。采用单因素及多因素逻辑回归方法筛选最具预测价值的临床及常规影像学特征并建立传统模型。采用逻辑回归构建结合了三期增强联合影像组学评分（radscore）、临床及常规影像学特征的联合模型，并制作列线图。采用受试者工作特征曲线（receiver operating characteristic curve，ROC）和决策曲线（decision curve analysis，DCA）分别分析各模型的效能和临床应用价值。结果 本研究中，三期增强联合影像组学模型是最优的组学预测模型，测试集中曲线下面积（area under the curve，AUC）为 0.828，敏感度及特异度分别为 81.2%、60%；传统模型、影像组学模型及联合模型在测试集中的 AUC 分别为 0.614、0.828 及 0.841；联合模型较传统模型的预测效能具有显著意义的提升（AUC：0.841 和 0.614，P=0.0099）。结论 基于增强 MRI 的影像组学模型在术前预测 HCC 的 MVI 中有一定的价值，基于三期增强联合的影像组学模型是本研究最优的组学预测模型。

PU-432

# Non-mass-like enhancement on dynamic contrast-enhanced breast MR imaging: development and validation of radiomics–based signature for breast cancer diagnosis

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Purpose
To assess the additional value of radiomics-based signature for the differentiation of the benign and malignant non-mass enhancement lesions (NMEs) on dynamic contrast-enhanced breast MR imaging (breast DCE-MRI).
Materials and Methods
In this retrospective study, 232 patients with histopathologically confirmed 247 NMEs (malignant: 191; benign: 56) were enrolled from December 2017 to October 2020, as a primary cohort for the development of discriminative models. Radiomic features were extracted from one post-contrast phase (around 90 s after contrast injection) of breast DCE-MRI images. The least absolute shrinkage and selection operator (LASSO) regression model was applied for the feature selection and the construction of radiomics-based signature. Three discriminative models based on clinical and routine MR features, radiomic features and the combination information were built by applying multivariable logistic regression analysis. In addition, an independent cohort of 72 patients with 72 NMEs (malignant: 50; benign: 22) was collected from November 2020 to April 2021 for the validation the three discriminative models. Finally, the combining model was assessed by using nomogram and decision curve analysis.
Results
The routine MR model with two selected features of time-intensity curve (TIC) types and MR-reported axillary lymph nodes (ALN) status showed a high sensitivity of 0.942 (95%CI, 0.906 - 0.974) and a low specificity of 0.589 (95%CI, 0.464 - 0.714). The radiomics model with 6 selected features was significantly associated with malignancy (P<0.001 for both primary and validation cohorts). Finally, the individual combining model, which contained factors including TIC types and radiomics signatures, showed good discrimination, with an acceptable sensitivity of 0.869 (95%CI, 0.816 to 0.916) and improved specificity of 0.839(95%CI, 0.750 to 0.929), and good calibration. The nomogram was applied to the validation cohort, reaching good discrimination, with a sensitivity of 0.820 (95%CI, 0.700 to 0.920) and 0.864 (95%CI,0.682 to 1.000) and good calibration. The combining model was clinically helpful demonstrated by decision curve analysis.
Conclusions

Our study added radiomics signatures into the conventional clinical model and developed a radiomic nomogram including radiomics signatures and TIC types. This radiomics model could be helpfully applied to differentiate benign NMEs from malignant NMEs for patients with suspicious lesions at breast MR imaging.

PU-433

# 基于 cine CMR 的心肌放射组学特征预测心肌梗死的研究

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**目的:**虽然通过心脏磁共振增强延迟强化(CMR-LGE)成像可以定量和定性地评估心肌梗死(MI)，但是增强需要从静脉注射钆剂会增加肾源性系统性纤维化(NSF)风险，特别是那些有心血管疾病的患者。本研究的目的是利用基于 CMR 的放射组学在不引入钆剂等对比剂的情况下预测 MI。
**材料与方法:** 回顾性收集 48 例于 2017 年 10 月-2020 年 12 月期间在深圳市人民医院因急性心肌梗死（AMI）入院，并成功行 PCI 术后 于 2 ~6 天内对其行 CMR-LGE 检查证实。根据 LGE 评估是否存在 MI，在电影磁共振（cine CMR）的舒张末期图像上将患者左心室心肌节段分为 MI 节 段 组（ｎ＝266）和无 MI 节 段 组（ｎ＝ 406），提取放射组学特征后将这些节段按 0.7:0.3 分为训练集和验证集。采用 Pearson 相关分析和 Mann-Whitney U 秩和检验剔除冗余和无关特征。采用最小绝对收缩和选择算子(LASSO)算法对训练集中的特征进行选择后计算放射组学分数，并使用受试者工作特征曲线下面积(ROC- AUC)评估其预测性能。
**结果:** 48 例患者 768 个心肌节段中 291(38%)个节段有心肌梗死，477(62%)个节段无心肌梗死。经单因素分析后，与 MI 相关的放射组学特征（RFs）有 22 个，且均有统计学意义。LASSO 回归选择了 18 个 RFs 并计算放射组学信号构建预测模型。在训练集和验证集中，预测 MI 节段的 ROC-AUC 分别为 0.74(95% CI:0.69-0.78)和 0.68 (95%CI: 0.60-0.75)。两者间差异无统计学意义(p=0.14)。
**结论：**基于 Cine MR 的放射组学特征对心肌梗死具有良好的预测性能，这表明在不使用造影剂的情况下，它有可能成为一种很有前途的心肌梗死成像生物标志物。
**[关键词]** 心肌梗死；心脏磁共振电影成像；放射组学

PU-434

# Precise Differentiation between Glioblastomas, Metastasises and Primary Central Nervous System Lymphomas and Prediction of Ki-67 Expression Using Radiomics Based on Conventional MRI

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**Purpose**

The pathologic differentiation of brain tumors and the proliferation of tumor cells play an important role in prognosis and management of patients. The purpose of our study were as follows: 1) to propose a radiomic model based on morphological MRI to differentiate between glioblastomas (GBMs), brain metastasises and primary central nervous system lymphomas (PCNSLs); 2) to propose a radiomic model to non-invasively predict the Ki-67 expression of different types of brain tumors. 3) to compare the performance of different radiomics classifiers and identify the optimal one for 1) and 2).

**Materials and Methods**

Between July 2013 and June 2020, a total of 104 patients with pathologically confirmed brain tumors (52 GBMs, 22 metastasis and 30 PCNSLs) were included in this retrospective study. FLAIR, non-contrast and contrast-enhanced T1-weighted images based on conventional MRI were adopted for radiomics analysis. The entire tumor and its core composed of the contrast-enhanced and necrosis areas were contoured by semi-automatic methods. The radiomics process consisted of feature extraction, feature selection and radiomics model building for the classification of brain tumors and the prediction of Ki67 expression. Four frequently used radiomics classifiers including support vector machine (SVM), Random Forest (RF), Logistic Regression (LR) and Multilayer Perceptron (MLP) were investigated for feature classification. Additionally, the accuracy, sensitivity, specificity and area under curve (AUC) were calculated to evaluate the performance of the corresponding models respectively to differentiate types of brain tumors, predict the Ki67 expression. and identify the optimal classifier.

**Results**

The radiomics model proposed in our study demonstrated differentiating brain tumor types and predict Ki-67 with promising results. The SVM of the above mentioned four classifiers showed to be the optimal one to classify the types of brain tumors with AUC, accuracy, sensitivity and specificity of 0.97, 0.95, 0.94 and 0.95, and to predict the Ki-67 expression of 0.95, 0.94, 0.93 and 0.95, respectively. For Ki-67 prediction, the predictive performance of the radiomics model with SVM classifier for glioblastoma turned out to be slightly superior that of brain metastasis ((AUC=0.98 vs. AUC=0.96). In addition, the increased feature set of the radiomics model for differentiation of the three types of brain tumors led to a slightly improved performance for the Ki-67 expression prediction.

**Conclusion**

The radiomic features based on conventional MRI demonstrated high values for brain tumors classification and Ki-67 prediction. Additionally, brain tumor types showed significant impact on the prediction of Ki-67 expression. The application of radiomics proved potential ability in clinical management for patients with brain tumors.

PU-435

# 基于 DCE-MRI 深度学习在术前预测乳腺癌腋窝淋巴结转移的研究

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目的：探讨基于 DCE-MRI 建立的深度学习模型在术前无创预测乳腺癌患者腋窝淋巴结转移的价值。

材料与方法：回顾性收集并纳入符合标准的 2017 年 2 月至 2019 年 10 月烟台毓璜顶医院术前行 DCE-MRI 检查的乳腺癌患者 825 例，将患者按 9:1 比例随机分为训练集（742 例）和内部验证集（83 例），并纳入公开数据库（TCIA）行 DCE-MRI 检查的乳腺癌患者 59 例作为外部验证集。在 DCE-MRI 增强最明显的一期图像上逐层进行肿瘤和淋巴结感兴趣区的分割。对肿瘤和淋巴结的分

割图像进行预处理后分别输入 3D ResNet 网络自动学习图像特征来建立深度学习模型；在 3D ResNet 网络的全连接层融合肿瘤和淋巴结的深度特征建立二者结合特征的深度学习模型，三个模型分别命名为 $DL_{tumor}$、$DL_{LN}$ 和 $DL_{tumor+LN}$。另外，提取肿瘤和淋巴结的影像组学特征，利用 Lasso-Logistic 回归筛选特征并建立三个影像组学模型，命名为 $RM_{tumor}$、$RM_{LN}$ 和 $RM_{tumor+LN}$。同时，将深度学习模型、影像组学模型的预测性能与 2 位放射科医师的诊断能力进行比较。为进一步探究人工智能对放射科医师诊断能力的辅助价值，我们选择预测效能最优的模型来辅助放射科医师对淋巴结状态进行再判读，并与第一次判读结果进行比较。该研究的淋巴结状态以病理结果为金标准。利用 ROC 曲线下面积（AUC）、准确性、敏感性、特异性等来评估分析各个模型的预测表现。

结果：深度学习模型在乳腺癌患者腋窝淋巴结转移预测方面的表现整体上优于影像组学模型，其中，$DL_{tumor}$、$DL_{LN}$、$DL_{tumor+LN}$ 在内部验证集中 AUC 分别为 0.790、0.815、0.892。由此可见，$DL_{tumor+LN}$ 的预测效能最优，其准确度、敏感度和特异度分别为 86.7%、82.4%和 89.8%。$DL_{tumor+LN}$ 在外部验证集中 AUC 为 0.732。内部验证集中，在 $DL_{tumor+LN}$ 判断结果的辅助下，放射科医师 1 诊断淋巴结转移的准确性从 75.9%增加至 81.9%，放射科医师 2 的准确性从 68.7%增加至 72.3%。

结论：该研究证明了淋巴结特征对于评估乳腺癌淋巴结状态的价值。基于 DCE-MRI 的深度学习模型有潜力在术前无创地进行乳腺癌患者腋窝淋巴结转移的预测，同时，它可以辅助放射科医生对淋巴结转移进行更高效的诊断。

PU-436

# 3.0T MRI 体素内不相干运动扩散加权成像联合纹理特征评估中低分化直肠腺癌的研究

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目的：探讨 3.0T MRI 体素内不相干运动扩散加权成像（IVIM-DWI）联合纹理特征（TA）对直肠腺癌分化程度的评估价值。方法：回顾性收集直肠腺癌患者 71 例，依据病理结果将其分为低分化组 23 例、中分化组 48 例。 所有患者均于术前接受 MRI 平扫和增强及 IVIM-DWI 序列。在 GE AW 4.6 工作站测量 IVIM-DWI 参数值；利用 ITK-SNAP 软件在 LAVA-FLEX 序列轴位增强静脉期逐层勾画肿瘤感兴趣区并利用 A.K.软件提取肿瘤的三维纹理特征。采用 MedCalc(16.8.4 版本)软件分别对上述参数值进行统计学分析。比较两组间上述参数的差异，采用 ROC 曲线对有统计学意义的参数进行诊断效能评估，并通过多因素 logistic 回归分析建立预测模型。结果：（1）两组间 D、D*值具有统计学意义（$P < 0.05$）；D*的 ROC 曲线下面积(AUC)最大（0.76），其敏感度及特异度分别为 43.75%和 95.65%，约登指数为 0.394；（2）对 725 个纹理特征降维后得到 3 组纹理参数分别是 wavelet-HHL_glszm_SmallAreaEmphasis，wavelet-HHL_firstorder_Median 和 wavelet-HLL_firstorder_Maximum；3 组参数间均具有统计学意义（$P < 0.05$）；wavelet-HHL_glszm_SmallAreaEmphasis 和 wavelet-HHL_firstorder_Median 的 AUC 最大，均为 0.712，wavelet-HHL_glszm_SmallAreaEmphasis 的敏感度及特异度分别为 87.5%、56.52%，约登指数为 0.4402；wavelet-HHL_firstorder_Median 的敏感度及特异度分别为 72.92%和 65.22%，约登指数为 0.3813；（3）logistic 回归预测模型得到 D*、wavelet-HHL_firstorder_Median 和 wavelet-HLL_firstorder_Maximum3 个变量是重要的独立预测因子，回归预测模型的 AUC 为 0.86、敏感度 72.92%和特异度为 95.65%，约登指数为 0.6857；其 AUC 明显高于其他单一参数的 AUC。结论：3.0T 磁共振 IVIM-DWI 参数联合 TA 在术前能够为直肠腺癌分化程度的评估提供有价值的信息。

PU-437

# 基于 mpMRI 放射组学和机器学习预测 子宫内膜癌淋巴血管侵犯的研究

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**目的：**基于多参数 MRI（mpMRI）的放射组学特征和机器学习预测子宫内膜癌（endometrial cancer，EMC）的淋巴血管侵犯（lympho-vascular space invasion, LVSI），为临床医生治疗方案的选择提供更准确有效的决策支持。
**材料与方法：**回顾性收集 202 例经手术病理证实为 EMC 患者并行盆腔 MRI 检查的影像及临床病理资料，从 mpMRI（包括 T2WI、CE-T1WI 和 ADC mapping）影像图片中提取 321 个放射组学特征。用 ICC 值评估放射组学组间的一致性，采用 t 检验和 $\chi^2$检验或 Mann–WhitneyU 检验分析年龄、分级、淋巴结转移、宫颈基质侵犯（cervical stromal invasion，CSI）和 FIGO 分期等临床资料以及放射组学与 LVSI 的相关性，得到有统计学意义的特征（$p<0.05$）再次纳入 LASSO 回归模型进行降维并计算出放射组学信号，预测 LVSI 效能采用受试者（receiver operating characteristic，ROC）的曲线下面积（area under the curve，AUC）评价。
**结果：**202 例子宫内膜癌患者中，LVSI 阳性者共 46 例（22.8%），年龄约 55.31±9.37，单因素分析表明年龄、分级和淋巴结转移在有无 LVSI 间有显著差异（$p<0.05$）。其他临床病例资料对预测 LVSI 无统计学意义。放射组学特征经单因素分析后，有 27 个特征在有无 LVSI 间差别有统计学意义，LASSO 回归筛选出 18 个放射组学特征计算出放射组学信号。构建预测模型，并进行内部验证，结果表明模型对 LVSI 具有较高的预测能力，在训练集和验证集中，AUC 分别为 0.88(95% CI:0.81-0.95)和 0.82 (95%CI: 0.70-0.94)。两者间差异无统计学意义(p=0.45)。
**结论：**基于 mpMRI 的放射组学信号模型对 EMC 的 LVSI 术前评估能达到较高的诊断效能，有助于对 EMC 患者进行风险分层，指导临床精准医疗的发展。
**关键词：**子宫内膜癌，淋巴血管间隙侵犯，多参数 MRI，放射组学，LASSO 回归

PU-438

# 基于放射组学的胶质母细胞瘤患者总体生存预测模型的比较和总结研究

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目的
建立由放射组学特征、伦勃朗视觉感受图像（Visually Accessible Rembrandt Images，VASARI）特征及临床特征组成的多种胶质母细胞瘤总体生存预测模型；评估多种模型的预测能力并比较常用的 COX 回归算法和随机生存森林的性能；回顾并总结已发表的胶质母细胞瘤的放射组学生存分析研究。
材料与方法
回顾分析我们医院和公开癌症基因图谱（TCGA）数据库中的胶质母细胞瘤患者，每个病例都具有术前磁共振 T1WI、T2-FLAIR 及 T1C 序列的影像资料。病例随机分为训练组和内部验证组，以及一组独立测试组。每个病例包括 4 个临床特征，23 个视觉访问特征和 642 个利用放射组学相关软

件提取的放射组学特征。使用最小绝对收缩和选择算子（LASSO）对 VASARI 特征和放射组学特征进行相关性筛选。利用多因素 COX 回归和随机生存森林对筛选出来的特征建立生存预测模型。使用一致性指数（concordance index，C-index）和 IBS 评分（Integrated Brier scores，IBS）来评估模型的预测能力。
结果
200 个纳入研究的病例，平均年龄为 55.14±15.36 岁。筛选出 1 个视觉访问特征和 15 个放射学特征与总体生存时间具有相关性。肿瘤累及皮层的病例总体生存时间更短（p=0.006）。总结发现 10 个具有重复性的放射学特征。对于总体生存预测，随机生存森林比 COX 回归算法表现更好；基于放射学特征的随机生存森林模型的预测能力在本研究的所有模型中最好（独立测试组：C-index=0.935±0.023）。
结论
在胶质母细胞瘤总体生存预测中，随机生存森林的预测性能优于 COX 回归算法，基于放射学特征的随机生存森林是最佳预测模型，同时总结了 10 个具有预测潜能的可重复性放射学特征。

## PU-439

# 乳腺癌磁共振影像组学特征的可重复性研究

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目的：评估乳腺癌患者重复性检查的磁共振影像组学特征的可重复性。
材料与方法：本研究回顾性分析了 21 位治疗前行重复性 MR 检查的乳腺癌患者的 T1 增强图像，两次检查时间间隔不超过一周。将这两次检查的乳腺 T1 增强图像导入 3D-slicer 软件，并由两位不同的放射科医师用区域生长法进行乳腺肿块的分割，并提取包括基于形状特征、一阶强度统计特征、纹理特征和小波特征等的 849 个影像组学特征。以组内相关性系数 （ICC） 评估两次检查间 MRI 放射组学特征的重复性，将 ICC≥0.9 的影像组学特征被认为有优秀的可重复性。
结果：在提取的 849 个乳腺癌 MR 影像组学特征中，共有 34.69%（286/849）的影像组学特征拥有优秀的可重复性，其中基于的形状特征的总体重复性最好，有 58.33%（7/12）的特征拥有优秀的可重复性；纹理特征的总体可重复性较差，只有 26.67%（20/75）的特征拥有优秀的可重复性；一阶强度统计特征和小波特征中拥有优秀重复性的特征分别为 44.44%（8/18）及 33.74%（251/744）。
结论：乳腺 MR 影像组学特征的可重复性差别较大，未来需要在多中心大样本的数据集中进一步研究，以指导稳定影像组学特征的选择。

## PU-440

# 基于深度学习的肝细胞肝癌微血管浸润预测研究

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**目的：**探讨基于 MR 弥散加权图像，使用卷积神经网络 (CNN) 预测肝细胞肝癌 (HCC) 微血管浸润 (MVI) 的价值。
**材料和方法：**本研究经本机构伦理委员会审查批准，患者知情同意书被免除。对本机构从 2012 年 7 月至 2018 年 10 月期间确诊 HCC 且进行手术切除的患者进行筛选，共 97 名被试者，100 个 HCC 病灶符合入组标准。所有被试者均接受 包括 DWI 序列在内的 MRI 扫描检查。 DWI 序列中包括三个 b 值 ：0,100,600 sec/mm2。首先，通过对三个 b 值图像进行单指数拟合来计算 ADC 图

像。然后，从 b0、b100、b600 和 ADC 图像中提取 HCC 的多个 2D 轴位影像块（28×28）以增加用于训练 CNN 模型的数据集。最后，基于 CNN 模型对来自三个 b 值图像的深度特征和 ADC 进行融合，用于 MVI 预测。数据集分为训练集（60 个 HCC）和独立测试集（40 个 HCC）。深度学习模型在 HCC 的 MVI 预测中的输出概率，符合正态分布的使用通过独立样本 t 检验进行检验，对于不符合正态分布的数据使用 Mann-whitney U 检验进行评估。使用 ROC 曲线和曲线下面积 (AUC) 用于评估固定测试集中 HCC 的 MVI 预测性能。 P<0.05 被认为具有统计学意义。
结果：通过较高 b 值（b600）图像获得的深度特征对 MVI 预测具有较高效能 (AUC=0.72，p=0.021) ；较低 b 值图像（ b0）与 b100 图像所获得的深度特征的预测性能分别为：AUC=0.68, p=0.031；AUC=0.70, p= 0.027。通过 ADC 图获得的深度特征对于 MVI 的预测具有最低性能（AUC=0.66，p=0.042）。通过融合 b0，b100,b600 以及 ADC 图获得的深度特征，对于 MVI 预测具有最高效能（AUC=0.79，p=0.009）。
结论：融合来自 DWI 三个 b 值图像和 ADC 图像的深层特征为 MVI 预测产生更好的性能。

## PU-441
# 基于 Gabor 小波滤波的纹理分析在脑胶质瘤分级上的应用研究

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胶质瘤的分级在临床上有指导后续治疗的作用，纹理分析是一种可以实现无创脑胶质瘤分级的方法。本文目的是探究基于 Gabor 小波滤波的纹理分析方法对脑胶质瘤分级应用效果。采集临床 60 例脑胶质瘤病例，根据世界卫生组织（World Health Organization：WHO）病理分级标准，其中包括Ⅱ级胶质瘤弥漫型星形细胞瘤和少突胶质细胞瘤）22 例，Ⅲ级胶质瘤间变型少突星形细胞瘤和间变星形细胞瘤 18 例；Ⅳ级胶质瘤胶质母细胞瘤例 20 例。采集常规磁共振图像信息包含平扫 T2 序列图像和 T2_flair 序列图像以及造影剂增强 T1 序列图像。在 MATLAB 平台上处理三种序列图像，选取脑胶质瘤病灶最大层面图像进行 4 个尺度上的 Gabor 小波滤波，对滤波后的图像做同样的纹理分析。纹理分析以肿瘤的核心实质区域为感兴趣区，计算四种纹理参数：均值、标准差、峰度、偏度。为探究四种尺度滤波对纹理分析的影响，做了Ⅱ级与Ⅲ级间纹理参数的 ROC 分析，以及Ⅲ级与Ⅳ级间纹理参数的 ROC 分析，计算出敏感性，特异性和曲线下面积。并在三个级别的胶质瘤间做了斯皮尔曼（Spearman）等级相关性分析，计算出 rho 系数及 P 值。最终通过留一法进行交叉验证得出基于 gabor 小波滤波的纹理分析方法在胶质瘤分级上的准确度。基于支持向量机的机器学习内核，通过交叉验证留一法计算出Ⅱ级和Ⅲ级间总体参数的正确率为 0.915。在Ⅲ级和Ⅳ级间的总体参数正确率为 0.979。

## PU-442
# 基于无纲量的纹理分析在Ⅱ、Ⅲ级胶质瘤鉴别上的应用

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1.胶质瘤的分级在临床上有指导后续治疗的作用，纹理分析是一种可以实现无创脑胶质瘤分级的方法。本文目的是探究基于无纲量的纹理分析方法在Ⅱ、Ⅲ级胶质瘤鉴别上的应用。采集临床 38 例脑胶质瘤病例，根据世界卫生组织（World Health Organization：WHO）病理分级标准，其中包括Ⅱ级胶质瘤弥漫型星形细胞瘤和少突胶质细胞瘤 20 例，Ⅲ级胶质瘤间变型少突星形细胞瘤和间变星形细胞瘤 18 例。采集常规磁共振图像信息包含平扫 T2 加权序列图像，T2_flair 加权序列图像，造影剂增强 T1 序列图像，弥散序列图像 ADC 图，磁敏感序列图像 SWI。在 MATLAB 平台上处理

5 种序列图像，选取脑胶质瘤病灶最大层面图像做四种无纲量的纹理分析，计算出各个无纲量纹理参数。通过对纹理参数做 Mann-Whitney U 检验和 ROC 分析，得出 25 个纹理参数在Ⅱ、Ⅲ级胶质瘤上是有显著性差异的，具体统计数据如附表。

## PU-443

# Radiomics Analysis Based on Preoperative Magnetic Resonance Imaging for Evaluation of Postoperative Immunohistochemical Biomarkers in Rectal Cancer

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Purpose: To develop and validate radiomic model for evaluation of postoperative immunohistochemical biomarkers of rectal cancer based on preoperative magnetic resonance imaging (MRI).
Materials and Methods: This study consisted of 124 patients (86 in the primary cohort and 38 in the validation cohort) with rectal cancer who underwent preoperative MRI and postoperative immunohistochemical assay. We focused on evaluating three confirmed immunohistochemical biomarkers including Ki67, p53 and EGFR expression statuses. 796 radiomic features were extracted from preoperative T2-weighted imaging (T2WI) and diffusion-weighted imaging (DWI). mRMR and LASSO were used to select the texture feature. Rad-score was calculated by summing the selected features weighted by their coefficients. The ROC was performed to evaluate the performance of the model and the decision curve for clinical usefulness.
Results: 30 features were selected from 796 features. Rad-score for evaluating the expression status of Ki67 with AUC values of 0.91(0.87-0.95) and 0.81(0.66-0.96), p53with AUC values of 0.82(0.77-0.88) and 0.80(0.65-0.96), EGFR with AUC values of 0.86(0.81-0.91) and 0.76(0.58-0.93) respectively in training group and test group respectively.
Conclusion: Radiomic analysis based on preoperative MRI have potential to noninvasively evaluate the postoperative immunohistochemical biomarkers of rectal cancer.

## PU-444

# 人工智能(AI)辅助心功能分析在儿科患者中的应用

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目的：探讨人工智能(artificial intelligence, AI)在小儿心脏磁共振检查心功能分析中的可行性和潜力，并进一步比较其与传统人工分析的一致性。
材料和方法：纳入 26 例儿童患者，年龄 3～13 岁。所有患者均行覆盖整个左室的 8-10 片心脏短轴电影 cine_tf2d 序列扫描(Siemens, 3T Skrya)，分别采用 AI (Siemens，内联 VF 技术)和手工分析(Simpson 体积法)法对心功能进行分析。按年龄(>10/≤10 岁)、心率(HR)(> 80/≤80/min)、是否屏气进行分组比较。采用 Bland-Altman 和 Pearson 相关性分析对二者进行比较分析。
结果：AI 追踪到心外膜边缘错误者 16 例(61.5%)，分别位于肝、主动脉、心房、右心室。相较于年轻患者，年龄较大患者 AI 测量具有较好的一致性(偏倚:-1.6±13.7;R =0.748.)。HR 较低的患者亦表现出良好的一致性(偏倚:-1.9±11;r=0.748.)(图 1)(偏倚 3.0±17.6;r = -0.041)。更重要的是，我们的研究证实，两种测量方法在屏气患者中一致性较好，而在自由呼吸患者中一致性较差。

结论：人工智能技术辅助心功能分析与手工法对年龄较大、心率较低或呼吸困难的患儿有较好的一致性。然而，对于一些高 HR、年轻或自由呼吸的患者，计算机生成的轮廓可能不准确，不符合解剖。因此，人工智能技术的准确性和临床可行性有待进一步提高。