Vancomycin is a vital treatment option for patients suffering from critical infections, and therapeutic drug monitoring is recommended. Bayesian forecasting is reported to improve trough concentration monitoring for dose adjustment” Broeker et al (2019).

Abstract:

Objectives: Vancomycin is a vital treatment option for patients suffering from critical infections, and therapeutic drug monitoring is recommended. Bayesian forecasting is reported to improve trough concentration monitoring for dose adjustment. However, the predictive performance of pharmacokinetic models that are utilized for Bayesian forecasting has not been systematically evaluated.

Method: Thirty-one published population pharmacokinetic models for vancomycin were encoded in NONMEM®7.4. Data from 292 hospitalized patients were used to evaluate the predictive performance (forecasting bias and precision, visual predictive checks) of the models to forecast vancomycin concentrations and area under the curve (AUC) by (a) a priori prediction, i.e., solely by patient characteristics, and (b) also including measured vancomycin concentrations from previous dosing occasions using Bayesian forecasting.

Results: A priori prediction varied substantially—relative bias (rBias): -122.7–67.96%, relative root mean squared error (rRMSE) 44.3-136.8%, respectively—and was best for models which included body weight and creatinine clearance as covariates. The model by Goti et al.
displayed the best predictive performance with an rBias of -4.41% and an rRMSE of 44.3%, as well as the most accurate visual predictive checks and AUC predictions. Models with less accurate predictive performance provided distorted AUC predictions which may lead to inappropriate dosing decisions.

Conclusion: There is a diverse landscape of population pharmacokinetic models for vancomycin with varied predictive performance in Bayesian forecasting. Our study revealed the Goti model as suitable for improving precision dosing in hospitalized patients. Therefore, it should be used to drive vancomycin dosing decisions, and studies to link this finding to clinical outcomes are warranted.

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