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EDITORIAL

The CVC and CRBSI: don't use it and lose it!

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In a recent article in Intensive Care Medicine, van der Kooi and colleagues report on the PROHIBIT trial aimed at preventing catheter-related bloodstream infections (CRBSI) in intensive care units (ICU) [1]. Following a baseline observation period, the investigators randomly allocated 14 ICUs to interventions that included a catheter insertion and care and hand hygiene improvement strategies. Participating ICUs were geographically distributed in Europe among 11 culturally diverse countries and were university-affiliated in one half of cases. Catheter insertion practices and hand hygiene adherence improved with the assigned interventions and these had significant reduction in the primary outcome of incidence density of CRBSI.

This study was a major undertaking that involved more than 35,000 central venous catheter (CVC) insertions among more than 25,000 patients admitted to ICUs. The study may be considered to have two key findings. First, the authors were able to successfully demonstrate that their interventions could improve hand hygiene adherence and catheter insertion and management techniques. Second, that these interventions resulted in a reduction in CRBSI. This study builds on and is a major contribution to the body of literature on CRBSI prevention in the ICU.

It is an important observation that the hand hygiene component of this study improved adherence to hand hygiene practices and that in turn this was associated with a reduction in CRBSI. Numerous previous studies have both demonstrated the importance of hand hygiene in reduction of nosocomial infections, and that interventions to improve adherence are associated with improved outcomes [2–4]. However, much of the existing literature is based on "pre-post" intervention designs that have major methodological limitations. This study demonstrated the benefits of hand hygiene and catheter management on a reduction in CRBSI in a prospective controlled clinical trial.

Although not surprising based on contemporary observations elsewhere, it is disappointing that hygiene compliance at baseline averaged 49% in this study [5]. Hand hygiene is a relatively simple, inexpensive, and effective intervention that has few barriers to implementation [4]. However, while programmatic and infrastructural aspects may influence practices, the greatest challenges for successful hand hygiene adherence is human behavior and its resistance to change [6]. We contend that the rationale for and body of literature to support the benefit of hand hygiene is adequate. We must therefore shift our research efforts away from further attempts to demonstrate the effectiveness of hand hygiene toward a better understanding the determinants of hand hygiene adherence, knowledge translation, and implementation and maintenance of these practices [7–11].

As with hand hygiene, it is important to note that the catheter insertion and management intervention also led to a reduction in CRBSI incidence density [1]. Previous works have looked at this topic most commonly using the "pre-post" design with bundles of care [12]. The PROHIBIT study included numerous items on its catheter insertion and management protocol. The possibility exists that there may be additional aspects that could be added to this protocol that may further improve it such as use of ultrasound guidance or requirement for direct supervision of operators with limited experience. However, given the demonstrated benefit and that the CVC

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insertion and management protocol prescribed in the PROHIBIT study is not onerous, we believe this represents a reasonable standard for implementation in ICUs.

While it is important to devise and implement means to reduce infectious complications of CVCs, it must be recognized that the only way to 100% ensure prevention of a CRBSI in a given patient is to avoid inserting a CVC in the first place. The overall utilization of CVCs decreased significantly in the PROHIBIT study from 88.3 to 73.5 CVC days/ICU patient-days (Table S3), and this was likewise associated with a reduction in CRBSI [1].

Central venous catheters have many potential indications for use in ICU patients as listed in Table 1. While by virtue of the severity of their illness and need for complex care and monitoring, many or most patients admitted to ICUs will require a CVC. Indeed, it is our experience that many members of the ICU team view CVC insertion as a routine or standard procedure associated with the admission to ICU. However, like with any intervention that has the potential for harm, we must be judicious with the use of CVCs and recognize that minimizing their use is potentially an effective way to reduce CRBSI. Although there is a paucity of clinical trial data [13], an increasing body of observational literature is challenging dogma and questioning the necessity for routine CVC insertion for "classical" indications such as lower dose vasopressor infusion [14–17].

In summary, the PROHIBIT study is an important work and contribution to the critical care literature. It confirms the importance of hand hygiene and attention to CVC insertion procedures and management on reducing the incidence of CRBSI. Based on the results of this study and the vast previous literature, we believe that there is compelling evidence to support broad implementation of hand hygiene and catheter insertion and management protocols in our ICUs. However, further moving forward we must also address that the "root problem" of CRBSIs is the CVC itself. The onus is on us to use these devices judiciously in our clinical practices. Further research efforts aimed at optimizing their safe *non-use* is warranted.

Table 1 Potential reasons for insertion of a central venous catheter among patients admitted to intensive care units

Indication
Central venous pressure measurement
Venous blood gas measurement
Vasopressor and inotrope infusion
Volume resuscitation
Parenteral nutrition
Hemodialysis access
Ease of multiple venous access (i.e., multi-lumen catheter)
Introducer for transvenous pacemaker or pulmonary artery catheter

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Compliance with ethical standards

Conflicts of interest
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