

Insertion Site and Central-line Associated Infections in Neonates: A Choice Between Scylla and Charybdis!

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Central-line associated bloodstream infections (CLABSI) are a dreaded, often inevitable complication in sick neonates receiving medications or parenteral nutrition through central venous catheters (CVC) in the neonatal intensive care unit (NICU). Apart from prolonging the hospitalization, CLABSI results in higher mortality, healthcare costs, and even adverse cognitive outcomes [1,2]. The incidence of CLABSI in the NICUs ranges from 3.2 to 21.8 episodes per 1000 catheter-days [3]. The wide variation in the incidence likely reflects the prevalent infection prevention and control (IPC) practices rather than the case mix in the ICUs. To improve the specific IPC measures and reduce the incidence of CLABSI, healthcare providers frequently employ central-line bundles, a package of evidence-based practices, in neonates with CVC. The systematic review by Payne et al which included 24 studies, found a 60% reduction in the CLABSI rates after implementing these bundles [1].

The central-line bundles are broadly classified into the ‘insertion’ and ‘maintenance’ bundles. The insertion bundles typically include maximum barrier protection, hand hygiene, skin cleansing with chlorhexidine, and using a checklist and sterile dressing/gauze at the insertion site [4]. Interestingly, the optimal site of insertion or the catheter type is generally not a part of the insertion bundles in neonates, unlike in adults.

The immediate neonatal period offers a unique and additional site for CVC insertion- the umbilical vein, which is not accessible after the first few days of life. Inserting an umbilical venous catheter (UVC) requires less technical expertise than placing a percutaneously inserted central catheter (PICC). The latter is even more difficult in extreme preterm neonates with immature skin. Therefore, many neonatologists prefer inserting the UVC in the first few hours of life in sick neonates. On the other hand, the umbilical stump can get quickly colonized, given that the local site is not covered with a sterile pad/

gauze, unlike the PICC insertion site. Coupled with the recommended dry cord care practice, UVC should theoretically be associated with higher CLABSI rates than PICC. Previous observational studies that compared the incidence rates of CLABSI following UVC and PICC use have reported conflicting results – while a few studies found no difference, others demonstrated higher rates in the former group, particularly with a longer dwell time of the UVC (typically seven days or more) [5].

In this issue of *Indian Pediatrics*, Arun et al have published the results of their open-label randomized controlled trial (RCT) comparing the effects of inserting UVC and PICC on the incidence of CLABSI in neonates with a birth weight (BW) of <1250g and requiring a central line on day 1 of life [6]. The authors reported no significant difference in the CLABSI incidence between the groups (21.1% vs 18.2%; $P = 0.57$). The overall incidence of complications, including line occlusion and malposition, was also comparable. The authors deserve credit for answering an interesting clinical question by conducting an RCT with adequate methodological rigor and enrolling a reasonably large number of neonates with BW < 1250g. They even used a different allocation ratio (1.2:1) to account for an expected procedure failure risk in the UVC group. Also, they fixed the UVC by bridging the catheter using a protective skin adhesive and not using the traditional method of sutures [6].

However, are the study findings likely to influence clinical practice in the NICU or inform policymaking? Unfortunately, the answer is a qualified no for two key reasons: first, the negative results are likely due to the low power of the study, thanks to the inadequate sample size. The authors could enroll only half of the estimated number because of the COVID-19 pandemic. Moreover, the estimated sample size was based on an unrealistic relative reduction of 40% in the CLABSI incidence in the PICC group [6]. Second, the study’s primary outcome—incidence of CLABSI, defined as the proportion of enrolled neonates

with CLABSI—does not account for the days of catheter use, an independent risk factor for CLABSI. The ideal outcome would have been the incidence rate per 1000 catheter-days, an outcome used almost universally in such studies [4]. Having the denominator of central line days would have addressed this and also ‘adjusted’ for the significantly different primary line duration between the UVC and PICC groups (5 vs. 7 days). Instead, the reported primary outcome precludes comparison of the CLABSI incidence and pooling the study results with that of the previous studies. More importantly, the study did not answer the more pertinent research question – does electively replacing the UVC with PICC after 7 days reduce the CLABSI rates compared to continuing to use UVC longer, for example, 14 days?

To conclude, the study results and those of the previous studies reaffirm that the optimal site of insertion of central lines expected to be used for about a week is a choice between a rock and a hard place during the first week of life in neonates. The Centers for Disease Control and Prevention (CDC) also recommends that the choice of central line type in NICU should not be solely based on preventing CLABSI [7]. Healthcare providers in NICUs should focus on rigorously implementing central line bundles rather than searching for a silver bullet to prevent CLABSIs. As with most things in life, it all boils down to simple measures: to paraphrase the indomitable Sherlock Holmes, “It is elementary, dear Watson!”.

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