Vancomycin Administration Through a Novel Midline Catheter: Summary of a 5-Year, 1086-Patient Experience in an Urban Community Hospital

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Abstract

Background: *The 2016 Infusion Therapy Standards of Practice no longer require that low pH (<5) medications be administered via central venous access devices. Nevertheless, the practice of placing PICCs for vancomycin administration often persists.*

Purpose: *To demonstrate the safety and efficacy of intravenous vancomycin administration through a short and long term midline catheter.*

Methodology: *A retrospective chart review was performed on 1086 patients who received intravenous vancomycin through a midline catheter.*

Results: *There were no catheter-associated bloodstream infections and no deep vein thromboses. Phlebitis occurred rarely (0.6%), as did benign infiltrations (1.2%). There were no extravasation injuries.*

Conclusions: *These outcomes summarize more than 5 years of experience administering intravenous vancomycin (4 mg/mL) safely and cost-efficiently through a nontrimmable midline catheter.*

Keywords: *Vancomycin, midline, vesicant*

Introduction

The decision to place a central line (ie, central venous catheter or peripherally inserted central catheter [PICC]) inevitably entails life-endangering risks.[1-3] It is well established, for example, that central line-associated bloodstream infection (CLABSI) rates for both central venous catheters and PICCs range from approximately 2 per 1000 to 5 per 1000 catheter-days in hospitalized patients, and that mortality from such infections can be as high as 25%.[4] Moreover, occurrence of silent deep vein thrombosis (DVT) from PICCs ranges from 27.2%-71.9%, posing the risk of pulmonary embolism and heightening the risk of infection.[5,6] Despite these risks, and the fact that the Infusion Nurses Society (INS) 2016 Infusion Therapy Standards of Practice no longer list pH as a criterion for central line placement, many clinicians persist in placing central lines solely for the administration of mildly acidic medications.[7,8] There seems to be persisting confusion over the importance of dilution, rather than pH, as a factor in the etiology of infusion thrombophlebitis.[9-11]

Vancomycin, for example, continues to be cited frequently as the indication for central line placement, despite the fact that 5 peer-reviewed, published articles and 2 scientific posters attest to the relative safety of administering vancomycin via peripheral intravenous catheters, including midlines.[12-18] Moreover, not 1 patient of the almost 2000 patients enrolled in these multiple studies sustained a single significant vancomycin-related extravascular tissue injury.

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http://dx.doi.org/10.1016/j.java.2016.10.092

Table 1. Sample Characteristics

N	Male/ female (%)	Average age (y)	Midline location upper arm/forearm (%)	Vancomycin dosage range (g QD-BID)	Vancomycin duration range (d)	Vancomycin duration average (d)
1086	47/53	73.6	99.8/0.2	0.5-2.0	1-25	7.5

Apparently, old habits—even those with no evidence-base—die hard.[19]

This article summarizes the 5-year, 1086-patient experience of the vascular access team (VAT) at New York Presbyterian Hospital, Queens (NYPQ), in connection with vancomycin administration through a unique, power-injectable midline catheter (Powerwand, Access Scientific, San Diego, CA). Before this report, we published preliminary data on both short-term (< 6 days) and long-term (up to 25 days) vancomycin administration via the study midline.[12,18]

Methods

Midline Method of Placement

All midlines were inserted according to the manufacturer's directions for use, by fully credentialed VAT-registered nurse personnel, using the accelerated Seldinger technique and ultrasound guidance.[20] Preparation included 2% chlorhexidine skin antisepsis; aseptic technique with either maximum or partial-body sterile barrier protection; sterile mask, cap, gloves, and gown; and, following insertion, chlorhexidine-impregnated sponge and transparent semipermeable dressing. Vessels of choice for midline catheter placement included the basilic, brachial, and cephalic veins of the upper arm. Veins in the midforearm region were used only if upper arm veins were deemed clinically inappropriate.

Care and Maintenance

All midline catheters were flushed with 10 cc normal saline every 8-12 hours and otherwise maintained in accordance with the INS Infusion Therapy Standards of Practice.[7]

Vancomycin Dosage and Dilution

NYPQ pharmacy routinely dilute vancomycin to 4 mg/mL. Doses of 1 g were administered via infusion pump over 60 minutes; other vancomycin doses were administered at commensurate rates.

Retrospective Chart Review

Chart records from 2011 to June 2016, on 10,078 midline patients, were reviewed to determine whether intravenous vancomycin—regardless of dosage or duration—was administered at any time during midline use. Records of those patients who had received vancomycin through the midline were then perused for evidence of phlebitis, infiltration/extravasation, upper extremity DVT, and catheter-associated bloodstream infection.

Phlebitis was considered to be present if 1 or more of the following indicators were included in the medical record chart: the written diagnosis of "phlebitis" or "thrombophlebitis" by a nurse or physician; any of the signs or symptoms from the Infusion Therapy Standards Phlebitis Scale[7]; or a grade of 1-4, using the Phlebitis Scale,[7] in the nursing or physician notes.

Infiltration was considered to be present if 1 or more of the following indicators were included in the medical record chart: the written diagnosis of "infiltration" by a nurse or physician; evidence of measured arm swelling, not attributed to generalized edema, in the area of infusion; or ultrasound evidence of extravascular tissue infiltration. (Note: A standard rating tool for infiltration is not used routinely at NYPQ.)

DVT, by which is meant symptomatic DVT, was considered to be present if 1 or more of the following indicators were included in the medical record chart: the written diagnosis by a nurse or physician of "DVT" or "deep vein thrombosis" in the midline vessel, with or without a duplex ultrasound report of a DVT; or clinical findings consistent with symptomatic DVT, along with duplex ultrasound confirmation in the midline vessel.

Midline-associated bloodstream infection was considered to be present if 1 or more of the following indicators were included in the medical record chart: a written diagnosis by a nurse or physician of "bloodstream infection" or "BSI" attributed to the midline catheter or a positive blood culture within 48 hours of removal of the midline catheter without attribution to another source.

Results

The records of 1086 patients were reviewed, each having received intravenous vancomycin via the study midline. This represents 10.8% of all patients who received midline catheters during the study period. Forty-five percent of patients received vancomycin for < 6 days, 55% of patients received vancomycin for 7-14 days, and 5% of patients received vancomycin for 15-25 days.

Vancomycin doses ranged from 0.5-1.0 g, once or twice daily. Duration of vancomycin treatment ranged from 1-25 days. The average duration of vancomycin therapy was 7.5 days.

Fifty-three percent of patients were women and 47% were men. The average age was 73.6 years. More than 96% of patients received more than 1 antibiotic agent, as well as other intravenous medications, through the midline catheter (Table 1).

One thousand eighty-four midline catheters were placed in 1 of 3 deep veins of the upper arm; only 2 midlines were placed in the cephalic vein of the midforearm. There were 10 (0.92%) midlines removed for reasons that were not cited in the patient