The frequency and reasons for central line accesses in critical care units

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ABSTRACT

Background: A quality improvement initiative sought to understand opportunities to reduce central line utilization. This pilot study assessed the most common reasons for and rates of line access.

Methods: 15 nurses across three critical care settings tracked accesses of central venous catheters and peripherally inserted central catheters.

Results: The results from 119 shifts showed that lines are accessed on average seven times per shift. The most common reason for access was medication delivery. Blood collections were 22% of accesses (medication delivery was 51% of accesses).

Conclusions: These results show opportunities to reduce reliance on central lines by moving blood collections to an alternative method.

KEYWORDS

Central line; critical care; study; practice; infection

INTRODUCTION

Improved procedures from the Society for Healthcare Epidemiology of America, the Association for Professionals in Infection Control, and the Centers for Disease Control and Prevention [1, 2] on central line insertion and maintenance have reduced central line-associated blood stream infections (CLABSI). The reduction of central line utilization, however, has been more resistant to change: central line utilization has increased over time [3]. A reason for this resistance is that while it is accepted that infection rates are strongly correlated to the number of line days and line touches [4], central lines provide reliable patient access, particularly for blood collections in otherwise difficult venous access patients [5].

To understand possible levers to reduce central line utilization, we performed a pilot study in various critical care units to define the most common reasons for central line access and how they relate to patient treatment. The goal was to approximate the percentage of line uses that could be avoided or switched to other, less risky vascular access devices with changes in practice or policy. The results may be used to inform the protocol design of a broader study on the effect of hospital policy changes to central line access practices.

METHODS

The study was evaluated by the University Hospital of Cleveland Medical Center (UHCMC) Investigational Review Board and exempted from review. The study was deemed to be observational for quality assurance purposes and no patient identifying data was collected.

The cardiac intensive care unit (CICU), the surgical intensive care unit (SICU), and the medical intensive care unit (MICU) were chosen for the study because of the high percentage of patients with indwelling central lines. Five nurses were chosen in each of the critical care units (a total of 15 nurses in all) to participate in the study by their nurse managers based on interest in the study. Each nurse was asked to track line access data for all the patients they cared for who had an internal jugular or subclavian central venous catheter (CVC) or a peripherally inserted central catheter (PICC) for up to ten shifts. Data collection included the type of central line, the patient's primary diagnosis, the time of each access, the number of accesses, and the reason for access. Data was gathered prospectively in real time on paper worksheets and was later collected and tabulated by a single researcher.

RESULTS

The average daily census (ADC) of the critical care units at the UHCMC are:

CICU ADC: 15
MICU ADC: 19
SICU ADC: 17

Over the first three months of 2017, >20% of patients in the three units had central line access, representing a total of 993 line days. A total of 119 day-time and night-time shifts' worth of data from 14 nurses were gathered, representing nine shifts per nurse on average. Data from five shifts was excluded because of catheter type; an additional five shifts were excluded because the care was delivered in a non-critical care unit. There were more observations in the SICU and CVC lines were four times more common as PICC lines (99 vs 24).

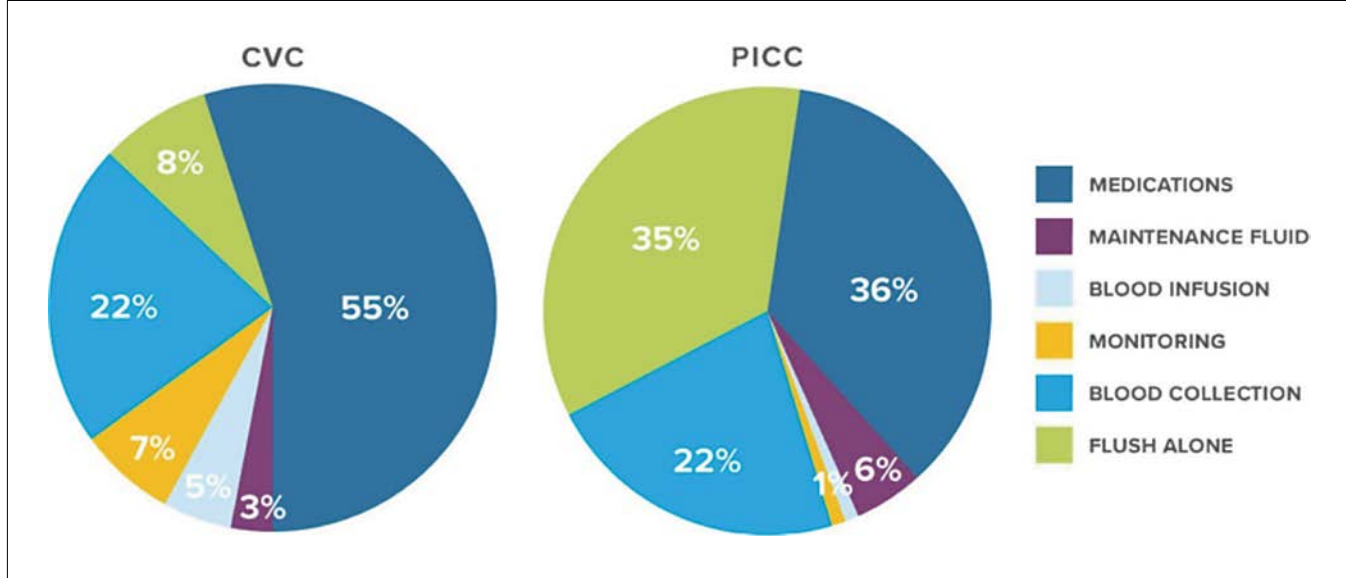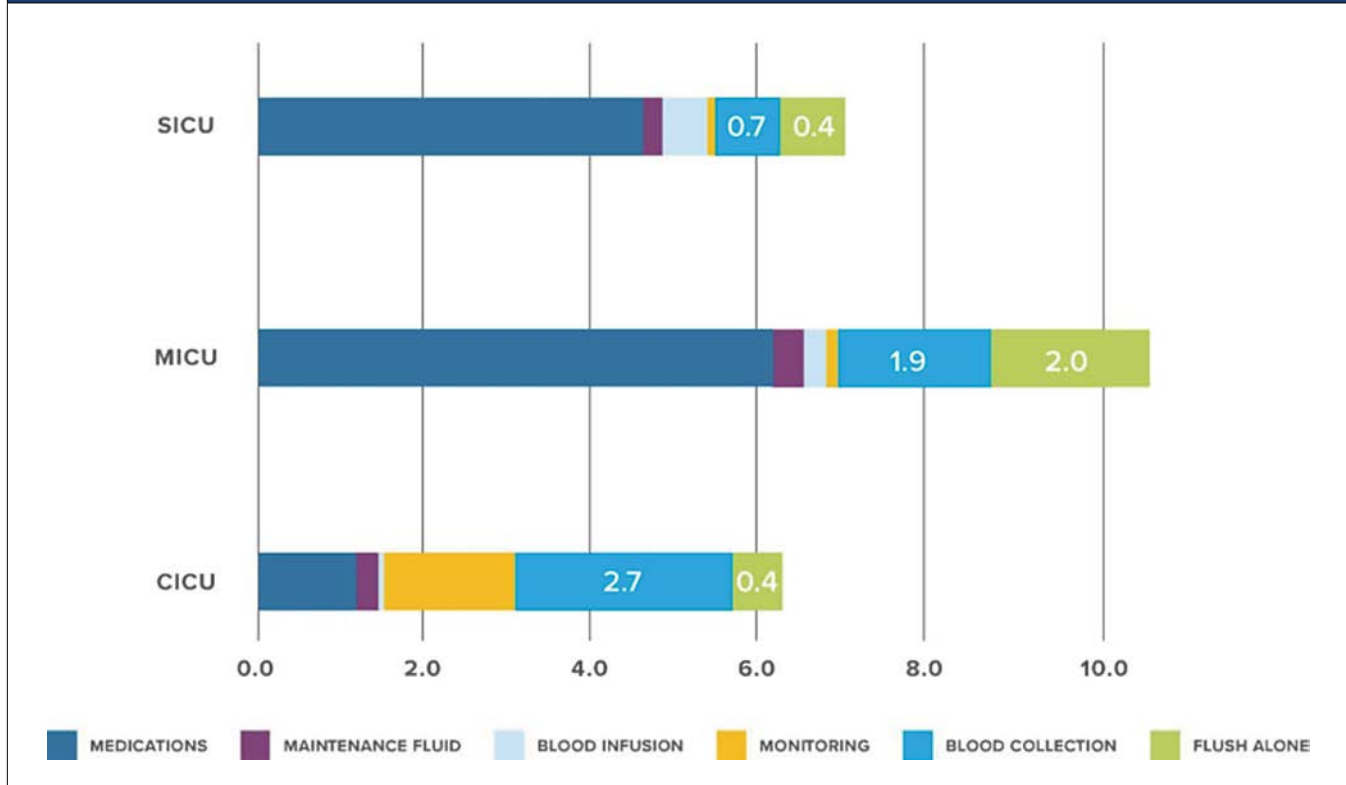**FIGURE 1: Comparison line access by line type.**

FIGURE 2: Count and type of access in average shift.

Overall, the most common reason for line access was to deliver a medication (including flushes following delivery), which accounted for 51% of all accesses. Blood collections, including flushes following the collections, represented 22% of accesses; flushes alone represented another 12% of accesses. The number of unique accesses or connections to a line for maintenance fluids is small at 3%, likely because the lines remain running for several hours without disconnection (see full breakout in Figure 1).

The usage of central lines for blood collections was not driven by the type of line (Figure 1). PICC lines were used for blood collections nearly as frequently as CVC lines. CVC and PICC lines were otherwise accessed differently: PICC lines were not used for cardiac monitoring and were more likely to have maintenance flushes. Overall, access rates were similar for the line types (CVC: 8 accesses/shift vs PICC: 6 accesses/shift).

The patient's diagnosis was included in the study but did not provide differentiating analysis information. The patient unit, as a proxy for patient disease, did seem to affect the rate of line utilization for blood collections. The CICU had the highest rate, followed by the MICU and the SICU (Figure 2).

DISCUSSION

PICC lines are typically used if the patient requires prolonged IV therapy, often in the form of antibiotics, Total Parenteral Nutrition (TPN), or infusates, which are too caustic for peripheral infusion. CVCs are used for resuscitation efforts, often including vasopressors, large fluid or blood administration, cardiac monitoring, blood draws, and central venous oxygen saturation (SvO2) measurements. CVCs also are preferred in critically ill patients since they typically have more lumens, larger bore, and faster flow rates into the central circulation. Both CVC and PICC lines are placed by a subset of specially trained nurse practitioners, physician assistants, residents, and attending physicians.

Beginning in 2014, the UHCMC adopted the CLABSI best practice bundles set forth by the Joint Commission. The insertion bundle includes proper hand hygiene; use of full barrier precautions, including personal protective equipment (sterile gown, sterile gloves, and large sterile drapes); and optimal site placement. All patients in the critical care areas are bathed daily with chlorhexidine. Line maintenance includes daily review and monitoring. The CLABSI target for each of the critical care units is a rate of 1.29 per 1,000 catheter line days.

All three critical care units at the UHCMC have been meeting or besting target CLABSI rates and quality monitoring shows strong adherence to policies on line insertion. However, as part of continual improvement, the institution sought to understand avenues to further reduce CVC utilization by reducing CVC line days and the number of CVC accesses. This pilot study was designed as a first step in understanding how often lines are accessed and the most common reasons for those accesses.

The results show that over one-fifth of all central line accesses are for blood collections, which do not have to be performed through a central line. Central line infections were initially understood to be caused by bacterial migration from the insertion site; however, they are now thought to be caused by the ingress of bacteria from one of the catheter's connection ports as the line dwell increases [6]. Therefore, the common avenues to CLABSI reduction are employing sterile insertion techniques, ensuring proper disinfection prior to each access, and line removal at the earliest occasion [7].

One limitation of this study is that each nurse only completed up to ten shift observations, which may not be enough to capture the full variability of patient care progression. There is also potential recall bias whenever using self-reporting data. Even though the data was captured in real time, a single visit to the bedside might include several procedures, thereby clouding even recent memory of the interaction.

A 242-bed community hospital in eastern Pennsylvania with a 14-bed ICU reported in 2011 on a practice bundle change of "no blood draw from a central line without physician order" [7]. The practice change was enacted following a discussion by a multidisciplinary team that included physicians, nurses, infection preventionists, and quality managers to reduce the CLABSI rate by lowering line accesses. The authors noted that the overall CLABSI rates trended downward over the 22-month period of evaluation after the practice bundle change. Though not noted by the authors, of further interest is that total central line days also decreased with a negative trend in the central line utilization ratio.

This pilot study and the finding that over 20% of central line accesses across three critical care units were for blood collections suggest that banning blood collections from central lines at our hospital could significantly reduce central line accesses. A further analysis of how access rates and reasons for access change over the dwell of the line could inform potential policy shifts to reduce line utilization.

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