INTENS CRIT CARE NUR 77 (2023) 103442

Contents lists available at ScienceDirect

Intensive & Critical Care Nursing

journal homepage: www.sciencedirect.com/journal/intensive-and-critical-care-nursing

Editorial

Central line-associated bloodstream infection prevention: "scrub the hub" or antiseptic barrier caps?

In intensive care units (ICUs), central venous intravascular catheters are utilized for purposes such as treatment, transfusion, monitoring, hemodialysis and fluid support (Fahy and Sockrider, 2019). Various complications may occur with central line-associated bloodstream infections (CLABSI) being the most prevalent, especially in resource-low countries (Azak et al., 2023; Blot et al., 2022). CLABSI may result in additional morbidity and, possibly, mortality (Danielis et al., 2021; Rae et al., 2021). It is assumed that most CLABSI originate extraluminal, via a contaminated insertion site. Still, up to 40% of CLABSI may arise from intraluminal contamination, *i.e.*, via contaminated access ports (Voor In 't holt et al., 2017). Following multiple manipulations, the risk of catheter hub contamination increases, thereby facilitating the process of intraluminal infection. Healthcare workers have a responsibility to prevent CLABSI (Lin et al., 2022) and this includes that intravenous (IV) ports can only be accessed when sterile or, at least, appropriately disinfected. In this issue of *Intensive & Critical Care Nursing*, Akbıyık et al. investigated the microbial contamination on central venous catheter needleless connectors (NCs) of 24 ICU patients (Akbıyık et al., 2023). Twenty-two of the NCs were microbially contaminated. Most reported bacteria were coagulase-negative staphylococci, followed by other skin flora (Akbıyık et al., 2023). While the pathogenicity of these microorganisms is definitely lower compared with *Staphylococcus aureus* or typical Gram-negative hospital flora such as *Enterobacterales* spp. and *Pseudomonas aeruginosa*, they are responsible for the majority of CLABSI cases and, therefore, clinically relevant nonetheless (Al-Shukri et al., 2022). Akbıyık et al. (2023) also reported a correlation between catheter dwelltime and microbial load on the NCs ($r = 0.24$) as with length of ICU stay ($r = 0.29$). The relationship between exposure time and cumulative risk of device-associated infection has been repeatedly demonstrated, hence the importance to question the need for daily checking the necessity of the catheter (Blot et al., 2022). However, the correlation between catheter dwelltime (and length if ICU stay) and microbial load is particularly worrisome as NCs are assumed being disinfected before use. The observed relationship, although weak, would assume inappropriate disinfection practices in the hours or days before the study. However, in the study concept, NCs selected for study purposes were indicated with a "do not use" label. This methodological aspect of the study targeted a high reproducibility, but it implied a mismatch with the clinical context as it is. Consequently, any clinical relationship in this study is difficult to interpret.

Evidently there are also non-modifiable risk factors such as advanced age, immunosuppression, and a high severity of disease index (Moriyama et al., 2022). Likewise, in the study of Akbıyık et al. (2023), the microbial load in NCs correlated with advanced age ($r = 0.32$), thereby underscoring the high-risk profile of elderly patients. On the other hand, why would NCs in older adults be more contaminated, if these devices are to be disinfected every single time the port is accessed, and, according to the protocol, NCs were not even supposed to be used in the first place? As with the positive correlations of catheter dwelltime and length of ICU stay, this observation may as well be a coincidental finding. Because of the limited sample size of the study, more detailed (regression) analyses were deemed pointless and would have resulted in statistical overkill. Nonetheless, the strict methodological/microbiological approach of the study hampered the assessment of clinical associations with microbial load.

The risk of CLABSI can be strongly reduced, even close to zero, with a high standard of infection prevention (Blot et al., 2014). Akbıyık et al. (2023) reported that microbial contamination completely disappeared after thorough disinfection of NCs with 70% alcohol. However, this practice requires well-educated ICU nurses and knowledge of ICU clinicians about CLABSI prevention is generally poor (Labeau et al., 2008; Labeau et al., 2009). In a meta-analysis including 55 clinical studies, a low ICU nursing education level was associated with a 3.3 to 3.6-fold higher rate of nosocomial infection (Rae et al., 2021). Unfortunately, the matter of appropriately disinfecting NCs is burdened by excessive workload. Therefore, the 30 s drying time is easily neglected. To overcome this hurdle, antiseptic barrier caps were developed to prevent contamination of NCs. A meta-analysis of 14 studies compared antiseptic barrier caps with manual scrubbing (Tejada et al., 2022). The authors concluded that, overall, antiseptic barrier caps significantly reduced the CLABSI rate (relative risk 0.60; 95% confidence interval 0.41–0.89). Antiseptic barrier caps proved valuable in ICU as in non-ICU patients. Additionally, the use of antiseptic barrier caps proved to be cost-effective with median cost-savings per CLABSI of $21,890 (interquartile range $16,350–45,000) (Tejada et al., 2022). The strength of the antiseptic barrier caps is that contamination is prevented in the first place. Furthermore, in experimental settings overt microbial contamination with *S. aureus* was effectively eradicated by the device (Casey et al., 2018). Therefore, the antiseptic barrier caps provide an additional defense line in case of accidental contamination of NCs.

Akbıyık et al. (2023) demonstrated that NCs are nearly always contaminated, even without being accessed, and therefore these devices carry an inherent risk for CLABSI. The observation that all NCs were adequately disinfected appears to annihilate this potential threat but

DOI of original article: https://doi.org/10.1016/j.iccn.2023.103414.

https://doi.org/10.1016/j.iccn.2023.103442

Available online 28 April 2023

Table 1
Essential characteristics of "scrub the hub" approach *vs.* antiseptic barrier caps for needleless connectors.

"Scrub the hub" with alcohol swab	Antiseptic barrier cap
Contamination potential	
Contamination likely in-between distinct access actions	Contamination prevented by the cap
Handling time	
Time consuming with 10 to 15 s of scrubbing and additional drying time (usually 30 s)	Immediate access of the port possible after removal of the cap; after medication has been administered a new cap is added on the needleless connector.
Efficiency of disinfection	
Effective disinfection of the access port is possible but only when procedure is flawlessly followed.	Access port remains uncontaminated during its use. In experimental settings needleless connectors contaminated with *S. aureus* were adequately disinfected by the antiseptic barrier cap.
Cost	
Minimal cost (one alcohol swab per access action)	Higher cost with new barrier cap after each access; though cost-effective via its capacity to prevent central line-associated bloodstream infection.

important footnotes need to be considered. The recommended "scrub the hub" policy includes 10 to 15 s rubbing of the NC with an alcohol swab. Subsequently, one needs to allow the hub to dry. This make take up to 30 s. While this may seem 'endless' for the busy ICU nurse, the disinfecting protocol in the study was even more thorough with 30 s of scrubbing the hub, and an additional one-minute drying time. Such, a practice is unlikely to be adapted in daily ICU practice. Given the favorable CLABSI prevention data in the meta-analysis by Tejada et al. (2022) and the additional cost-effectiveness, the use of antiseptic barrier caps is likely to be the safer and more practical choice (Table 1).

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Stijn Blot: 3M symposium participation.

References

Akbıyık, A., Kaya, S., Aksun, M., 2023. Determination of microbial contamination on the outer surface of needleless connectors before and after disinfection. Intensive Crit. Care Nurs. 103414.

Al-Shukri, R.N., Al-Rawajfah, O.M., Al-Daken, L., Al-Busaidi, M., 2022. ICU-acquired central line-associated bloodstream infection and its associated factors in Oman. Am. J. Infect. Control 50 (9), 1026–1031.

Azak, E., Sertcelik, A., Ersoz, G., Celebi, G., Eser, F., Batirel, A., et al., 2023. Evaluation of the implementation of WHO infection prevention and control core components in Turkish health care facilities: results from a WHO infection prevention and control assessment framework (IPCAF)-based survey. Antimicrob. Resist. Infect. Control 12 (1).

Blot, K., Bergs, J., Vogelaers, D., Blot, S., Vandijck, D., 2014. Prevention of central line-associated bloodstream infections through quality improvement interventions: a systematic review and meta-analysis. Clin. Infect. Dis. 59, 96–105.

Blot, S., Ruppé, E., Harbarth, S., Asehnoune, K., Poulakou, G., Luyt, C.-E., et al., 2022. Healthcare-associated infections in adult intensive care unit patients: Changes in epidemiology, diagnosis, prevention and contributions of new technologies. Intensive Crit. Care Nurs. 70, 103227.

Casey, A.L., Karpanen, T.J., Nightingale, T., Elliott, T.S.J., 2018. An in vitro comparison of standard cleaning to a continuous passive disinfection cap for the decontamination of needle-free connectors. Antimicrob. Resist. Infect. Control 7, 50.

Danielis, M., Bellomo, F., Farneti, F., Palese, A., 2021. Critical incidents rates and types in Italian Intensive Care Units: A five-year analysis. Intensive Crit. Care Nurs. 62, 102950.

Fahy, B., Sockrider, M., 2019. Central venous catheter. Am. J. Respir. Crit. Care Med. 199 (11), P21–P22.

Labeau, S., Vereecke, A., Vandijck, D., Claes, B., Blot, S., 2008. Critical care nurses' knowledge of evidence-based guidelines for preventing central venous catheter-related infections: an evaluation questionnaire. Am. J. Crit. Care 17, 65–72.

Labeau, S., Vandijck, D., Rello, J., Adam, S., Rosa Ferrao, A., Wenish, C., et al., 2009. Centers for disease control and prevention guidelines for preventing central venous catheter-related infection: results of a knowledge test among 3405 European critical care nurses. Crit. Care Med. 37, 320–323.

Lin, F.F., Murphy, N., Martinez, A., Marshall, A., 2022. An audit of central venous catheter insertion and management practices in an Australian tertiary intensive care unit: A quality improvement project. Intensive Crit. Care Nurs. 70, 103217.

Moriyama, K., Ando, T., Kotani, M., Tokumine, J., Nakazawa, H., Motoyasu, A., Yorozu, T., 2022. Risk factors associated with increased incidences of catheter-related bloodstream infection. Medicine 101 (42), e31160.

Rae, P.J.L., Pearce, S., Greaves, P.J., Dall'Ora, C., Griffiths, P., Endacott, R., 2021. Outcomes sensitive to critical care nurse staffing levels: A systematic review. Intensive Crit. Care Nurs. 67, 103110.

Tejada, S., Leal-Dos-Santos, M., Peña-López, Y., Blot, S., Alp, E., Rello, J., 2022. Antiseptic barrier caps in central line-associated bloodstream infections: A systematic review and meta-analysis. Eur. J. Intern. Med. 99, 70–81.

Voor In 't holt, A.F., Helder, O.K., Vos, M.C., Schafthuizen, L., Sülz, S., van den Hoogen, A., Ista, E., 2017. Antiseptic barrier cap effective in reducing central line-associated bloodstream infections: A systematic review and meta-analysis. Int. J. Nurs. Stud. 69, 34–40.

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