Is the pH of vancomycin an indication for central venous access?

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ABSTRACT

All vascular access devices (VADs) have associated risks and benefits. Therefore, the decision to place a particular VAD rests on the assumption that the benefits of that device will outweigh the risks and allow for effective delivery of the treatment plan. The study by Caparas and colleagues, in the present issue of JVA, challenges the pH restrictions presented in the Standards. Caparas and her team have reconfirmed the previously reported findings that peripheral venous administration of vancomycin carries a low risk of phlebitis and extravasation and an even lower risk of catheter-related bloodstream infection. Central venous administration of vancomycin, on the other hand, carries the greater risk of central line associated bloodstream infection and deep vein thrombosis (DVT). In light of these findings and a lack of evidence to the contrary, the decision to place a central venous access device based solely on the pH of the intended therapy, vancomycin in particular, is not supported by the evidence and findings of this study. From a risk-benefit perspective, based on Caparas's study evidence, midline catheters are a safe option for patients for the administration of vancomycin, under specific concentrations, and for many other indicated medications and solutions.

Key words: Central venous, Intravenous catheter, Midline, Vancomycin, Complications, Deep vein thrombosis

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All vascular access devices (VADs) have associated risks and benefits. Therefore, the decision to place a particular VAD rests on the assumption that the benefits of that device will outweigh the risks and allow for effective delivery of the treatment plan.

For peripherally inserted central catheters (PICCs), the benefits of a multi-lumen access to the superior vena cava must outweigh the risks of the two most serious complications: bloodstream infection and deep vein thrombosis (DVT). These potentially lethal risks are far from uncommon (1, 2). Clinically apparent DVT appears in up to 3% of critically ill PICC patients, whereas silent (subclinical) DVT has been reported in as many as 27.2% of these cases, exposing patients to an increased risk of infection and pulmonary embolism (3, 4). In hospitalized patients, PICC-associated bloodstream infections occur at a rate of 1.1-3.5 per 1000 catheter days (5, 6). The dangers of administration of intravenous vesicants and hyperosmolar nutritional infusates frequently offset these risks and render central venous access necessary and desirable.

In clinical practice, vascular access specialists often decide which VAD is most appropriate for a given patient. The decision for a specific device is frequently guided by the Infusion Nursing Standards of Practice (7). These

Standards teach that therapies appropriate for central venous catheters include "...vesicant or known irritants, parenteral nutrition, a variety of antibiotics and any medications with a pH of less than 5 or greater than 9 and osmolality of greater than 600mOsm/L" (ibid, S38). Thirteen references are offered in support of this position. The goal of the study, conducted by Caparas and colleagues, is to take a closer look at these 13 references as well as other recently published studies to determine if the pH of a solution is an automatic indication for central venous access (8). It is interesting to note that guidelines issued by the Centers for Disease Control (CDC), Infectious Disease Society of America (IDSA), American Society of Health-System Pharmacists (ASHSP) do not contain a pH criteria similar to those in the *Standards* (9, 10). Nevertheless, based on the *Standards*, the need to administer vancomycin (pH 3.9) – the most common intravenous treatment for (MRSA) methicillin resistant staphylococcus aureus – is often considered an automatic indication for central venous access by vascular access specialists.

The study by Caparas and colleagues (8), in the present issue of JVA, challenges the pH restrictions presented in the *Standards* in three ways. First, the study references a thorough review of the 13 citations in the *Standards* and reports

that no evidence supporting the pH restrictions could be found. An extended search by the authors in the English-language literature likewise yielded no evidence to suggest that pH alone causes infusion-phlebitis. Moreover, three published peer-reviewed studies were discovered, demonstrating safe peripheral administration of intravenous vancomycin, in part based on concentration (11-13). Second, with regard to intravenous vancomycin specifically, the study demonstrates identical (0%) phlebitis rates in both the central and peripheral (midline) groups, thus dispelling the notion that phlebitis is an inevitable consequence of peripheral vancomycin therapy. Finally, as in the other published studies, vancomycin infiltrations in the present study were minor (Grade I) and did not result in tissue injury or necrosis, thus confirming the designation of vancomycin as an irritant, not a vesicant (11).

The performance of PICCs was comparable to the midline study device with respect to total complications. However, as reported, the specter of central-line associated bloodstream infection loomed large. One suspected PICC-associated bloodstream infection occurred during the trial. Two confirmed PICC-associated bloodstream infections occurred just prior to matriculating the affected patients into the trial. Unfortunately, the investigators did not conduct a survey using ultrasound for detection of silent DVT.

Caparas and her team have reconfirmed the previously reported findings that peripheral venous administration of vancomycin carries a low risk of phlebitis and extravasation and an even lower risk of catheter-related bloodstream infection. Central venous administration of vancomycin, on the other hand, carries the greater risk of central line-associated bloodstream infection and deep vein thrombosis. In light of these findings and a lack of evidence to the contrary, the decision to place a central venous access device based solely on the pH of the intended therapy, vancomycin in particular, is not supported by the evidence and findings of this study. From a risk-benefit perspective, based on Caparas' study evidence, midline catheters are a safe option for patients for the administration of vancomycin, under specific concentrations, and for many other indicated medications and solutions.

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