

## Best evidence in critical care medicine

# Central venous catheterization: the impact of insertion site

### Article appraised

Lorente L, Henry C, Martin MM, Jumenez A, Mora M. Central venous catheter-related infection in a prospective and observational study of 2,595 catheters. *Crit Care* 2005; 9: R-631-5.

### Structured abstract

**Background:** Central venous catheterization is a common procedure in critical care medicine and anesthesia. Infection impacts patient outcome and, depending on definition, complicates 5–19% of central venous catheter (CVC) insertions. One of the factors hypothesized to affect infection rates is the site of venous cannulation.

**Design:** A three-year prospective observational study comparing the site of non-antimicrobial impregnated venous catheter insertion, and incidence of both catheter related local infections (CRLI) and catheter related blood stream infections (CRBSI). CRLI was defined as any sign of local infection, induration, erythema, heat, pain or purulent drainage, as well as catheter tip colonization. Catheter related blood stream infections were defined as positive peripheral blood culture, catheter tip colonization with the same organism, and signs of systemic infection with no other apparent source.

**Patients:** All patients admitted to a 24 bed intensive care unit during the three-year study period.

**Intervention:** None

**Primary endpoint:** The incidence of catheter tip infections (> 15 colony forming units on catheter tip), CRLI and CRBSI.

**Results:** There were 2,595 CVCs in 2,018 patients, for a total of 18,999 catheter days. Catheter insertions were as follows: 917 subclavian CVCs (8,239 total days), 1,390 jugular CVCs (8,361 days) and 288 femoral CVCs (2,399 days). The incidence density (number of infections per 1,000 catheter days) of CRLI for each site was subclavian 1.57, jugular 7.65, and femoral 15.83 (mean 6.05). The incidence of CRBSI for each site was: subclavian 0.97, jugular

2.99, and femoral 8.34 (mean 2.79). The femoral site had a significantly higher incidence density of CRLI and CRBSI than either the internal jugular or subclavian. The jugular site had a significantly higher incidence than the subclavian.

**Conclusion:** To minimize the risk of CVC related infection, the preferred order of insertion, for non-antimicrobial impregnated catheters, should be subclavian first, followed by jugular and then femoral.

### Commentary by C.J. Torok-Both, M.J. Jacka and P.G. Brindley

Complications of central venous catheterization can be categorized according to mechanical, thrombotic and infectious etiologies. This study focused on infectious complications. The authors found an eightfold increase in the rate of infection using the femoral site as compared to the subclavian, and a threefold increase using the jugular site compared to the subclavian. It was concluded that, for central line insertion, subclavian CVCs should be the first choice, followed by jugular CVCs, and finally, femoral CVCs. Although subclavian CVCs had been recommended by previous consensus reports and expert opinion, this approach has not been previously supported by strong prospective evidence.<sup>1</sup> As such, this study has important implications for clinicians and educators.

Lorente *et al.*, acknowledge that their prospective observational study had limitations: 1) insertion sites were not randomly assigned; 2) there was an absence of multivariate analysis (to control for cofounders); and 3) the definition of CRLI differed from the recent Centre for Disease Control definition. Randomization is important because femoral CVCs may have been used more often in emergency situations. However, this observational study of over 2,000 patients duplicated a prospective randomized controlled trial by Merrer *et al.* of just 289 patients<sup>1</sup>. Merrer *et al.* did randomize patients, but did not include the internal jugular site. Merrer *et al.* observed a higher frequency of infectious complications from the femoral

vs. subclavian site [19.8 vs. 4.5%, ( $P = 0.001$ )], and a markedly higher thrombosis rate for the femoral site vs subclavian sites [21% vs 1.9 % ( $P < 0.01$ )]. Major mechanical complications were not significantly different [1.4% vs 2.8% ( $P = 0.44$ )]. From their data, Merrer *et al.* suggest that a minor complication can be prevented for every third patient, and a major complication can be prevented for every 16th patient when using a subclavian, as compared to a femoral CVC approach. Immediate mechanical complications due to pneumothorax or arterial puncture, with the cervicothoracic approach, may lead some to favour the femoral CVC. However, clinicians must appreciate that delayed complications from infection or thrombosis also account for considerable morbidity.

For any central line insertion the clinician should employ maximal barrier technique: large sterile drapes, surgical antiseptic handwash, sterile gown, sterile gloves, mask cap and skin cleanser.<sup>2,3</sup> In addition, application of a dressing, a protocol for hub disinfection, and use of antibiotic impregnated catheters may decrease infectious risk.<sup>2,4</sup> However, concerns of cost, antibiotic resistance, and allergy/anaphylaxis, have slowed widespread use of these catheters. Lorente and Merrer have demonstrated that the site of insertion provides another means to decrease infection.

Central venous catheter insertion requires initial training and maintenance of competence. Proficiency with upper extremity lines can be aided by appropriate knowledge of the relevant anatomy, consistent technique, and ultrasound guidance. Of note, in experienced hands (more than 50 insertions) the rate of complications is reduced by 50%.<sup>5</sup> Femoral CVCs are acceptable, especially in critical situations. However, they should be replaced or removed at the earliest opportunity, especially if inserted under less than sterile conditions. The work of Lorente and Merrer provides mounting evidence to encourage clinicians to preferentially insert subclavian CVCs, and for educators to ensure proficiency with this common intervention.

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## References

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