

Forget skin scrubbing and other antiseptics: prevent catheter related infections using chlorhexidine plus alcohol

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One of the fundamental interventions that we as clinicians perform on critically ill patients is vascular access. Fluid resuscitation, drug administration, intravascular pressure monitoring, blood gas analysis and hemodialysis are just some of the numerous interventions necessary for survival and better patient outcome. Sadly, there are risks for every well intended intervention and in vascular access the most important one is infection. Millions of patients require these catheters yearly and roughly 5% will develop a catheter-related infection (CRI); up to 35% of those who do, will subsequently succumb to that infection (1,2).

International guidelines for the prevention of intravascular CRIs favor using chlorhexidine-alcohol (CHG-OH) solutions for skin preparation before insertion of central venous catheters and peripheral arterial catheters (3) although they acknowledge the lack of a formal comparison between povidone-iodine plus alcohol (PVI-OH) and CHG-OH; they have left this as an unresolved issue.

A common practice during skin preparation is scrubbing the skin with a detergent before the antiseptic application; although published evidence of its effectiveness is scarce many centers do this as a standard of care.

Recently the CLEAN trial published in *Lancet* (4) sought to explore the effectiveness of the aforementioned antiseptic solutions with or without skin scrubbing prior to the antiseptic. In this well designed trial by Olivier-Mimoz *et al.* the authors compared in a multicenter ICU setting the use of CHG-OH *vs.* PVI-OH (with or without skin scrubbing) in the prevention of CRIs, catheter-related bloodstream infections (CR-BSI) and catheter colonization. Nearly 2,350 patients were enrolled with a total of 5,159 catheters placed. The patients were randomized properly and no differences

in patient's characteristics were seen in any of the groups.

The authors defined catheter colonization as a quantitative catheter-tip culture showing at least one microorganism in a concentration of at least 1,000 CFU per mL. Catheter-related sepsis without bacteremia as a combination of fever or hypothermia and catheter colonization with resolution of fever or hypothermia within 48 h after catheter removal and without any change in antimicrobial therapy. CR-BSI, as a combination of fever or hypothermia with one or more positive peripheral blood cultures, drawn 48 h before or after catheter withdrawal; isolation of the same organism from the colonized catheter or from the catheter insertion site or a blood culture differential time-to-positivity of 2 h or more, and no apparent source of bacteremia other than the catheter. CRIs were either catheter-related sepsis without bacteremia or CR-BSI.

The study clearly demonstrated a hazard ratio reduction favoring CHG-OH for catheter colonization compared with PVI-OH, regardless the type and severity of the patients and irrespective of the type of catheter and site of insertion. The study also demonstrated a significant statistical difference favoring CHG-OH for the reduction of CRI and CR-BSI in patients with hemodialysis catheters and arterial catheters, but the group of central venous catheters failed to show reduction in these end points. Only subclavian venous catheters were favored by CHG-OH; femoral and internal jugular catheters were not associated with infections' reduction.

The authors stated that there was a similar effect on Gram positive and Gram negative bacteria. Although using the tables provided in the appendix we found that patients in the CHG-OH group had less colonization by

Gram-positive bacteria than the PVI-OH group (53.5 vs. 80.8, $P=0.0001$). No differences were observed in the CRI and CR-BSI associated with Gram-positives or any other microorganism; and even in colonized catheters the number of colonies was significantly lower in patients under de CHG-OH protocol. Many studies have shown (5,6) a higher impact on gram positive bacteria when chlorhexidine is used in ICU, but more recently studies have also shown a favorable impact on other pathogens especially in multidrug-resistant Gram-negative rods (7,8).

The other main finding of this study is that skin scrubbing with detergent had no impact on any of the primary or secondary outcomes related to infection. It is common that in any invasive procedure health care providers scrub the skin in order to remove excess biological material and dirt; this is the first study that demonstrates that this has no impact the patient's outcome, at least infection wise, but let us not generalize the word "scrubbing"; scrubbing of catheters' ports play a strong role in the in infection's prevention; antiseptic scrubbing combined with personal protective equipment (PPE) when handling these ports reduce the likelihood of infection (9) and it is important to point out that the trial did not make a formal analysis on the type of antiseptic used for this purpose, the number of medications, manipulations of the ports, adherence to antiseptic scrubbing and PPE leaving these actions unresolved. The lack of formal audits for adherence as described in the discussion leaves room for improvement and further studies in this topic, it also raises the question of the exact time when the breach for colonization and/or infection took place; was it during insertion or during the following days after insertion?

We found interesting that approximately one fourth of catheters were inserted femoral. This is probably due to the diversity of catheters studied, since this trial included arterial, venous and hemodialysis catheters. For jugular and femoral insertion sites a higher risk of infections has been well described (10,11). Some studies while attempting to reduce CRI only involved a small number of patients with venous femoral access (12) this is important while taking into account the subgroup of patients with a central venous access compared with arterial or hemodialysis catheters.

It would have been favorable if the study had divided the catheters by the number of lumens and additionally clarified which patients were under total parenteral nutrition, since these two factors have been implicated with a higher incidence of infection (13). We speculated that in the group of central venous access there were a low percentage of

patients with total parenteral nutrition since roughly the duration of catheters was 3 to 11 days.

As with any infection prevention trial one of the most important outcomes is infection related mortality and length of hospital stay, and amend economic cost. The trial did not show a difference in both of these outcomes in patients assigned to either antiseptic solution or scrubbing.

Without a doubt the findings by Olivier-Mimoz and his group make any ICU that still use povidone or chlorhexidine alone for skin preparation reconsider this topic and to start reading the labels. For preventionist lower colonization ultimately leads to lower infection rates and these results help support many administrative decisions regarding cost reduction and patient safety. Finally, we believe that this trial will pave the way for a more robust and solid evidence background for future prevention guidelines.

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Footnote

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References

1. Mermel LA. Prevention of intravascular catheter-related infections. *Ann Intern Med* 2000;132:391-402.
2. McGee DC, Gould MK. Preventing complications of central venous catheterization. *N Engl J Med* 2003;348:1123-33.
3. O'Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis* 2011;52:e162-93.
4. Mimoz O, Lucet JC, Kerforne T, et al. Skin antiseptics with chlorhexidine-alcohol versus povidone iodine-alcohol, with and without skin scrubbing, for prevention of intravascular-catheter-related infection (CLEAN): an open-label, multicentre, randomised, controlled, two-by-two factorial trial. *Lancet* 2015;386:2069-77.
5. Dalglish L, Jhattu H, Gomersall JS. Daily 2% chlorhexidine gluconate bath wash in a tertiary adult

- intensive care and high dependency units to reduce risk of hospital acquired multi resistant organisms: a best practice implementation project. *JBI Database System Rev Implement Rep* 2015;13:434-48.
6. Noto MJ, Domenico HJ, Byrne DW, et al. Chlorhexidine bathing and health care-associated infections: a randomized clinical trial. *JAMA* 2015;313:369-78.
 7. Chung YK, Kim JS, Lee SS, et al. Effect of daily chlorhexidine bathing on acquisition of carbapenem-resistant *Acinetobacter baumannii* (CRAB) in the medical intensive care unit with CRAB endemicity. *Am J Infect Control* 2015;43:1171-7.
 8. Mendoza-Olazarán S, Camacho-Ortiz A, Martínez-Reséndez MF, et al. Influence of whole-body washing of critically ill patients with chlorhexidine on *Acinetobacter baumannii* isolates. *Am J Infect Control* 2014;42:874-8.
 9. Moureau NL, Flynn J. Disinfection of needleless connector hubs: clinical evidence systematic review. *Nurs Res Pract* 2015;2015:796762.
 10. Parienti JJ, Mongardon N, Mégarbane B, et al. Intravascular complications of central venous catheterization by insertion site. *N Engl J Med* 2015;373:1220-9.
 11. Ruesch S, Walder B, Tramèr MR. Complications of central venous catheters: internal jugular versus subclavian access—a systematic review. *Crit Care Med* 2002;30:454-60.
 12. Parienti JJ, du Cheyron D, Ramakers M, et al. Alcoholic povidone-iodine to prevent central venous catheter colonization: A randomized unit-crossover study. *Crit Care Med* 2004;32:708-13.
 13. Dezfulian C, Lavelle J, Nallamotheu BK, et al. Rates of infection for single-lumen versus multilumen central venous catheters: a meta-analysis. *Crit Care Med* 2003;31:2385-90.

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