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Vancomycin One Compartment vs Two Compartment Models

What are the differences between these models for adult patients?

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What are the differences between these models for adult patients?

Although vancomycin is typically characterized as a 2 or even a 3-compartment model, there are numerous pharmacokinetic (PK) studies that describe a 1-compartment model that are commonly used in Bayesian dosing. Within DoseMeRx, we have two standard vancomycin models that are applicable for use in a wide range of adults who are not currently receiving dialysis.

Of course, the decision on which model to select when you have access to both is based on your own clinical judgment. However, understanding the differences will help you determine which model may be more suitable for your patient.

One (1)-Compartment Vancomycin Model

Background: The one-compartment vancomycin model implemented in DoseMeRx is derived from a retrospective study conducted in 215 patients (Buelga et al. AAC 2005). It has been further validated in multiple publications and used clinically in over 10,000 patients with a wide range of conditions. Total body weight and creatinine clearance are the covariates in this model.

Creatinine clearance is calculated using ideal body weight. In cases where serum creatinine is less than 0.68mg/dL (60 µmol/L), the value is rounded up to the 0.68mg/dL (60 µmol/L) minimum threshold. The 1 compartment model is validated for use for patients weighing between 40 and 200kg and height between 150 and 220cm.

With a single compartment model, there are less free parameters to fit. Therefore, an individualized fit is more likely to be achieved from a single trough level. It will model a 'smoothed average' of the 2 compartments. A recent paper found that a 1 compartment model may be sufficient to guide vancomycin dosing in adult patients with stable renal function (Shingde RV, et al. Ther Drug Monitor 2019).

Summary: The 1 compartment model may be suitable for patients who are less complex medically and have stable renal function.

Two (2)-Compartment Vancomycin Model

Background: The two-compartment vancomycin adult model implemented in DoseMeRx is derived from a retrospective study with a cohort of 1,812 patients (Goti et al. Ther Drug Monitor 2018) . This model is particularly useful for AUC-based dosing as it models both the distribution and elimination phases of vancomycin. Total body weight and creatinine clearance are the covariates in this model (for non-hemodialysis patients). Creatinine clearance is calculated based on Cockroft-Gault using ideal body weight. For patients over 65, it rounds the minimum serum creatinine value used up to 1 mg/dL (88.4µmol/L). Creatinine clearance is "capped" at a maximum of 150mL/min for all patients. This model is validated for use for patients weighing between 40 and 200kg and height between 150 and 220cm. A 2019 review of pharmacometric models for Bayesian forecasting found that this model had a high predictive performance (Broeker et al. Clin Microbiol Infect 2019).

As this model fits a more complex pharmacokinetic curve, in order to get the best individual fit, two lab results, such as a post-infusion peak and a trough, are most effective at individualizing the two phases for the patient using this model. There is flexibility in the timing of the levels that can be obtained (e.g. they don't always have to be during the same dosing interval). Random levels can also be utilized in model fitting as well.

Summary: The use of this model is highly recommended in complex patients who may have altered clearance or volume of distribution, such as those in the ICU. However, due to the way

that Bayesian dosing works, if, your patient is similar to the cohort of the two compartment model, a single level will also give a high quality fit.

Did this answer your question?

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