

Addressing the Root Cause of Catheter-Related Infection

Is Thrombus Formation Linked to Catheter-Related Infection?

Over five million patients receive therapy through a central venous catheter in the United States each year.¹ Of those, approximately 250,000 (approximately 5%) develop a catheter-related bloodstream infection (CRBSI). Mortality associated with CRBSIs accounts for 2,400–20,000 deaths annually. The costs of such infections are substantial, averaging \$45,000 per patient and up to \$2.3 billion annually.^{2,3} Most concerning is the effect on patients quality of life, with increased frequency of hospitalization.

The rate of catheter-related complications varies depending on the type of vascular access device used. Peripherally Inserted Central Catheters (PICCs) are associated with the lowest rates of infection (approximately 0.1%, 0.5 per 1000 catheter-days).⁴ The 2011 Guidelines for the Prevention of Intravascular Catheter-Related Infections were developed jointly by the Centers for Disease Control and Prevention (CDC) and Healthcare Infection Control Practices Advisory Committee (HICPAC). The guidelines provide evidence-based recommendations for the prevention of catheter-related infections, and highlighted the following:

Prevention of CRBSIs begins with using maximum precautions to create a sterile field during the insertion of a CVC and continues with appropriate maintenance of the site.

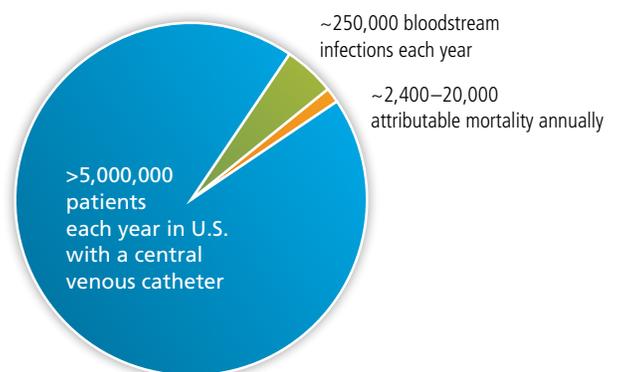
Use maximal sterile barrier precautions

Use maximal sterile barrier precautions, (cap, mask, sterile gown, sterile gloves, and a sterile full body drape) for the insertion of CVCs, PICCs, or guidewire exchange.

Skin preparation

Prepare clean skin with a >0.5% chlorhexidine preparation with alcohol before catheter insertion and during dressing changes. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol can be used as alternatives.

Prevalence and Relevance



For select high risk patient the use of additional antimicrobial and antiseptic techniques may be considered *after* all other options have been exhausted, although no specific guidelines are currently in place.

Antimicrobial/Antiseptic Impregnated Catheters and Cuffs

Use a chlorhexidine/silver sulfadiazine or minocycline/rifampin-impregnated CVC in patients whose catheter is expected to remain in place >5 days *if, after* successful implementation of a comprehensive strategy to reduce rates of CLABSI, the CLABSI rate is not decreasing. In 1998, the FDA released a precaution statement warning clinicians on the potential for serious hypersensitivity reaction to chlorhexidine-impregnated medical devices.

Antibiotic Lock Prophylaxis, Antimicrobial Catheter Flush and Catheter Lock Prophylaxis

Use prophylactic antimicrobial lock solution in patients with long term catheters who have a history of multiple CRBSI despite optimal maximal adherence to aseptic technique.

THE RELATIONSHIP BETWEEN THROMBOSIS AND INFECTION

When introduced into the body, catheters begin to accumulate fibrin. This is the body's natural attempt to protect itself against a foreign body. Approximately 25% of catheters may become occluded.⁵

Fibrin deposits and thrombi provide a rich culture medium for bacterial growth. Thrombus formation is linked to infection risk, caused by the interaction of fibrin, blood components, and a biofilm layer that attracts, encloses, and protects bacteria and other microorganisms.

The matrix of host products serves as scaffolding for the simultaneously developing biofilm and provides receptor-binding sites for newly arriving bacteria.⁶

In a post-mortem evaluation of 72 cancer patients with CVCs, there was a strong correlation between catheter-related sepsis and CVC thrombosis.⁷

- A fibrin layer was present on ALL catheters
- Catheter-related thrombosis was present in 43% of cases
 - 23% of these had sepsis
- Every patient with sepsis had thrombosis

GUIDANCE ON THE USE OF ANTIMICROBIAL IMPREGNATED CATHETERS

The two most commonly used antimicrobial catheters are impregnated with silver sulfadiazine and chlorhexidine or minocycline and rifampin. The antimicrobial activity of these catheters decreases over time limiting their effectiveness in patients who will maintain the catheter for an extended period of time.⁸ Due to their broad-spectrum inhibitory activities, the use of catheters coated with minocycline and rifampin have proven to be significantly superior to those coated with chlorhexidine and silver sulfadiazine. The half-life of antimicrobial activity associated with catheters coated with minocycline and rifampin against *S. epidermidis* is 25 days compared to 3 days for catheters coated with chlorhexidine and silver sulfadiazine.^{9,10} A potential drawback to using antimicrobial impregnated catheters is the risk for antibiotic resistance and potential for hypersensitivity reactions that can be serious and even life-threatening.¹⁰

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