Clinical research on optimizing pharmacotherapy in elderly patients with reduced kidney function

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Japan's aging rate reached its highest level in 2005 and is expected to remain high. Risk factors for adverse drug events in the elderly are multiple medications, long-term doses, and age-related changes such as kidney function. In particular, reduced kidney function is a factor that requires special attention in elderly patients. Six out of 10 hospitalized elderly patients are an eGFR of less than 60 ml/min in our center. In this background, we conducted two clinical research on optimizing pharmacotherapy in elderly patients with reduced kidney function.

An administration plan for vancomycin (VCM) in bedridden elderly patients has not been established. This retrospective study aimed to evaluate the prediction accuracy of the area under the concentration-time curve (AUC) of VCM by the Bayesian approach using creatinine-based equations of estimated kidney function in such patients. Kidney function was estimated using the Japanese equation of estimated glomerular filtration rate (eGFR) and the Cockcroft-Gault equation of estimated creatinine clearance (eCCr). eCCr (serum creatinine (SCr) + 0.2) was calculated by substituting the SCr level +0.2 mg/dL into the Cockcroft-Gault equation. For eGFR/0.789, eGFR, eCCr, and eCCr (SCr + 0.2), the AUC values were calculated by the Bayesian approach using the therapeutic drug monitoring (TDM) software, BMs-Pod (ver 8.06) and denoted as $AUC_{eGFR/0.789}$, AUC_{eGFR}, AUC_{eCCr}, and $AUC_{eCCr\ (SCr\ +\ 0.2)}$ respectively. The reference AUC (AUC_{REF}) was calculated by applying VCM's peak and trough steady-state concentrations to first-order pharmacokinetic equations. The medians (range) of $AUC_{eGFR/0.789}/AUC_{REF}$, AUC_{eGFR}/AUC_{REF}, AUC_{eCCr}/AUC_{REF}, and $AUC_{eCCr\ (SCr\ +\ 0.2)}/AUC_{REF}$ were 0.88 (0.74-0.93), 0.90 (0.79-1.04), 0.92 (0.81-1.07), and 1.00 (0.88-1.11), respectively. Moreover, the percentage of patients within 10% of the AUC_{REF}, defined as |Bayesian-estimated AUC - AUC_{REF}| < AUC_{REF} × 0.1, was the highest (86%) in $AUC_{eCCr\ (SCr\ +\ 0.2)}$. These results suggest that the Bayesian approach using eCCr (SCr + 0.2) has the highest prediction accuracy for the AUC_{REF} in bedridden elderly patients. Although further studies are required with more accurate determination methods of the CCr and AUC, our findings highlight the potential of eCCr (SCr + 0.2) for estimating VCM's AUC by the Bayesian approach in such patients.

Clinical decision support systems (CDSS) are reported to be useful in preventing dosage errors in renally excreted drugs by alerting hospital pharmacists to inadequate dosages for hospitalized patients with decreased GFR. However, it is unclear whether CDSS can reduce dosage errors in renally excreted drugs in hospitalized patients. To prevent dosage errors in renally excreted drugs, we introduced a prescription checking system (PCS) for in-hospital prescriptions. This retrospective study aimed to evaluate whether a prescription audit by hospital pharmacists using the PCS reduced the rate of dosage errors in renally excreted drugs. The target drugs were allopurinol, cibenzoline, famotidine, and pilsicainide. Interrupted time series analysis was used to evaluate trends in the 4-weekly dosage error rates over 52 weeks before PCS implementation and 52 weeks after PCS implementation. Before and after PCS implementation, 474 and 331 prescriptions containing one of the targeted drugs, respectively, were generated. The estimated baseline level of the 4-weekly dosage error rates was 34%. The trend before the PCS implementation was stable with no observable trend. The estimated level change from the last point in the pre-PCS implementation to the first point in the PCS implementation was −20% (P<0.001). There was no change in the trend after PCS implementation. We demonstrated that a prescription audit by hospital pharmacists using the PCS reduced the rate of dosage errors in the target renally excreted drugs in hospitalized patients. Although further studies are needed to confirm whether our results can be generalized to other health facilities, our findings highlight the need for a PCS to prevent the overdose of renally excreted drugs.