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Research Article

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Should We Take the Serum Albumin Value into Account When Adjusting the Vancomycin Dosage?

V Rodrigues *, S Valongo, & D Palma

Hospital de Cascais, Pharmacy, Cascais, Portugal

***Corresponding author:** V Rodrigues, Hospital de Cascais, Pharmacy, Cascais, Portugal.

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Abstract

Monitoring the pharmacokinetics of drugs with a narrow therapeutic index is essential to optimize efficacy and minimize toxicity. Vancomycin is primarily eliminated through glomerular filtration and has approximately 55% protein bounding . As albumin is the main circulating transport protein, hypoalbuminemia can influence the pharmacokinetic and pharmacodynamic behavior of bound drugs . In our clinical practice, we observed unexpectedly elevated vancomycin trough concentrations in predominantly elderly patients with hypoalbuminemia. This prompted a review of the literature to assess its impact on vancomycin pharmacokinetics. A PubMed search conducted in August 2024 using the terms "vancomycin" and "hypoalbuminemia" yielded 37 results, of which only two met inclusion criteria. In a study of septic adults, 41% over 65 years, severe hypoalbuminemia (2.5 g/dL) was associated with a high likelihood that a loading dose was unnecessary and risked toxic trough values . A second study, including adults with 50% over 75 years, showed that vancomycin half-life was significantly prolonged in severe versus non-severe hypoalbuminemia (33.2 ± 5.4 vs 24.9 ± 1.6 hours; $P = 0.049$). It also reported higher nephrotoxicity in severe hypoalbuminemia (26% vs 8%; $P < 0.001$). These findings highlight hypoalbuminemia as a relevant factor when dosing vancomycin. Future work will focus on developing a robust research protocol to further confirm its impact. We conclude that incorporating albumin levels into pharmacokinetic monitoring may help prevent overdosing and improve patient safety.

Keywords: Vancomycin, Hypoalbuminemia, Pharmacokinetics.

Introduction

Pharmacokinetic monitoring of drugs with a narrow therapeutic margin is a practice that allows optimizing treatment by increasing efficacy and avoiding toxicity. Vancomycin is excreted mainly by glomerular filtration, with a percentage of binding to plasma proteins around 55 [1] .Serum albumin is the main transport protein in circulation. Changes in its physiology, such as hypoalbuminemia, affect the pharmacokinetic and pharmacodynamic properties of the drugs to which it binds [2]. In our clinical practice we have found that some patients present a considerable deviation from the predicted vancomycin trough with serum concentrations higher than expected. The common characteristic of these patients, the majority of whom are elderly, is the fact that they have hypoalbuminemia. To review the impact of hypoalbuminemia on vancomycin pharmacokinetics. This prompted us to review the impact of hypoalbuminemia on vancomycin pharmacokinetics in the literature.

Materials and Methods

Literature review, in August 2024, searching for articles in PubMed using the terms "vancomycin" and "hypoalbuminemia". We had 37 results but only 2 met the criteria within the scope of our question.

Results

In the study carried out on septic adult patients (41% over 65 years old) with severe hypoalbuminemia (2.5 g/dL), there was a high probability that the loading dose would not be necessary and was even associated with toxic minimum vancomycin concentration values [3]. In the second study with adult population

(50% over 75 years old) it was found that the half-life of vancomycin in patients with severe hypoalbuminemia (2.5 g/dL) was significantly longer than in patients with non-severe hypoalbuminemia (33.2 + 5.4 vs 24.9 + 1.6; P = 0.049) [4]. The same study identified a higher percentage of vancomycin-associated nephrotoxicity in patients with severe hypoalbuminemia compared to patients with non-severe hypoalbuminemia. (26% vs 8%; P < 0.001).

Discussion

The literature review allowed us to identify two studies that enhance hypoalbuminemia as an important factor to take into account when adjusting the dose of vancomycin in adult patients. These results are in line with the hypothesis generated during the pharmacokinetic monitoring of patients undergoing treatment with vancomycin in our hospital. In this context, in order to ensure the impact of hypoalbuminemia on the pharmacokinetics of vancomycin, our future objective is to develop a robust research protocol that corroborates the reviewed studies.

Conclusion

We concluded that it is important to consider hypoalbuminemia when monitoring the pharmacokinetics of patients undergoing vancomycin treatment, as they may require lower doses of vancomycin compared to patients with albumin levels within the normal range.

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