

# Review: Intravascular catheter-related infections can be prevented by using simple procedures

Mermel LA. Prevention of intravascular catheter-related infections. *Ann Intern Med.* 2000 Mar 7;132:391-402. Erratum. 2000 Sept 5;132:395.

## QUESTION

Can evidence-based recommendations be made for interventions dealing with insertion and maintenance of intravascular catheters to reduce bloodstream infections (BSIs) in critically ill patients?

## DATA SOURCES

Studies were identified by searching MEDLINE (1966 to February 1999), reviewing proceedings of conferences from 3 professional associations, and scanning bibliographies of book chapters and review articles.

## STUDY SELECTION

Randomized controlled trials (RCTs) and, if RCTs did not address the specific issue, other prospective studies were selected if catheters were inserted in new sites, cultures used semiquantitative or quantitative methods, and BSI in prospective studies was microbiologically confirmed with percutaneously drawn blood cultures that matched catheter cultures.

## DATA EXTRACTION

Data were extracted on patients and interventions (intravenous antimicrobial, warfarin, or heparin prophylaxis; insertion procedures, including tunneling; cutaneous antiseptics; sterile barrier procedures;

catheter dressings; ointments; contamination-shielded catheters; maintenance; hubs and connection ports; and coated or impregnated catheters and cuffs). Evidence was graded: I (well-designed meta-analysis of RCTs), IIa ( $\geq 1$  well-done RCT that met review inclusion criteria), IIb ( $\geq 1$  well-done RCT that allowed catheter exchange over guidewires into the old site), III (non-RCT), and IV (expert opinion or descriptive study).

## MAIN RESULTS

34 recommendations were made; those with grade I and II evidence follow.

**Catheter modifications:** Impregnation with chlorhexidine and silver sulfadiazine reduces BSIs in short-term ( $< 2$  wk), high-risk situations (I). Impregnation with minocycline and rifampin prevents BSI better than does usual care (IIa) or coated catheters (IIb). Hubs with povidone-iodine or antiseptic protection may prevent infection in central catheters that are in place  $\geq 2$  weeks (IIa). Silver-impregnated subcutaneous collagen cuffs do not prevent BSI (IIa). Routine central venous replacement if the integrity of the catheter polymer is stable does not prevent BSI (I).

**Catheter site interventions:** Chlorhexidine for skin preparation and full-barrier precautions before insertion reduce BSIs (IIa).

Povidone-iodine ointment for the insertion site of hemodialysis catheters prevents BSI (IIb). A contamination shield for pulmonary artery catheters prevents BSI (IIa). BSIs are also reduced with subcutaneous tunneling of short-term catheters inserted in internal jugular or femoral veins if they are not used for drawing blood (IIa). Antibiotic ointment has not been shown to reduce BSIs. Dressing type is not associated with BSI; gauze dressings should be used for sites that ooze blood (IIb). Specialized nursing care prevents BSI related to short-term peripheral catheters (IIa).

**Systemic interventions:** Low-dose heparin (I) and warfarin (IIa) reduce thrombus formation. Vancomycin and teicoplanin prophylaxis do not prevent BSI (IIa), although the study sample size may have been too small to show benefit.

## CONCLUSION

The risk for intravascular catheter-related infection is reduced by simple interventions during insertion and maintenance of the catheters.

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*For correspondence:* Dr. L. Mermel, Division of Infectious Diseases, Rhode Island Hospital, 593 Eddy Street, Providence, RI 02903, USA. FAX 401-444-8154. ■

## COMMENTARY

This review by Mermel comes 4 years after the U.S. Hospital Infection Control Practices Advisory Committee (HICPAC) guidelines on the same subject. No major areas of disagreement exist between the current review and the HICPAC guidelines, but this review makes 14 timely recommendations on issues for which the HICPAC made no official recommendation and thus reinforces the work of HICPAC.

Some of the most important of these recommendations, not all provided in the abstract, include regular changes in needleless systems to reduce contamination of the devices, use of antiseptic-laden ports and connector devices for heavily manipulated catheters in intensive care units, avoidance of femoral catheterization, and adequate nurse-to-patient ratios. These are category III and IV recommendations (i.e., nonrandomized trials or expert opinion), but they are important because they identify emerging issues in the prevention of catheter-related infection.

Cost is a key issue for quality-improvement personnel in considering the implementation of the proposed interventions. Some of the

proposals require the provision of institutional resources. 2 examples are adequate nurse-to-patient ratios and special nursing teams to care for short-term peripheral venous catheters in institutions that have high endemic rates of catheter-related infections. These are not so much new interventions as recognition of the value of past resources that have been lost in our current financially constrained environment.

Little information is available to provide guidance on the cost benefits of most of the proposed interventions. 1 exception noted in this review is the anticipated cost savings reported for antimicrobial-impregnated catheters. Justification of new resources will require quality-improvement staff to clarify for hospital administration the extent to which the proposed interventions will provide a satisfactory return on their investment. Given the well-known costs of catheter-related infections, even small reductions in the number and incidence of these complications are likely to financially justify the evidence-based interventions proposed in this review.

Patrick J. Brennan, MD  
University of Pennsylvania  
Philadelphia, Pennsylvania, USA