



**衛生防護中心**  
Centre for Health Protection

# **Recommendations on Prevention of Intravascular Catheter Associated Bloodstream Infection**

Version 2.1

**Scientific Committee on Infection Control, and  
Infection Control Branch, Centre for Health  
Protection, Department of Health**



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## **Background**

The Scientific Committee on Infection Control (SCIC) endeavours to prevent healthcare associated infections including Intravascular Catheter Associated Bloodstream Infection. The recommendations provided by SCIC serve as guidance for the hospital colleagues in the formulation of strategies, programmes and plans for the prevention of intravascular catheter associated bloodstream infection.

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## Introduction

Use of vascular catheters has become an indispensable part of modern medicine practice, particularly in intensive care units. Their use may put patients at risk for local and systemic infectious complications such as local site infection or bloodstream infection. (1,2)

2. The common causes of CABSIs are migration of micro-organisms from the skin at the insertion site into the cutaneous tract of the catheter and contamination of the catheter hub. (1) This guideline provides healthcare professionals with background information and recommendations to reduce the incidence of CABSIs and emphasizes strategies on minimizing these hazards when using different intravascular catheters.

## Recommendations on Prevention of Intravascular Catheter Associated Bloodstream Infection

### 1 Education, Quality Assurance and Surveillance

- 1.1 Implementation of educational programs regarding the indications for intravascular catheter use, proper procedures for the insertion and maintenance of intravascular catheters, and appropriate infection control measures to prevent CABSIs. (3–5)
- 1.2 Ensure persons who insert or manage intravascular catheters are trained and competent for the procedure. (3)
- 1.3 Well-organized surveillance program that can monitor and evaluate the performance of care is one of the tools for the prevention of the CABSIs. (1,4) Both process and outcome measures on the care of intravascular catheter should be monitored. For the infection rate, it is preferable to express it by an incidence density such as “CABSIs per 1000 catheter patient days”. (6)

### 2 General Aspects

- 2.1 Hand hygiene  
Perform hand hygiene procedures, either by washing hands with soap and water or with alcohol-based hand rubs (ABHR), before and after inserting, accessing, dressing catheters and palpating catheter insertion sites. (3,7–10)
- 2.2 Use aseptic technique for catheter insertion and catheter site care

- 2.2.1 Prepare skin with an antiseptic, e.g. 70% alcohol for peripheral venous catheter insertion, 2% chlorhexidine in alcohol for CVC and peripheral arterial catheter insertion and dressing changes. (3,8,9,11–13)
- 2.2.2 No recommendation can be made for the safety or efficacy of chlorhexidine in infants aged <2 months. (3,11)
- 2.2.3 For CVC insertion and dressing changes, apply repeated up and down, back and forth strokes for at least 30 seconds starting at the insertion site and working outward to the periphery. (13)
- 2.2.4 Antiseptics should be allowed to dry. (3,8,9,11,13)
- 2.2.5 Use clean gloves for peripheral intravascular catheter insertion; do not touch the insertion site after the application of skin antiseptics. Wear sterile gloves for the insertion of arterial and central venous catheters. (3)

### 2.3 Catheter and site care

- 2.3.1 Use sterile, transparent, semipermeable dressing or sterile gauze to cover the catheter site. (3,12,14,15)
- 2.3.2 A gauze dressing is preferred if the site is bleeding, oozing or the patient is diaphoretic. (3,8,9,11,12)
- 2.3.3 Replace dressing if it becomes damp, loosened, or visibly soiled. (3,8,9,11,12)
- 2.3.4 Leave the transparent semipermeable membrane dressing applied to a peripheral cannula insertion site in situ for the life of the cannula, provided that the integrity of the dressing is retained. (8,9,16)
- 2.3.5 Secure the catheter after insertion. (3)
- 2.3.6 Evaluate the catheter insertion site daily by palpation to discern tenderness and by inspection if a transparent dressing is in use. Gauze and opaque dressings should not be removed if the patient has no clinical signs of infection (except for CVC, refer to 3.1.8). If the patient has local tenderness or other signs of possible CABSIs, an opaque dressing should be removed and the site inspected. (3)
- 2.3.7 Remove the catheter when it is no longer used. (3,17)

## 3 Care of Specific Catheters

3.1 Central venous catheters (CVCs), including peripherally inserted central venous catheters (PICCs), haemodialysis (HD) and pulmonary artery catheters (PACs)

The central line bundle approach is a group of evidence-based interventions for patients with intravascular central venous catheters that, when implemented together, result in better outcomes than when implemented individually. The central line bundle consists of 5 key components:

- a. Hand hygiene
- b. Maximal barrier precautions
- c. 2% Chlorhexidine skin antisepsis
- d. Optimal catheter site selection, with subclavian vein as the preferred site for non-tunneled catheters
- e. Daily review of line necessity, with prompt removal of unnecessary lines.

This is not intended to be a comprehensive list of all elements of care related to central lines. Other elements of care, such as daily site care and selection of dressing material, are not excluded for any purpose other than to have a bundle that is focused. (11,18)

- 3.1.1 Use maximal sterile barrier precautions (including the use of all-inclusive procedure carts or kits such as cap, mask, sterile gloves, sterile gown, one large sterile drape, and other necessary supplies) for insertion of central line. (3,11,12,19)
- 3.1.2 Use new sterile gloves before handling the new catheter when guidewire exchanges are performed. (3)
- 3.1.3 Weigh the risks and benefits of placing a central venous device at a recommended site to reduce infectious complications against the risk for mechanical complications. (3)
  - a. Avoid using the femoral vein in adult patients, particularly in obese patients. (3,11)
  - b. A subclavian site is preferred to a jugular or femoral site in adult. (3,12)
- 3.1.4 Use a jugular or femoral catheter rather than a subclavian one for haemodialysis or pheresis to avoid subclavian vein stenosis. (1,3)
- 3.1.5 Prepare skin with antiseptic chlorhexidine 2% in 70% isopropyl alcohol which has been proven to provide better skin antisepsis than other antiseptic agents such as povidine-



- iodine solutions. (3,8,9,11–13,18)
- 3.1.6 For ultrasound guided insertion, use sterile sheath and sterile gel for ultrasound transducer. (19,20) Remove the ultrasound gel thoroughly before applying the dressing.
  - 3.1.7 Minimal numbers of ports and lumens of central venous catheters essential for management of patients should be used. (3,12,21)
  - 3.1.8 Designate a CVC line or one port of a multi-lumen CVC for exclusive use of parenteral nutrition. (1,8,9,12,13,22)
  - 3.1.9 Replace gauze dressing every 2 days and transparent dressing every 7 days for short-term CVC. The risk of catheter dislodging should be weighed for changing of dressing in paediatric patients. (3,8,9,11–13)
  - 3.1.10 Routine replacement of intravascular catheters is not necessary if they are functioning and have no evidence of causing local or systemic complications. (3,11,12)
  - 3.1.11 Do not replace intravascular catheters over guidewire if CABS I is suspected. (3,12)
  - 3.1.12 Promptly remove the catheter when it is no longer essential. (3,11) When adherence to aseptic technique cannot be ensured (i.e. catheters inserted during a medical emergency), replace the catheter as soon as possible, i.e. within 48 hours. (3)
  - 3.1.13 Use a sterile sleeve for all pulmonary artery catheters. (3)
  - 3.1.14 Before elective surgical procedures for haemodialysis patients, including the insertion of HD catheters *per se*, conduct MRSA screening and decolonization with mupirocin and chlorhexidine bath to reduce postoperative infection risk. (13,23)
  - 3.1.15 For haemodialysis, use povidone iodine antiseptic ointment or bacitracin/ gramicidin/ polymyxin B ointment at the hemodialysis catheter exit site after catheter insertion and at the end of each dialysis session only if this ointment does not interact with the material of the hemodialysis catheter per manufacturer's recommendation. (3,11)

## 3.2 Peripheral venous catheters

- 3.2.1 For adults, use an upper-extremity site for catheter insertion. Replace a catheter inserted in a lower extremity site to an upper extremity site as soon as possible. For pediatric patients, the upper or lower extremities or the scalp (in neonates or

- young infants) can be used as the catheter insertion site. (3)
- 3.2.2 For adults, no need to replace catheters more frequently than every 72-96 hours. If sites for venous access are limited, catheter can be maintained for longer period but close monitoring of insertion site is necessary. For paediatric patients, only replace catheters when clinically indicated. (3)
  - 3.2.3 Remove the peripheral intravascular catheter if there is sign of phlebitis or malfunctioning. (3)
  - 3.2.4 Flush the peripheral intravascular lock or needle free device with normal saline for maintaining the patency and lowering the overall catheter-related complications though they are not necessarily infection related. (8,9,12,24)
  - 3.2.5 Efficacy of normal saline solution as an alternative to heparin solution for the maintenance of peripheral IV devices is to eliminate the risk of heparin-induced thrombocytopenia, thrombus, haemorrhage and medication incompatibility which can provide a safer therapy for patient as well as cost savings. (24–26) Therefore, normal saline flush is superior and preferable.
- 3.3 Peripheral arterial catheters
- 3.3.1 A minimum of a cap, mask, sterile gloves and a small sterile fenestrated drape should be used during insertion. During axillary or femoral artery catheter insertion, maximal sterile barriers precautions should be used. (3)
  - 3.3.2 For adults, use of the radial, brachial or dorsalis pedis sites is preferred over the femoral or axillary sites. For children, the brachial site should not be used. The radial, dorsalis pedis, and posterior tibial sites are preferred over the femoral or axillary sites. (3)
  - 3.3.3 Do not routinely replace. Replace only when clinically indicated. (3)
  - 3.3.4 Use disposable transducer assemblies when possible. (3)
  - 3.3.5 Replace the transducers assemblies at least every 96 hours together with other components of the system, including the tubing, continuous-flush device and flush solution. (3)
- 3.4 Pressure monitoring systems
- 3.4.1 Keep all components of the system sterile. (3)
  - 3.4.2 Use a closed (continuous) flushing system to maintain the

patency of the system. (3)

3.4.3 Do not infuse the dextrose-containing solution or parenteral nutrition fluids through the system. (3)

### 3.5 Umbilical catheters

3.5.1 Avoid tincture of iodine for disinfection of umbilical insertion site in newborn infants. Other iodine-containing preparation, for example, povidone iodine, is acceptable. (3)

## 4 Maintenance of Administration Sets

4.1 Replace administration sets including extension tubings and add-on devices no more frequently than every 96 hours, unless CABSIs are suspected or confirmed, but at least every 7 days. (3,12,27,28)

4.2 Replace administration sets transfusing blood, blood products or lipid containing solutions after administration or within 24 hours. (3,12)

4.3 Disinfect IV injection port, stopcocks, needleless intravascular device or heparin-block with 70% alcohol, 2% chlorhexidine in alcohol or iodophor preparation before access. (3,8,9,11–13)

4.4 IV injection port: there have been reports of higher infection rate associated with the use of stopcocks. (29,30) When stopcocks are to be used, cap all stopcocks when not in use. (3)

4.5 Do not draw blood specimens through single-lumen peripheral or central venous lines intended for infusions except when catheter-associated bacteremia is suspected. Dedicate a specific lumen from a multi-lumen for blood-letting. (31)

4.6 Maintain a closed infusion system.

4.6.1 The closed infusion system has been shown to result in significant reduction in the incidence of CABSIs. (3,32)

4.6.2 The closed infusion system is defined as:

1) the container of intravenous solution is fully collapsible (the residue after administration does not exceed 5% of the nominal volume), and hence does not require external air vent to allow the solution to empty AND

2) the connecting administration set has no air-vent.

The whole infusion system is maintained closed to the external environment while infusing except for the situation listed in para 4.7.3.

- 4.6.3 In the situation when intravenous solution or medication is delivered by a semi-rigid plastic or glass bottle, an air vent to empty the solution is allowed.
- 4.7 In-line filters: Do not use filters routinely for infection-control purposes. (1,8,9) There is no reliable evidence to support their efficacy in preventing BSI related to catheters, infusate or infusion system. They may become blocked, especially with certain solutions, e.g., dextran, lipids, mannitol, thereby increasing the number of line manipulations and decreasing the availability of administered drugs. However, they may have a role for parenteral nutrition solutions for reasons other than infection prevention. (9)

## **5 Care of Infusate, IV Medication and Admixture**

- 5.1 Complete lipid-containing solutions within 24 hours of hanging the solution. For lipid emulsions alone, it should be completed within 12 hours, and at maximum within 24 hours. (1)
- 5.2 Use single-dose vial of parenteral additive and medication as far as possible. Do not combine the leftover content of single-use vials for later use. (1,8,9)
- 5.3 Disinfect diaphragm of the multidose vials with 70% alcohol before insertion. Sterile device should be used.) (1)
- 5.4 Discard multidose vial of parenteral additive and medication if contaminated. (1)
- 5.5 Do not use any parenteral fluid or admixture that has visible turbidity, containing particulate matter or container with leaks or cracks. Save and report the item for investigation. (1)
- 5.6 Do not adopt routine culture of parenteral fluids, as a check on sterility for infection preventive measure. (31)
- 5.7 Attach a distinctive supplementary label to each admixed parenteral fluid stating the additives and dosage, the date and time of compounding, the expiration time and the signature of the person who did the compounding. (31)

## **6 Needleless Intravascular Catheter Systems**

- 6.1 Scrub the access port with an appropriate antiseptic for at least 15 seconds and access the port only with sterile devices to minimize the risk of contamination. (3,8,9,11,12,33–35)
- 6.2 Replace caps or needleless connectors no more frequently than at 72-hour intervals unless clinically indicated or follow the manufacturers' recommendations. (1,3,8,9)

- 6.3 Replace needleless components at least as frequently as the administration set and ensure the components are compatible to minimize the leaks and breaks in the system. (3,8,9)

## **7 Special Considerations for the Prevention of CABS**

- 7.1 There is no conclusive evidence to adopt any kinds of agents to be the lock solution for preventing CABS. (3)
- 7.2 Do not routinely use antibiotic lock solutions to prevent CABS. Use prophylactic antibiotic lock solution only in special situations, such as in treating a patient with a long-term cuffed or tunneled catheter, or port who has a history of multiple infections despite optimal maximal adherence to aseptic technique. (3,8,9,11,12)
- 7.3 The use of an antimicrobial- or antiseptic-impregnated catheter should be based on the need to enhance prevention of CABS after maximizing the adherence of infection control measures (educating personnel, using maximal sterile barrier precautions and using 2% Chlorhexidine skin antisepsis). However, both of them only offer marginal benefit in reducing CABS. (3,11,12)
- 7.4 When using antimicrobial- or antiseptic-impregnated catheters, monitor patients for untoward effects, such as anaphylaxis. (3,11,12)
- 7.5 Prophylactic antimicrobials: Do not administer intranasal or systemic antimicrobial prophylaxis routinely before insertion or during use of an intravascular catheter to prevent catheter colonization or bloodstream infection. (3,8,9,11,12)

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## Appendix I: Summary Table of Recommendations for Various Catheters

	Central Venous Catheter	Peripheral Venous Catheter	Peripheral Arterial Catheter
Gloves and attire	<ul style="list-style-type: none"> <li>• Sterile gloves</li> <li>• Maximal sterile barrier precautions<sup>†</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Clean gloves</li> </ul>	<ul style="list-style-type: none"> <li>• Sterile gloves</li> <li>• Cap, mask, sterile gloves and a small sterile fenestrated drape</li> <li>• Maximal sterile barrier precautions<sup>†</sup> if axillary or femoral artery is used</li> </ul>
Skin antisepsis	<ul style="list-style-type: none"> <li>• 2% chlorhexidine in alcohol</li> <li>• Repeated strokes for at least 30 sec from insertion site to the periphery</li> <li>• Allow to dry</li> </ul>	<ul style="list-style-type: none"> <li>• 70% alcohol</li> <li>• Allow to dry</li> </ul>	<ul style="list-style-type: none"> <li>• 2% chlorhexidine in alcohol</li> <li>• Allow to dry</li> </ul>
Site selection	<p><b>Adult:</b></p> <ul style="list-style-type: none"> <li>• Subclavian site is preferred</li> <li>• Avoid femoral vein, particularly in obese patients</li> </ul>	<p><b>Adult:</b></p> <ul style="list-style-type: none"> <li>• Use upper-extremity site</li> </ul> <p><b>Children:</b></p> <ul style="list-style-type: none"> <li>• Use upper or lower extremities or the scalp (in neonates or young infants)</li> </ul>	<p><b>Adult:</b></p> <ul style="list-style-type: none"> <li>• Use radial, brachial or dorsalis pedis sites</li> </ul> <p><b>Children:</b></p> <ul style="list-style-type: none"> <li>• Use radial, dorsalis pedis or posterior tibial sites</li> <li>• Avoid brachial site</li> </ul>
Dressing change	<ul style="list-style-type: none"> <li>• Transparent dressing: every 7 days</li> <li>• Gauze: every 2 days (for non-tunnelled / short-term CVC)</li> </ul>	<ul style="list-style-type: none"> <li>• Transparent semipermeable dressing: leave in situ for the life of the cannula, provided that the integrity of the dressing is retained</li> <li>• Gauze: preferred if bleeding, oozing or profused sweating</li> <li>• Replace any dressing if damp, loosened, or visibly soiled</li> </ul>	
Catheter change	<ul style="list-style-type: none"> <li>• Do not routinely replace</li> <li>• Do not replace over guidewire if CABS I is suspected</li> </ul>	<p><b>Adult:</b></p> <ul style="list-style-type: none"> <li>• No need to replace more frequently than every 72-96 hours</li> </ul> <p><b>Children:</b></p> <ul style="list-style-type: none"> <li>• Only when clinically indicated</li> </ul>	<ul style="list-style-type: none"> <li>• Only when clinically indicated</li> </ul>

	<b>Central Venous Catheter</b>	<b>Peripheral Venous Catheter</b>	<b>Peripheral Arterial Catheter</b>
Removal	<ul style="list-style-type: none"> <li>• Promptly remove if no longer needed</li> <li>• If aseptic technique cannot be ensured (i.e. inserted during emergency), replace ASAP, i.e. within 48 hours.</li> </ul>	<ul style="list-style-type: none"> <li>• Remove if no longer needed</li> <li>• Remove if there is sign of phlebitis or malfunctioning</li> </ul>	<ul style="list-style-type: none"> <li>• Remove if no longer needed</li> </ul>

† Maximal sterile barrier precautions: cap, mask, sterile gloves, sterile gown and one large sterile drape

## Appendix II: Compliance Checklist for Catheter Associated Bloodstream Infection (CABSI)

	Central Venous Catheter	Peripheral Venous Catheter	Peripheral Arterial Catheter
Gloves and attire	<input type="checkbox"/> Wear sterile gloves <input type="checkbox"/> Use maximal sterile barrier precautions	<input type="checkbox"/> Wear clean gloves	<input type="checkbox"/> Wear sterile gloves <input type="checkbox"/> Use cap, mask, sterile gloves and a small sterile fenestrated drape <input type="checkbox"/> Use maximal sterile barrier precautions if axillary or femoral artery is used
Skin antisepsis	<input type="checkbox"/> Use 2% chlorhexidine in alcohol <input type="checkbox"/> Repeated strokes for at least 30 sec from insertion site to the periphery <input type="checkbox"/> Allow to dry	<input type="checkbox"/> Use 70% alcohol <input type="checkbox"/> Allow to dry	<input type="checkbox"/> Use 2% chlorhexidine in alcohol <input type="checkbox"/> Allow to dry
Site selection	<b>Adult:</b> <input type="checkbox"/> Subclavian site is preferred <input type="checkbox"/> Avoid femoral vein, particularly in obese patients	<b>Adult:</b> <input type="checkbox"/> Use upper-extremity site <b>Children:</b> <input type="checkbox"/> Use upper or lower extremities or the scalp (in neonates or young infants)	<b>Adult:</b> <input type="checkbox"/> Use radial, brachial or dorsalis pedis sites <b>Children:</b> <input type="checkbox"/> Use radial, dorsalis pedis or posterior tibial sites <input type="checkbox"/> Avoid brachial site
Dressing change	<b>For non-tunnelled / short-term CVC:</b> <input type="checkbox"/> Transparent dressing: every 7 days <input type="checkbox"/> Gauze: every 2 days	<input type="checkbox"/> Transparent semipermeable dressing: leave in situ for the life of the cannula, provided that the integrity of the dressing is retained <input type="checkbox"/> Use gauze when there is bleeding, oozing or profused sweating <input type="checkbox"/> Replace any dressing if damp, loosened, or visibly soiled	
Catheter change	<input type="checkbox"/> Do not routinely replace <input type="checkbox"/> Do not replace over guidewire if CABSI is suspected	<b>Adult:</b> <input type="checkbox"/> No need to replace more frequently than every 72-96 hours <b>Children:</b>	<input type="checkbox"/> Only when clinically indicated

		<input type="checkbox"/> Only when clinically indicated	
Removal	<input type="checkbox"/> Promptly remove if no longer needed <input type="checkbox"/> If aseptic technique cannot be ensured (i.e. inserted during emergency), replace ASAP, i.e. within 48 hours.	<input type="checkbox"/> Remove if no longer needed <input type="checkbox"/> Remove if there is sign of phlebitis or malfunctioning	<input type="checkbox"/> Remove if no longer needed

## Appendix II: Compliance Checklist for Catheter Associated Bloodstream Infection (CABSI) (cont'd)

Administration set maintenance	<p>Replace administration sets including extension tubings and add-on devices</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> no more frequently than every 96 hours, unless CABSI is suspected or confirmed, and</li> <li><input type="checkbox"/> at least every 7 days</li> <li><input type="checkbox"/> after administration or within 24 hours when transfusing blood, blood products or lipid containing solutions</li> </ul> <p>Disinfect IV injection port, stopcocks, needleless intravascular device or heparin-block before access with</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> 70% alcohol, or</li> <li><input type="checkbox"/> 2% chlorhexidine in alcohol, or</li> <li><input type="checkbox"/> iodophor preparation</li> </ul>
Care of infusate	<ul style="list-style-type: none"> <li><input type="checkbox"/> Use single-dose vial of parenteral additive and medication as far as possible</li> <li><input type="checkbox"/> Do not combine the leftover content of single-use vials for later use</li> </ul>
Needleless intravascular catheter systems	<ul style="list-style-type: none"> <li><input type="checkbox"/> Scrub the access port with an appropriate antiseptic for at least 15 seconds and access the port only with sterile devices</li> </ul>
CABSI surveillance	<ul style="list-style-type: none"> <li><input type="checkbox"/> A surveillance program for CABSI is in place</li> <li><input type="checkbox"/> Use incidence density unit such as “CABSI per 1000 catheter patient days” to express infection rate</li> </ul>