Effect of a Multidisciplinary Team Approach to Eradicate Central Line Associated Blood-Stream Infections (CLABSI)

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Introduction

Central venous catheters are essential for the care of the critically ill patient. However, serious complications can occur with their use. One such complication is central line associated bloodstream infection (CLABSI). Although the attributable mortality and cost of care is likely not affected, the economic costs and morbidity can be substantial.

In 2000, the estimated number of CLABSI in intensive care units (ICU) in the United States per year was 80,000. Since that time, both behavioral and technological interventions have resulted in reductions in CLABSI rates. For example, an estimated 25,000 fewer CLABSI occurred in 2009 in US ICUs than occurred in 2001. Hand hygiene, education programs and use of maximum barrier precautions, hand hygiene checklists and site observation are some of the behavioral changes that have resulted in reductions in CLABSI. Technological advances include aseptic or antibiotic chlorhexidine solutions for skin preparation, chlorhexidine patches for catheter site care and antibiotic impregnated catheters.

Although these aforementioned studies showed significant reductions in CLABSI, the rates remain relatively high. In this study we describe our approach toward reducing CLABSI rates in the intensive care units at UMass Memorial Medical Center, Worcester, MA.

Methods

In 2004, a critical care operations committee (CCOC) was formed at UMass Memorial Medical Center providing standardized care to our critically ill patients by developing clinical practice guidelines based on the best published medical evidence. This committee is multidisciplinary and includes physicians, nurses, pharmacists, infection control practitioners, administrators and patient representatives. One of the earliest developed committees was the multidisciplinary team approach to reducing the rate of CLABSI. Interventions (Table 1) that were incorporated into the initiative over time included an education program (that also emphasized hand hygiene), use of a dedicated catheter that has all of the necessary elements for reducing maximum barrier precautions, pre-procedural time out, use of a check list during catheter insertion, empowering the bedside nurse to stop the procedure if the elements in the checklist were not followed, incorporation of chlorhexidine solutions for skin preparation and chlorhexidine sponges for catheter dressings, tracking of high risk catheters (i.e. those were inserted during emergenecs or in the femoral vein), treating a CLABSI as a critical event and holding a root cause analysis after each one to discern the cause, use of the subclavian vein as the preferred site of catheter insertion, documentation of the catheter insertion with a standardized procedure note, and daily assessment as to the need of the central venous catheter.

We were attacked by infection control practitioners and were put into a database that was managed by the eICU data coordinator. Definitions of CLABSI were those published by the Centers for Disease Control and Prevention (Table 2). A panel of physicians that was led by the hospital epidemiologist adjudicated cases of suspected CLABSI. Data were presented to the CCOC on a quarterly basis and to the individual ICUs on monthly basis by means of an electronic newsletter. In addition, the data could be viewed on the CCOCC intranet website.

The number of catheterizations was modeled using general linear models with first and second order slopes for each type of catheter type to detect linear trends and change points. The number of catheterization infection rates were evaluated with a Poison test. The trend in catheter blood infection rates was modeled using Poison regression.

The distributional assumptions of methods used were evaluated using the Kolmogorov-Smirnov goodness of fit test for normality and by visual inspection of frequency histograms. Correlations between variables from models fit to the appropriate design. Poison regression was performed using LogCox. Linear models were fit using the Mixed procedure (SAS).

Results

From 2004 to 2011 the rate of CLABSI declined from 5.86 to 0.6 infections per 1000 catheter days (p<0.0001) (Figure 1). There was a 93% reduction in catheter-related bloodstream infections (PRCCD) from 2009 to 2011 catheter usage increased significantly (p<0.0001) whereas from 2010 to 2011 it dropped significantly (p=0.0015). However, the number of PICCs did not significantly change in frequency over time (Figure 2). Table 3 shows the longest CLABSI-free time and APACHE III scores for individual units. Microbiology data are presented in Table 4.

Discussion

Similar to other published reports, the primary finding of our study is that a multidisciplinary approach to the insertion and care of central venous catheters significantly reduces the number of catheter infections in rates of CLABSI. However, our study is different in several important ways from previous investigations. Other investigations included a single ICU that did not use antibiotic catheters 12 or selective site care. 9 11 In our study all ICUs (community hospitals versus tertiary medical centers) 7 8 In addition to the CCOC at the Pronovost study, 7 a series of chlorhexidine sponges and antibiotic impregnated catheters. The time in our study is also the longest for studies of this type.

Our ICU trauma unit has one of the highest CLABSI rates in the medical center has yet one of the lowest APACHE III scores. The lower APACHE III score likely reflects the fact that these patients are also admitted to this unit, which would "dilute" the acuity of the patient population. Since the protocol as to how we care for these catheters does not change from unit to unit, it is surprising that the rates are as high as they are in the trauma unit and the Medical 2 ICU particularly since similar units have a much lower rate. We do not have ready explanation for this finding.

Our CVC utilization rate peaked in 2010 and decreased in 2011. This observation is most likely the result of better adherence to catheter removal when indicated and an increasing reliance on PICCs.

In summary, use of a multiprofessional approach to catheter care resulted in over an 89% decrease in CLABSI over a 7-year period.

References