

Central Line Insertion and Maintenance Guideline

April 2012



Disclaimer

This statement is a general aide to guide appropriate practise, it is not intended to replace the critical evaluation processes that underpin the development of local policy and procedure nor a clinician's judgment in an individual case. Information should be critically evaluated as it relates to local circumstances and any changes in the literature that may have occurred since December 2011. In addition clinicians should review state government policy documents and regulations to identify any directives that may relate to this clinical practice.

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CENTRAL LINE INSERTION AND MAINTENANCE GUIDELINE

Introduction

The purpose of this guideline is to assist clinicians in preventing central line associated bloodstream infections (CLABSI).

This guideline has been developed to

- ▶ be consistent with the 2010 NHMRC & Australian Commission on Safety and Quality in Healthcare *Australian Guidelines for the Prevention and Control of Infection in Healthcare* www.nhmrc.gov.au
- ▶ reflect the latest evidence, OR
- ▶ reflect the advice of an “expert group” where the literature is out-of-date or does not exist. This group comprised microbiologists/infectious disease physicians, intensivists, an ICU nurse researcher specialising in intravascular access and an ICU nurse.
- ▶ be cost-neutral in the first instance; bearing in mind that CLABSIs cost many thousand dollars to treat, and increase ICU length of stay.^{1,2}

Scope

This guideline should be used for percutaneous insertion of central lines in adults.

Unless otherwise indicated, it may also be used for percutaneous insertion of central lines in children but not neonates.^{3,4,5}

This document does not include instructions on how to insert a central line, other than relating to aseptic technique. It is assumed the proceduralist has undertaken an appropriate training program or is supervised during the procedure.

Definitions⁶

Central line

A central line is defined as an intravascular access device or catheter that terminates at or close to the heart or in one of the great vessels. The line may be used for infusion, or haemodynamic monitoring. Examples include a central line for infusion, pulmonary artery (PA) catheter, sheath/introducer for PA catheter, dialysis or haemofiltration catheter in a great vessel, peripherally inserted central catheter (PICC).



The following are considered great vessels for the purpose of defining a central line: pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common iliac veins or femoral veins. A hollow introducer is considered a central line if the tip is situated in a great vessel.

A central line may be inserted centrally or peripherally (PICC) in the patient. Neither the location of the insertion site nor the type of device determines whether a line qualifies as a central line. The device must terminate in one of the great vessels (listed above) or in or near the heart to qualify as a central line.

Proceduralist

Health care professional performing the central line insertion, who has undergone specific training and education to perform this procedure. The proceduralist must have undertaken an appropriate training program or be supervised during the procedure.

Assistant

A medical officer or registered nurse who supports or aids the proceduralist, but does not physically take part in the procedure.

Supervisor

An experienced clinician with a high level of competence in central line insertion and a comprehensive understanding of the management of the potential complications.

Insertion Site

Adults

The insertion site should be determined according to clinical grounds,⁷ with a preference for the subclavian vein in most patients.⁸

Although some studies suggest greater colonisation and infection of central lines at the femoral site followed by the

jugular,^{9,10} another suggests equivalence between the femoral and the jugular sites except in patients with a high BMI, in which case the femoral vein has higher rates of CLABSI.¹¹ Conversely, in patients with a tracheostomy, use of the jugular vein may result in more CLABSI.¹² Other, albeit smaller studies do not show a difference in infection between subclavian, jugular and femoral sites, although colonisation remains higher at the femoral and jugular.^{13,14}



Children

The choice of insertion site will depend on patient size/age, the relative risk of mechanical versus infectious complications, and the need for sedation or general anaesthesia.¹⁵

Central Line Selection

The following should be considered when selecting a central line:

- ▶ The number of lumens should be kept to a minimum;¹⁶ bearing in mind the possibility of an escalation in treatment requiring more lumens.
- ▶ Any solution containing lipid, eg total parenteral nutrition (TPN) should have a dedicated lumen.
- ▶ The likely duration of central line placement.

Antimicrobial central lines^{17,18}

Chlorhexidine and silver sulphadiazine coated lines (not silver-only),¹⁹ and rifampicin and minocycline lines should be considered

- ▶ If the CLABSI rate remains high in spite of good compliance with the insertion and maintenance guidelines
- ▶ For patients who will have a central line in-situ >7 days²⁰
- ▶ For patients at particular risk of CLABSI, eg. burns, immunocompromised

Other factors to consider are:²¹

- ▶ Both types of catheter have limited antimicrobial action against some organisms.
- ▶ If rifampicin and minocycline lines are frequently used, there should be monitoring for the development of resistance.
- ▶ Hypersensitivity reactions to chlorhexidine-coated central lines have been reported, albeit rarely.

Preparation

To facilitate compliance with this guideline, all equipment for the procedure should be co-located and easy to take to the patient's bedside, eg. on a dedicated trolley or in a pack.



Aseptic Technique & Maximal Barrier Precautions²²

① The proceduralist²³

- ▶ dons hat (covering all head and facial hair), mask, eye protection
- ▶ removes jewellery from hands and arms
- ▶ ensures sleeves are above elbows
- ▶ performs a “surgical scrub” with a chlorhexidine-based solution, as per



manufacturer's instructions and local policy. This may be done with warm water and antimicrobial soap, or alcohol-based hand rub. This should not include scrubbing with a brush.^{24,25,26} If water is used, the proceduralist should not touch the taps with his/her hands after scrubbing.

- ▶ dons sterile gown and gloves.

② The assistant and supervisor don hat and mask and perform hand hygiene with alcohol-based hand rub.



③ If the supervisor physically assists with the insertion, he/she must undertake the same preparation as the proceduralist.

④ The insertion site should be

- ▶ Free of hair (clipping is preferred to shaving)²⁷
- ▶ Cleaned with $\geq 0.5\%$ chlorhexidine in 70% alcohol (unless contra-indicated, eg. chlorhexidine hypersensitivity) and allowed to dry^{28,29,30,31} If chlorhexidine is contra-indicated, use 5% povidone iodine in alcohol³²

Removal of skin lipids (“defatting”) with alcohol, ether or acetone is **not** recommended. Soap and water may be used prior to the chlorhexidine if the site is particularly soiled.

NB: some chlorhexidine and alcohol swabsticks are not sterile, so should not be put on the sterile field, and if used by the proceduralist he/she should change gloves after application.

- ⑤ Large drapes are used to cover the whole patient other than the insertion site.



- ⑥ Other than in an emergency, the proceduralist, supervisor or assistant **should stop the procedure if asepsis is breached.**

- ⑦ When the line is secured, the site should be cleaned of blood with $\geq 0.5\%$ chlorhexidine in 70% alcohol, allowed to dry, and a sterile occlusive dressing applied that covers the insertion site, and all of the central line, up to and including the hub.

- ⑧ Care must be taken not to contaminate the lines when connecting infusions, the transducer or dialysis/haemofiltration lines; eg.



- ▶ tip the transducer onto the sterile field and hand the end to the assistant to connect to the flush bag,
- ▶ handle the ends of all administration sets etc with gauze soaked in $\geq 0.5\%$ chlorhexidine in 70% alcohol.

Central Line Review

If the patient is admitted with a central line in-situ, the conditions under which it was inserted should be reviewed to ascertain whether it should be replaced.

Central lines should be reviewed daily for

- ▶ signs of local infection at the insertion site (tenderness, pain, redness, swelling)
- ▶ signs of systemic infection
- ▶ suture and dressing integrity
- ▶ catheter position
- ▶ patency of lumens
- ▶ ongoing need – remove as soon as possible³³

Central Line Replacement

Routine replacement of central lines is not recommended, and should only be done as clinically indicated.^{34,35,36,37}

Replacement of central line if inserted under emergency conditions

If there is any suspicion that strict asepsis was not maintained during central line insertion, a new line should be inserted at a new site as soon as possible within 24 hours.³⁸ This includes any item of the insertion checklist being omitted or modified; ie. cap, mask, sterile gloves and gown, full-body drape, skin preparation with $\geq 0.5\%$ chlorhexidine in 70% alcohol.

Re-wiring

Inserting a new central line over a guidewire into the same site as an existing line increases the risk of infection;^{39,40} it should therefore only be considered in the following circumstances⁴¹

- ▶ The risks of using another site outweigh the risk of infection using the same site, eg.
 - patient has burn injuries **AND**
 - no other unburned site
 - procedure technically difficult due to swelling
 - coagulopathic patient for whom central line replacement is necessary before coagulopathy can be corrected
- ▶ The central line has been in situ <72 hours **AND**
 - there is no suspicion of CLABSI, **AND**
 - the line was inserted with strict adherence to aseptic technique

NB

- ▶ special care must be taken not to contaminate the new central line; ie. do not contaminate sterile field, and change sterile gloves after removing the old central line
- ▶ the tip of the removed catheter should be sent for culture; if this is positive, the railroaded catheter should be removed and a new site used.

Replacing pulmonary artery catheter with a central line through an existing sheath

This should only be done

- ▶ if the sheath has been in situ <72 hours **AND**
- ▶ there is no suspicion of CLABSI, **AND**
- ▶ the line was inserted with strict adherence to aseptic technique.

Purpose-made central lines with a cap that fits over the pulmonary artery catheter sheath and locks, are recommended.

NB

- ▶ special care must be taken not to contaminate the new central line; ie. do not contaminate sterile field, and change sterile gloves after removing pulmonary artery catheter

Management of central lines with a blocked lumen

All attempts should be made to avoid blocked lumens (see maintenance guidelines), however if a lumen does become blocked, the central line should be removed within 24 hours.

Securement Devices

There is some evidence that when compared to sutures, sutureless securement devices decrease CLABSI and catheter dislodgement when used with PICCS in adults and children, however it is not clear whether this is the case for centrally-inserted central lines.⁴²

Dressings^{43,44,45}

Sterile, transparent semi-permeable dressings allow visualisation of the insertion site, and an additional anchor if properly maintained. Sterile gauze dressings may be used instead of the transparent dressing if the site is bleeding or the patient is diaphoretic.



- ▶ All dressings should be changed if they are soiled, wet or loose
- ▶ Transparent dressings should be otherwise changed every 7 days using aseptic technique and alcoholic chlorhexidine, except in paediatric patients where the risk of catheter dislodgement outweighs the risk of infection
- ▶ Gauze dressings should be otherwise changed every 2 days using aseptic technique
- ▶ Antibiotic or antiseptic ointments should not be used at entry sites as they may interact with the catheter material or the transparent dressing.

The latest review of the evidence concludes there is insufficient evidence to determine if there is a difference in preventing CLABSI between gauze and tape or polyurethane dressings.⁴⁶

Chlorhexidine patches

There is good evidence that chlorhexidine-impregnated sponges reduce the rate of CLABSI, even when background levels are low. If the CLABSI rate remains higher than desired in spite of good compliance with the insertion and maintenance guidelines, chlorhexidine patches should be used as a first intervention in conjunction with the transparent dressing on all central lines (including temporary dialysis catheters & pulmonary artery catheters)^{47,48}

Central Line Maintenance

Accessing central line lumens or connectors

Care must be taken not to contaminate the lines when accessing central lines and their administration sets:

- ▶ Hand hygiene must be performed prior to each access (e.g. to give a medication or to connect or disconnect administration sets)
- ▶ A single patient use application of $\geq 0.5\%$ chlorhexidine in 70% alcohol should be used and allowed to dry when decontaminating the catheter hub, administration set connection, or injection ports prior to every access of the circuit. This includes every time an infusion set is added or removed, as well as administration of medication
- ▶ If chlorhexidine in alcohol is contraindicated in the manufacturer's instructions then either aqueous chlorhexidine gluconate or aqueous povidine iodine may be used).

Unused lumens

To prevent lumens becoming blocked, use all lumens for infusions or transducer if possible.

Unused lumens should be flushed with normal saline 4 hourly.

When not in use, patency of dialysis/haemofiltration catheters should be maintained as per local protocol.

Administration sets ^{49,50,51,52}

Administration sets for

- ▶ crystalloids, non-lipid TPN: all additional attachments and transducer sets should be changed between 96 hours and 7 days.
- ▶ Any lipid-containing solutions (including propofol): should be changed every 24 hours when the bag/bottle is changed.
- ▶ blood products should be discarded at the end of the transfusion, or at least every 24 hours

Administration sets should also be changed whenever the central line is changed, irrespective of how recently they were changed.

Needleless connectors

Both negative and positive pressure needleless connectors have been implicated in increases in CLABSI rates, with subsequent decreases in CLABSI with a return to split-septum needleless connectors. These devices should be monitored for any effect on CLABSI rates. ^{53,54}

Disconnection & re-connection of administration sets (& haemofiltration)

The preferred strategy is to discard and not re-use, intravenous (IV) administration sets when they are disconnected, eg for inter or intra-hospital transfers, medical imaging or procedures in other departments. However, if IV administration sets, caps or other connectors are to be reconnected to a central line, aseptic technique **must** be used to disconnect and reconnect including hand hygiene, decontamination of both the external catheter hub and the external connection of the administration set with a solution containing $\geq 0.5\%$ chlorhexidine in 70% alcohol, which is then allowed to dry.

Intravenous fluid bag changes

There is some evidence that for intravenous fluids not containing an additive there is no relationship between duration of use and colonisation, so they do not need to be changed every 24 hours.⁵⁵

For intravenous fluids containing an additive, the bag should be changed according to the medication manufacturer's instructions; if these are not available, the container should be changed every 24 hours.

Drug administration

The following technique should be used whenever accessing ports on an administration set:

- ▶ Use of a clean tray for equipment
- ▶ Hand hygiene using alcohol-based hand rub prior to drug preparation
- ▶ Thorough disinfection of access port, and allow it to dry
- ▶ Taking care not to touch any surface after it is disinfected

There is evidence that chlorhexidine and alcohol swabs ($\geq 0.5\%$ CHG) are more efficient than 70% isopropyl alcohol impregnated swabs^{56,57} at disinfecting access ports on IV administration sets, and are recommended in some central line maintenance guidelines.^{58,59}

Other Considerations

Chlorhexidine bathing

Chlorhexidine bathing has been shown to decrease CLABSI, either in addition to maximal barrier precautions^{60,61,62} or as a single intervention,⁶³ especially where underlying rates are $>5/1000$ line-days. However not all studies were well controlled, and there was no difference in a study where the underlying rate was $<5/1000$.⁶⁴

Blood sampling

If possible, blood should not be taken from central lines for blood tests.

If there is no alternative, it **must** be done using aseptic technique i.e. by using hat, mask, sterile gown and gloves and a dressing pack. The cannula-end and administration set end (and the tops of the culture bottles, if taking blood cultures) are disinfected with $\geq 0.5\%$ chlorhexidine in 70% alcohol, with care not to contaminate either before they are re-connected.

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