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Room for Improvement in Post-Central Venous Catheter Insertion Care

An estimated 80,000 catheter-related bloodstream infections (CRBSI) occur in intensive care units each year in the United States, and contribute significantly to patient morbidity and health care costs (1, 2). Decades of studying prevention strategies have led to evidence based recommendations for the prevention of CRBSI, with most strategies focused on measures to implement at the time of catheter insertion. Current guidelines recommend the use of central venous catheter insertion bundles including training and education of healthcare providers who insert and maintain catheters, use of maximal sterile barrier precautions during catheter insertion, and skin preparation with > 0.5% chlorhexidine with alcohol (3). Catheter-insertion bundles have proven effective in significantly reducing CRBSI rates, with many centers reporting zero infections for defined periods of time simply by using prevention strategies at the time of insertion (4).

Reductions in CRBSI rates to zero have prompted healthcare providers, insurers, regulators and other stakeholders to use CRBSI rates as a benchmark for healthcare quality and patient safety, have fueled campaigns targeting zero CRBSI, and have contributed to policy makers penalizing providers with non-reimbursement of services for patients with CRBSI (5). This penalty ignores the fact that not all CRBSIs are preventable. Certainly, implementing the recommendations that target the time of insertion reduces much of the risk of acquiring a CRBSI. However, there are risks that are not easily modified, including the need for life-saving therapies that mandate long dwell times. Likewise, the universal presence of microorganisms in the human environment can never be completely eliminated. In patients who require long-term vascular access, prevention strategies that go beyond the recommendations at the time of insertion become much more important.

In this issue of Critical Care Medicine, Dr. Timsit and colleagues present their findings of a secondary analysis of a randomized multicenter clinical trial evaluating the association between dressing disruption and development of CRBSI. One thousand four hundred and nineteen patients, 3275 catheters, and 11,036 dressing were studied. The primary finding of this study was that in adjusted analysis both second and final dressing disruptions were significantly associated with development of CRBSI and major catheter-related infection (MCRI). Multiple patient and catheter factors were found to be associated with dressing disruption by univariate and mixed logistic regression analysis. Importantly, among these factors catheter insertion in the femoral or internal jugular vein versus the subclavian vein and longer catheter time in place were risk factors that are potentially modifiable (6).

This study was well done and the findings support the need for improvement in post central venous catheter insertion care. In the original multicenter randomized clinical trial, compliance with insertion bundles was closely monitored and although CRBSI rates were low, ranging from 0.4 to 1.3 per 1000 catheter-days, CRBSI rates did not reach zero (7). This suggests that compliance with insertion bundles alone might not adequately reduce already low CRBSI rates. Given the association between catheter disruption and development of CRBSI, Dr. Timsit and colleagues correctly suggest the need to better characterize modifiable risk factors for catheter disruption and to develop, validate, and use more adherent dressings.

A limitation of this study is the observational design. Although multivariate analyses may address some known potential confounders, unknown potential confounders cannot be controlled for. A second limitation is that > 0.5% chlorhexidine with alcohol was not used for skin antisepsis. It remains unclear if > 0.5% chlorhexidine with alcohol had been used if the observed association between dressing disruptions and CRBSI would have remained. In adjusted analysis catheter colonization was not associated with second dressing disruption even though second disruption was associated with CRBSI and MCRI. This raises questions regarding the accuracy of the proposed biologic mechanism by which short-term central venous catheters become infected and suggests need for ongoing evaluation in future studies.

The benefit of early removal of non-essential catheters has been shown previously (4, 8) and was supported by the findings in this study. The preferential use of the subclavian site rather than a jugular or femoral site has also been shown previously (9) and was supported by the findings of this study. The use of the subclavian site however, must be balanced against the risks of mechanical complications including pneumothorax and hemothorax. The risk-benefit profile of peripherally inserted central catheters (PICCs) versus central venous catheters placed in the femoral, internal jugular, or subclavian site was not addressed in this study and should be evaluated in future studies.

In summary, this study suggests that improvement in post-central venous catheter insertion care offers an opportunity for further reduction in CRBSI rates even when baseline rates are low. Given the complexity of catheter insertion, post-insertion care, and patient and staff heterogeneity it seems unlikely that CRBSI rates can be sustained at zero. Studies to better characterize the causes of catheter dressing disruption and well designed randomized clinical trials testing post-catheter insertion interventions, including but not limited to the use of more adhesive dressings, would add to the growing body of evidence that supports effective strategies to reduce CRBSIs.

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