Prevention of peripheral intravenous catheter-related bloodstream infections: the need for a new focus

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Careful insertion and maintenance technique on every occasion is important — not routine replacement

Intravascular access device-related bloodstream infections, including *Staphylococcus aureus* bacteraemias (SABs), cause substantial clinical harm and waste scarce health care resources. And yet, many, if not most, are preventable. We are belatedly realising that to eliminate these complications we must conduct research, implement evidence-based interventions and reduce the clinical practice variation that leads to their occurrence. Public reporting and the financial disincentives associated with apparent poor performance are also pulling us along this path. In this issue of the Journal, Stuart and colleagues provide yet another wake-up call by describing a case series of 137 peripheral intravenous catheter (PIVC)-associated SABs.[1] They highlight some important failings in our processes for managing PIVCs that allow devastating complications to occur and which require our urgent attention.

Infections can occur at any time after PIVC insertion, but early infections typically reflect the insertion procedure.[2] More than half of the SAB episodes in Stuart et al's study (55%) occurred within 96 hours of insertion, suggesting suboptimal practice. Aseptic insertion is difficult in emergency situations, and SAB episodes were predominantly associated with insertion by the ambulance service or in the emergency department (ED) (21% and 40% of SABs, respectively). In addition, ambulance or ED insertions accounted for 61% of early infections (up to 96 hours). PIVCs inserted in the ED have been reported to have a sixfold higher incidence of SAB than lines inserted in

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wards.[3] Hospital-wide data including PIVC insertions that did not result in SAB were not available, but Stuart and colleagues' series suggests institutional reliance on the prehospital and ED settings for PIVC insertion as well as increased SAB risk associated with these settings.

Treating all PIVCs inserted by the ambulance service and in the ED as "guilty" of non-aseptic insertion is one avenue for potentially avoiding complications. At our hospitals, we try to remove such PIVCs within 24 hours. This may explain why we found just two PIVC-associated SABs in our study — only 10% of 5907 PIVCs were inserted in the ED.[4] However, "routine replacement" of PIVCs inserted by the ambulance service or in the ED increases workload in the wards, compromises vessel health and fails to address the root cause of the problem — non-aseptic insertion technique. It would be preferable to get it right the first, and every, time we perform an insertion. Achieving consistent aseptic insertion across the prehospital, emergency and inpatient spectrum, in addition to flagging and removing PIVCs inserted in true emergencies, requires a coordinated, disciplined approach, but we should demand nothing less.

Not all PIVC-related infections will be prevented with a focus on catheters inserted in prehospital and ED settings; indeed, Stuart et al found that most PIVC-associated SAB episodes (65%) occurring within 72 hours of insertion were among patients whose PIVCs were inserted in a ward. This rate demands close attention be paid to practices throughout the hospital; specifically, preinsertion skin preparation with alcoholic chlorhexidine $\geqslant 0.5\%$, hand hygiene and aseptic, non-touch technique using a sterile field and clean or sterile gloves. Correct insertion will prevent many infections — but not all, unless clean, intact dressings and aseptic technique when accessing the PIVC are also used. Careful daily assessment is required; of need, and for inflammation or infection, with prompt removal of clinically suspect or redundant lines. Amazingly, we do a poor job at identifying PIVCs that have no purpose and should be removed. New strategies to reduce complications could include chlorhexidine-impregnated dressings and bundles of care, both of which have been shown to be effective in reducing infections associated with central venous catheters (CVCs) and potentially also with PIVCs.[5,6] Our hospitals have moved from using "IV teams" to perform insertions to leadership by key individuals who champion policies and drive change to ensure PIVC care is evidence-based and standardised.

Stuart and colleagues found 24% of SABs (137/583) to be PIVC-associated, which was higher than the 4% (24/544) found in a recent US study.[3] Further, they found more SABs were associated with PIVCs than with CVCs (24% compared with 18%). In contrast, a review of 491 bloodstream infections, of which 31% were SABs, found many more were CVC-associated (38%) than PIVC-associated (7%).[7] Stuart et al's definition of PIVC-associated SAB allowed for up to 7 days between the presence of a PIVC and a positive blood culture for SAB, which is likely to have increased PIVC-associated SAB incidence; a more restrictive 48-hour time frame is more common.[8] This incidence rate may also have been increased by the use of site symptoms (redness, tenderness, phlebitis or induration) as confirmation of the PIVC source, rather than microbiological catheter-tip or site cultures. We observed that PIVCs frequently developed site symptoms, and these had poor positive predictive value for bloodstream infections.[4] Regardless of definitions, the overall incidence of PIVC-related bloodstream infection is very low — $\leqslant 1$ in 1000 patients;[4,9] randomised controlled trials of interventions would require logistically impossible sample sizes to prove efficacy using this end point.

The SAB episodes described by Stuart and colleagues occurred *despite* institutional policies already being in place for PIVC removal in 96 hours or less. Dwell times for episodes of PIVC-associated SAB averaged 3.5 days — within the recommended time frame — further suggesting that dwell time was not a factor. Some SABs occurred up to 9 days after insertion, but it is often impossible to resite catheters routinely, owing to patients' poor veins or clinical condition, or staff unavailability.[10] Undoubtedly, microbes increase over time, and longer overall dwell time holds greater risk than a shorter period, but strong data have indicated that two 3-day PIVCs hold the same risk as a PIVC with a dwell time of 6 days.[4,11]

Stuart et al's data confirm that SAB remains a problem with PIVCs and that, rather than relying on the "3 day rule" to prevent complications, strict attention to insertion and maintenance practice is required. This complements the message from our recent large trial published in *The Lancet* — PIVCs can be safely used beyond 96 hours, but they must also be aseptically inserted, carefully maintained, assessed daily and removed as soon as possible.[4] It is time to stop watching the clock and instead focus on our own practices — for our patients' benefit.

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