

prevention
of CVC
infections
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Skin
antiseptics

- The pathogenesis of CR-BSI may relate to catheter contamination at the time of insertion. As such, thorough skin antiseptics is crucial to preventing infections.
- Two percent chlorhexidine is the preferred method of skin antiseptics prior to CVC insertion. This is based upon a study of 668 patients who received a skin preparation of 2% chlorhexidine, 10% povidone-iodine, or 70% alcohol. The lowest incidence of CR-BSI was seen in the chlorhexidine group (2.3% versus 7.1% versus 9.3%, respectively). A meta-analysis of eight randomized trials comparing chlorhexidine to povidone-iodine confirmed this result
- The concentration of chlorhexidine is important, in that a study comparing 0.5% chlorhexidine with 10% povidone-iodine as skin antiseptics prior to CVC insertion showed no difference in CR-BSI rates
- Of note, skin should be allowed to dry prior to attempting venipuncture.

Full
barrier
precautions

- When placing a CVC, the ICU needs to be treated as if it is an operating room.
- This is based upon a study of 343 patients comparing the effects of full barrier precautions (mask, hair cap, sterile gloves, gown, and a full-sized sterile drape) to minimal barrier precautions (sterile gloves and a small drape). In this study of ambulatory oncology patients, the control group developed CR-BSIs more than six times as frequently as those in which the person inserting a CVC used full barrier precautions.

Insertion
site

- there are no prospective, randomized studies designed to evaluate the optimal location of CVC insertion, the majority of retrospective and nonrandomized prospective analyses (although not all) have demonstrated increased infectious complications associated with either the internal jugular or femoral approaches

Antiseptic
or antibiotic-
impregnated
catheters

- Antiseptic or antibiotic-impregnated CVCs represent the most studied, as well as controversial, component of efforts aimed at reducing CR-BSI.
- There are currently three types of impregnated CVCs:
 - (i) Antiseptic-impregnated CVCs are coated with chlorhexidine/silver sulfadiazine. A meta-analysis of 11 studies including 2603 CVCs comparing patients randomized to receive chlorhexidine/silver sulfadiazine or standard CVCs demonstrated an odds ratio of 0.56 favoring the antiseptic-impregnated catheters. It should be noted that although the data in aggregate demonstrated a reduction in CR-BSI, only one of the included studies was sufficiently powered to demonstrate this endpoint on its own.
 - (ii) Antibiotic-impregnated [minocycline/rifampin] catheters
 - these catheters may be more efficacious because they provide continuous antimicrobial activity for 14 days, and they also have stronger antimicrobial activity.
 - single prospective randomized trial comparing minocycline/rifampin impregnated CVCs with chlorhexidine/silver sulfadiazine impregnated CVCs demonstrated both a marked reduction in CR-BSI (0.3% versus 3.4%), and catheter colonization (22.8% versus 7.9%) with the minocycline/ rifampin CVCs. This study used, however, an older-generation chlorhexidine/silver sulfadiazine CVC. Second-generation catheters have been developed subsequently, which have an internal and external coating of chlorhexidine/silver sulfadiazine that may be more efficacious than older technology
 - (iii) Silver/platinum/carbon coated CVC
 - providing a continuous release of silver ions, which have bactericidal properties
 - studies evaluating CR-BSI and CVC colonization with this catheter have been neutral to favorable compared with standard CVCs.
 - In total, there have been more than 20 randomized, prospective trials evaluating the effect of antiseptic or antibiotic-impregnated CVCs. The majority of these studies demonstrate a benefit as measured by decreasing CR-BSI rates or catheter colonization.
 - In contrast, none of these studies have demonstrated harm associated with antiseptic or antibiotic-impregnated catheters, and early concerns about increasing antibiotic resistance in the setting of these catheters has never been demonstrated

hand
hygiene

- The first step in preventing CR-BSIs is perhaps the simplest and the most often forgotten.
- Studies have shown that physicians utilize appropriate hand washing approximately one-third of the time.

risk
factors
for line
infection

Host risk factors
Site: subclavian is a lower risk than internal jugular and femoral
Catheter material: antibacterial catheters may reduce infection, antiseptic catheters reduce colonization
Number of lumens: multilumen catheters increase the infection risk³⁰
Number of administrations through the lines
Dressing type frequency of changes
Skin preparation
Experience of technique of personnel
Occurrence of bacteraemia
Tunnelling: often used for long-term access but the data is contentious³¹

Comprehensive
prevention
programs

- Implementation of a multistep prevention program has been shown to basically eliminate CR-BSI in the SICU.
- A recent study by Berenholtz et al. demonstrated that a comprehensive program decreased the CR-BSI rate to 0.54/1000 catheter-days over the course of 16 months, with no infections reported for 9 months. The elements of their program included:
 - (i) an educational program;
 - (ii) the presence of a CVC insertion cart;
 - (iii) asking providers daily whether a CVC was needed;
 - (iv) a daily checklist performed by the bedside nurse; and
 - (v) empowering nurses to stop CVC insertion if guidelines were not followed properly.

Education

- Education of healthcare staff is a cornerstone of efforts to decrease CR-BSI.
- Educational programs highlighting best practice aimed at physicians, nurses, or the entire healthcare team have been shown to decrease CR-BSI rates markedly after their implementation in single-center studies.
- Because of staff turnover and to assure continued attention to the threat of CR-BSI, the program needs to be repeated at regular intervals.

Surveillance

- Monthly surveillance data can demonstrate how individual ICUs compare with national and statewide averages of similar ICUs, and can be a catalyst for change.

Miscellaneous
prevention
strategies

- Administration sets should be changed no more frequently than every 96 h, although those containing blood products or lipids should be changed daily.
- Needleless, open, and closed hub systems have not been demonstrated to change CR-BSI rates.
- There is no role for prophylactic antibiotics in preventing CR-BSI.

Early
removal

- The risk of CR-BSI goes up the longer a CVC stays in place. CVCs should be assessed daily and catheters should be removed as soon as possible.
- Despite the increasing risk of CR-BSI based upon catheter age, CVCs should not be replaced based upon the length of time they have been in place, as studies examining routine replacement every 3-7 days have not decreased infection rates.
- Guidewire exchange is associated with increased infectious risk and should not be performed under routine circumstances.

Dressing
care

- A randomized trial of pulmonary artery catheters that had gauze dressing changes every other day compared with transparent dressings changed every 5 days showed no differences in CR-BSIs.
- Therefore, CVCs can be dressed with either sterile gauze or transparent semi-permeable polyurethane dressings as a matter of institutional preference.