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EDITORIAL

Catheter-associated bloodstream infection rates: how low can you go?

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Device-associated infections remain an important challenge in intensive care units (ICU) as they come with considerable morbidity and possibly mortality [1, 2]. The average preventable proportion of healthcare-associated infection has been estimated to be 30%, but ranges from 10% to 70% [3]. This large variety can be explained by the fact that the risk reduction depends on setting, study design, baseline infection rate, and type of infection. Regarding the last of these, catheter-related bloodstream infection (CRBSI) is probably the infection that is most easy to avoid. Catheter-associated BSI (CABSI) is a surrogate that includes CRBSI and primary BSI. CABSI occurrence is mainly attributed to failure of infection control practices and less on underlying clinical conditions facilitating infection. The value of quality improvement interventions targeting optimized processes of care has been successfully demonstrated [4, 5]. Through high adherence to standard prevention recommendations, central line-associated bloodstream infection rates around or even below 1 per 1000 catheter-days can be achieved. Aiming for zero seems no longer unfeasible. The question arises whether CABSI can be avoided for extended periods of time by exclusively investing in optimizing processes of care. After all, despite all efforts, human error cannot be ruled out. Technological and biomaterial innovation can pave the way for preventing the very last cases of CABSI. However, with baseline infection rates close to zero it becomes increasingly difficult to demonstrate clinical benefit in a significant way. One might argue that the clinical relevance of avoiding the very last CABSI cases might overrule a non-statistically significant risk reduction [6]. At the same line, with decreasing baseline infection rates, the challenge for an innovative approach to demonstrate cost-effectiveness becomes harder. However, with an average cost of around 18,000 euros for a single episode of CABSI, cost-effectiveness in prevention is relatively easily achieved [7].

In this issue of *Intensive Care Medicine*, Eggimann et al. report very low CABSI rates over 11 years following the introduction of two approaches for continuous chlorhexidine exposure at the catheter insertion site (either through a chlorhexidine-impregnated sponge beneath a standard dressing, or a chlorhexidine-impregnated catheter dressing) included in a global improvement program in three separate ICUs of one hospital [8].

The program was able to reduce the CRBSI risk to a level as low as 0.1 per 1000 catheter-days. Despite important methodological flaws due to the before–after nature of the study, the absence of systematic catheter culture and the absence of adjustment of case-mix issues, the results are impressive. Indeed, the multifaceted approach progressively extended to the three ICUs did not allow any firm conclusion about the impact of one measure as compared to the other. The impact of chlorhexidine gluconate (CHG)-impregnated gel dressing or CHG dressing sponges seems major and confirmed results from randomized controlled trials [9, 10]. The advantage of CHG gel dressings over CHG sponges is suggested but could definitely not be demonstrated by the study. Finally, both CHG active dressings were demonstrated to be cost-effective when the rate of CRBSI is as low as 0.5 per 1000 catheter-days but should be evaluated in view of the cost per dressing (ranging 4.80 to 8.00 euro for the CHG-dressing) [7].

Notwithstanding these limitations, the study by Eggimann et al. demonstrates favorable CABSI rates over a prolonged time period. Noteworthy, this ICU still can adopt additional measures to reduce the CABSI risk even

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further. For example, adhesive anchor devices to secure catheters instead of sutures appeared not to be in use. These devices have been advocated since 2011 as they avoid skin disruption around the catheter insertion site and may, as such, decrease colonization and infection risk [11]. Furthermore, antiseptic barrier caps to avoid contamination of needleless connectors are not mentioned as daily practice in Eggimann's unit. A meta-analysis found these devices to reduce the CABSI rate by approximately 40% (incidence rate ratio 0.59, 95% confidence interval 0.45–0.077), despite all seven studies included were non-randomized trials and only one was conducted in an intensive care setting [12]. Finally, since accidental dressing disruption is recognized as a major risk factor for CABSI, additional research must clarify whether an acrylic terpolymer barrier film applied around the skin to prevent dressing disruption and skin breakdown further adds to the reduction of CABSI [13, 14].

With additional preventive measures available, units with an already favorable CABSI rate have to balance resource investments with the aim to escape an already uncommon event. Device-related adverse events apart from infections include misplacement, thrombosis, and dysfunctions. As we succeed with CRBSI and a risk level as low as 0.1 per 1000 catheter-days becomes feasible for CABSI beyond clinical trials, efforts are still required to control other life-threatening and now more frequent complications such as thromboembolic events and dislodgements [15].

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