

Components of CVC Care Bundle

Catheter site selection

- Site of insertion influences the subsequent risk for CR-BSI and phlebitis
- The influence of site is related in part to the risk for thrombophlebitis and density of local skin flora

O'Grady NP, Alexander M, Dellinger EP, et al. Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. MMWR Recomm Rep 2002; 51(RR-10):1-29.

Available online at: <http://www.cdc.gov/ncidod/hip/iv/iv.htm>

The Cochrane review article on central venous access sites for the prevention of infection, 2008

- Only one high quality block randomized controlled trial comparing mechanical, infectious and thrombotic complications of femoral and subclavian venous catheterization

Merrier J, De Joghe B, Golliot F et al. Complications of femoral and subclavian venous catheterization in critically ill patients: a randomized controlled trial

JAMA 2001 Aug 8; 286(6): 700-7

- Concealed, randomized controlled trial
- Between Dec 1997 and July 2000
- 8 ICUs in France

Merrer J, De Joghe B, Golliot F et al. Complications of femoral and subclavian venous catheterization in critically ill patients: a randomized controlled trial

JAMA 2001 Aug 8; 286(6): 700-7

- 289 adult patients receiving a first CVC randomly assigned to CVC insertion at femoral site (n=145) or subclavian site (n=144)
- Mechanical, infectious and thrombotic complications compared by catheterization site in 289, 270 and 233 patients respectively

The “infectious” results

| | RR | 95% CI |
|---|------|---------------|
| Colonization with or without sepsis | 4.57 | 1.95 to 10.71 |
| Sepsis with or without bacteremia | 3.04 | 0.63 to 14.82 |
| Colonized catheter (greater than 10 ³ colony-forming units/ml of gram positive microorganisms) | 3.65 | 1.40 to 9.56 |
| Colonized catheter (greater than 10 ³ colony-forming units/ml of gram negative microorganisms) | 5.41 | 1.61 to 18.15 |

The “thrombotic” results

- With regards to thrombotic complications (fibrin sheath, major and complete thrombosis),
RR was 0.92 (95% CI 2.80 to 47.52)
favouring subclavian access

The “mechanical” results

- With regards to mechanical complications (arterial puncture, minor bleeding, haematoma, misplaced catheter)
RR was 5.41 (95% CI 0.56 to 1.51)
favouring subclavian access

Ruesch S, Walder B, Tramer MR. Complications of central venous catheters:

internal jugular versus subclavian access – a systematic review.
Crit Care Med 2002 Feb; 30(2):454-60

- 3 trials (707 catheters) reported on bloodstream infection
- The incidence was 8.6% with the jugular access and 4.0% with the subclavian access
(RR 2.24 with CI 0.62 to 8.09)

Mermel LA et al. The pathogenesis and epidemiology of catheter-related infection with pulmonary artery Swan-Ganz catheters: a prospective study utilizing molecular subtyping. *Am J Med.* Sep 16 1991;91(3B):197S-205S

- Prospective clinical study of 297 Swan-Ganz catheters
- Adult medical and surgical patients
- Insertion into an internal jugular vein higher risk than subclavian vein
(RR 4.3, $p < 0.01$)

- Whenever possible, and not contraindicated, the subclavian line site should be preferred over the jugular site and the femoral site

Significant risk of subclavian catheterization

pneumothorax

subclavian artery puncture

subclavian vein laceration

subclavian vein stenosis

hemothorax

thrombosis

air embolism

catheter misplacement

in addition, subclavian site may be unavailable due to chest injury

Randolph AG, Cook DJ, Gonzales CA, Pribble CG. Ultrasound guidance for placement of central venous catheters: a meta-analysis of the literature. Crit Care Med 1996; 24:2053-8

- Use of bedside ultrasound for the placement of subclavian CVCs substantially reduced mechanical complications compared with the standard landmark placement technique (RR 0.22 with 95% CI 0.10 to 0.45)

Catheter site selection

- patient-specific factors (eg preexisting catheters, anatomic deformity and bleeding diathesis)
- relative risk of mechanical complications (eg bleeding and pneumothorax)
- availability of bedside ultrasound
- risk for infection

O'Grady NP, Alexander M, Dellinger EP, et al. Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. MMWR Recomm Rep 2002; 51(RR-10):1-29.

Available online at: <http://www.cdc.gov/ncidod/hip/iv/iv.htm>

Why not PICC?

- It is believed that PICC has the lowest infection rate
- The most recent evidence suggests that infection rates rival those of subclavian or internal jugular catheters placed in the acute care setting

Safdar N, Maki DG. Risk of catheter-related bloodstream infection with peripherally inserted central venous catheters used in hospitalized patients. *Chest* 2005 Aug; 128(2):489-495

- No head-to-head comparison has yet been done to make a definitive conclusion

Why not PICC?

- More vulnerable to thrombosis and dislodgment

Gonsalves CF, Eschelmann DJ, Sullivan KL, DuBois N, Bonn J.

Incidence of central vein stenosis and occlusion following upper extremity PICC and port placement. *Cardiovasc Intervent Radiol* 2003 Mar-Apr; 26(2):123-127. Epub 2003 Mar 6

- Less useful for drawing blood specimens

Why not PICC?

- Not advisable in patients with impending need for dialysis
(preservation of upper-extremity veins is needed for fistula or graft implantation given a possibly greater risk of subclavian vein stenosis)

Summary

- A subclavian site is preferred for infection control purposes
- Other factors (eg the potential for non-infectious complications and operator skill) should be considered when deciding where to place the catheter

Goetz AM et al. Risk of infection due to central venous catheters: effect of site of placement and catheter type. Infect Control Hosp Epidemiol. 1998 Nov; 19(11):842-5

- Prospective observational study in Veterans Affairs Medical Center, USA
- 300 CVCs in 204 patients
- Cox regression → association between catheter contamination and insertion at a femoral site (hazard 4.2, $p=0.0001$)

Richet H et al. Prospective multicenter study of vascular-catheter-related complications and risk factors for positive central-catheter cultures in intensive care unit patients.
J Clin Microbiol. 1990;28:2520.

- Prospective observational study at 8 French ICUs
- 503 CVCs studied
- Multivariate analysis → jugular insertion site independently associated with positive cultures of CVCs

Collignon P et al. Sepsis associated with central vein catheters in critically ill patients. *Intensive Care Med.* 1988;14:227

- Observational studies in 440 critically ill patients
- The lowest % of colonized catheters occurred with subclavian route and the highest the femoral route

(15% vs 34%, $p < 0.01$)