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Peripheral arterial catheter colonization in cardiac surgical patients

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Arterial catheters (ACs) are commonly inserted in critically ill patients for continuous blood pressure monitoring. They are most commonly inserted in the radial artery of the upper extremity and should not be confused with pulmonary artery catheters. Published studies have shown that the risk of bloodstream infections from infected ACs is similar to that from central venous catheters. The incidence density of AC-related bloodstream infections is 0.9–3.4 per 1,000 catheter days, which is 40%–90% of the incidence density of central venous catheter-related bloodstream infections.[1–5] In 2011, the CDC released updated infection prevention guidelines for intravascular catheters, recommending use of a cap, mask, sterile gloves, and a small sterile fenestrated drape for peripheral AC insertion.[6] However, there is significant practice variation regarding barrier precautions utilized for AC catheter insertion and low adherence to these guidelines.[7]

The primary aim of our proof-of-concept project was to determine the potential infectious risk of peripheral ACs inserted in the operating room or preoperative holding unit using less than maximal barrier precautions (ie, use of sterile gloves and a small drape rather than a large sheet drape that would keep ancillary instruments sterile when several inches away from the insertion site). Our hypothesis was that we would find a relatively high incidence of AC catheter colonization. Because several studies have demonstrated that the risk of catheter colonization correlates with the risk of catheter-related bloodstream infection,[8,9] we used AC colonization as our outcome measure.

This project was carried out at Rhode Island Hospital, a tertiary-care teaching hospital licensed for 719 beds. Patients were included in the study if they were undergoing cardiothoracic surgery and were admitted to our 16-bed cardiothoracic surgery intensive-care unit (CTICU) directly from the operating room with their ACs in situ. In the operating room, the insertion site was prepped with alcoholic chlorhexidine (Chlora Prep TM; Becton Dickinson, Franklin Lakes, NJ), and ACs were preferentially placed in the radial artery of an upper extremity 0–5 cm proximal to the patient's wrist by an anesthesiologist or nurse anesthetist using gloves, cap, mask, and a small sterile drape (46 by 66 cm). For patients in our cardiothoracic intensive care unit (CTICU) whose ACs were removed and who required insertion of a new AC, this procedure was carried out by physician's assistants using an AC insertion kit which included a hat, mask, sterile gloves, gown, sterile drape (76 × 91 cm) with 7.6 cm fenestration, and alcoholic chlorhexidine (Chlora Prep TM; Becton Dickinson, Franklin Lakes, NJ). Such catheters were preferentially inserted in the radial artery. We included patients who had > 1 AC placed during their hospitalization.

We prospectively obtained AC tip cultures when ACs inserted in the operating room or the CTICU were removed from patients as determined by the CTICU staff. Arterial catheter tip cultures

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were performed in our hospital microbiology lab using the roll-plate method.[10] Cultures growing at least 15 colony-forming units (CFUs) were considered colonized ACs.

We studied 100 AC tips removed from 97 patients that had been inserted from March 4, 2016, to June 24, 2016. The insertions were predominantly conducted by our attending anesthesiologists or nurse anesthetists (~8 different providers for 90% of the AC insertions). Providers did not have additional training, and no quality improvement project was associated with the study. The mean patient age was 67 years (range, 26–86 years). Overall, 42 patients had coronary artery bypass graft surgery, 36 had aortic valve replacement, 9 had mitral valve replacement, 9 had aortic aneurism or dissection repair, 1 had transcutaneous aortic valve replacement, and 1 had a surgical maze procedure. Also, 3 of the surgeries were emergent, nonelective cases in hemodynamically unstable patients. Moreover, 98 ACs were inserted in the operating room or preoperative holding unit, and 2 were inserted in the CTICU. Overall, 98 ACs were inserted in the radial artery and 2 were inserted in the femoral artery. The ACs remained in situ a mean of 5 days (range, 1–11 days). Only 1 radial AC, which was inserted in the operating room, was colonized; it grew 15–50 CFUs of coagulase-negative staphylococci. Two catheters had <15 CFUs, consistent with catheter contamination during catheter removal (one AC had 1 CFU of *Staphylococcus epidermidis*, and the other AC had 3 CFUs of *Micrococcus* and 3 CFUs each of 2 different *Bacillus* species). All other catheters had no growth. There were no AC-related infections.

Only 1% of the ACs placed in the operating room or preoperative holding unit were colonized despite most AC insertions with sterile gloves, mask, hat, and a small sterile drape. This was an unexpected finding based on prior published studies.[4] Our findings may reflect the fact that the majority of ACs were placed in the operating room or preoperative holding unit, rather than an ICU, with sterile gloves and alcoholic chlorhexidine for cutaneous antisepsis, which was not the case in many previously published studies.

In conclusion, the very low incidence of peripheral AC colonization we observed may be due to the controlled settings in which the catheters were placed (ie, predominantly in the operating room), catheter maintenance practices at our institution, or perhaps the low risk in cardiac surgical patients. We believe that the current practices with less than maximum barrier precautions, namely using a small drape rather than a large sheet drape in this patient population, presents a low risk of AC infection. However, the small number of ACs in this project limits the generalizability of our findings.

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