

Individualized medication model of vancomycin in patients with renal insufficiency using machine learning techniques

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Abstract

Objectives: Inappropriate dose of vancomycin can cause nephrotoxicity, which should be avoided in clinical, particularly in patients with renal insufficiency. We aim to use machine learning techniques to explore important variables influencing vancomycin dose in patients with renal insufficiency and establish an individualized medication model to benefit these patients. **Methods:** Vancomycin administration cases in patients with renal insufficiency were collected at Xinhua Hospital affiliated to Shanghai Jiaotong University School of Medicine from May 2018 to March 2022. Sequential Forward Selection was used for feature selection. Eight machine learning algorithms were compared the predictive performance, including XGBoost, LightGBM, CatBoost, GBDT, RF, SVC, KNN, and Logistic Regression. The one with the best predictive performance was chosen to calculate the importance score of modeling variables and establish the individualized medication model. Dose subgroups were divided into 500 mg, 1000 mg, 1500 mg and 2000 mg. Subgroup analysis based on the modeling variables were conducted. **Results:** This study included 237 eligible patients with 351 vancomycin cases. Six important variables were screened out, including gender, weight, AUC, uric acid, creatinine and total protein. CatBoost was chosen with the best prediction performance (accuracy=0.59) for modeling. The individualized medication model had precision over 53% and recall rate over 50% among all dose subgroups. The prediction of 1500 mg vancomycin had the best precision (65%), recall rate (71%) and F1-score (0.68). **Conclusion:** The individualized medication model of vancomycin for patients with renal insufficiency has good predictive performance, which can help clinicians make better decision of vancomycin use.

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