

Central Venous Catheter (CVC) Care for a Child

Document Type	Guideline
Function	Clinical Service Delivery
Directorates	Child Health
Department(s) affected	All clinical departments in Child Health
Applicable for which Patients, Clients or Residents?	Children with a CVC in situ
Applicable for which Staff?	All clinicians in Child Health
Keywords (not part of title)	intravenous, alteplase, vancomycin, gentamicin, ethanol, heparin
Author – role only	Nurse Consultant, Child Health
Owner (see ownership structure)	Nurse Consultant, Child Health on behalf of the Nurse Advisor, Child Health
Edited by	Clinical Policy Advisor
Date first published	November 2003
Date last published	June 2014
Review frequency	3 years
Unique Identifier	PP10/CVL/009

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1. Purpose of guideline

These guidelines have been developed for use by healthcare workers who insert central venous catheters (CVC), are involved in the ongoing maintenance of central venous catheters whilst in situ, and for persons responsible for surveillance and the prevention and control of infections in hospital, outpatient and home healthcare settings within Auckland District Health Board (ADHB).

These guidelines are designed to highlight the best critically appraised evidence currently available for the prevention of Central Line Associated Bacteraemia (CLAB) and to provide an opportunity to encourage and support a consistent, evidence-based approach nationally to the prevention of CLAB. In addition, these guidelines also detail the currently available best practices to ensure the safe and effective management of CVCs, including minimising potential risks, and detecting and managing complications early and appropriately.

Refer to Central Venous Catheter (CVC) Care in Adults for guidance on management in adult patients (see Associated ADHB documents section).

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2. Guideline management principles and goals

Central venous catheters are medical devices which travel from outside a patient's skin to the inside of a major blood vessel. The tip of a CVC should be intrathoracic and should ideally lie at the RA/SVC junction. CVCs play an important role in the management of sick infants and children allowing venous access for administration of intravenous fluids and medications, central venous pressure monitoring and blood sampling. While CVCs provide stable venous access, they can lead to infectious or mechanical complications.

By their nature, CVCs breach the body's skin defences and create a potential entry point for infection. Of particular concern are CLABs. That is where a patient's bloodstream becomes infected with bacteria that have been able to enter the bloodstream due to the presence of a central intravenous device. Therefore interventions to reduce the rate of CLAB are especially important. These guidelines reflect the substantial international experience in reducing CLAB through the implementation of the CVC insertion and maintenance bundles.

Careful consideration should be given to the choice of CVC and minimal number of lumens required as appropriate to clinical indication, prior to CVC placement.

Only designated, trained personnel who demonstrate competence in the insertion of central venous catheters should undertake the procedure of CVC insertions.

It is the responsibility of all staff members caring for a patient with a CVC to ensure that they have been assessed as competent to do so.

Nursing staff members who undertake to clear a blocked CVC are responsible for ensuring they have been assessed as competent to do so.

For administration of medications via a CVC, other than heparin/antibiotic/ethanol locking or fibrinolysis, refer to Auckland District Health Board policy for medication administration.

The careful preparation of family/whānau/caregivers and children, using age appropriate therapeutic play techniques and utilising play specialists, is recommended with all CVC management.

Where a child has a CVC in situ, this is to be used for intravenous therapy in preference to inserting a peripheral cannula.

Some children may require a specialised large bore central venous catheter, commonly referred to as a vascath (although a variety of brands may be used). For patients within the paediatric renal service this catheter is only accessed for haemodialysis/apheresis and managed by haemodialysis/blood bank staff members unless agreed to by the on call paediatric nephrologist.

Children who have a short term, uncuffed vascath are not able to be discharged with the catheter in situ but may move around within the hospital. The exception is where the vascath is positioned in a femoral vein where the patient requires bed rest or wheelchair on the ward only.

It is recognised that the recommended practices within this document may at times differ within specialty areas and under emergency situations.

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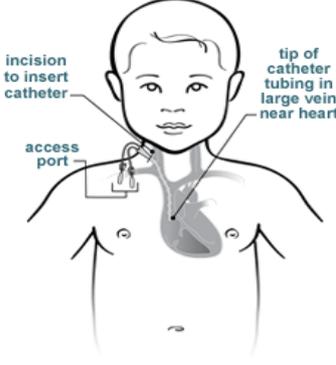
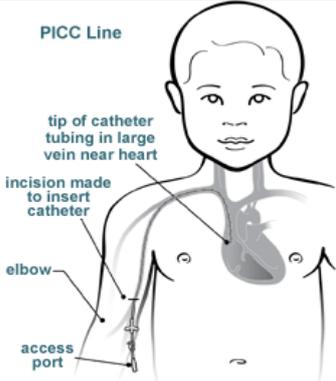
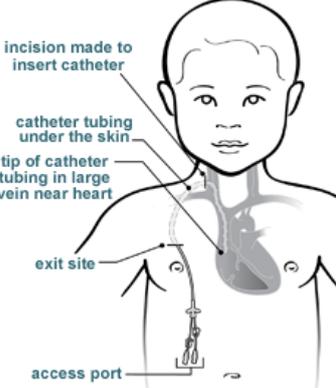
3. Definitions

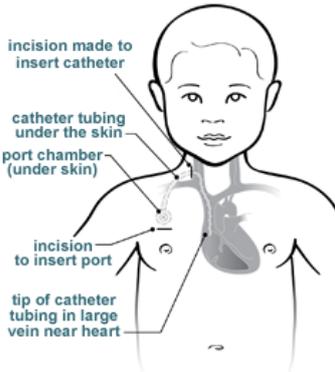
Term	Description
Aseptic non touch technique (ANTT)	Aseptic non touch technique refers to an antiseptic hand wash (30 seconds with antimicrobial soap and water OR alcohol hand rub), use of an aseptic field, appropriate gloves, and the maintenance of a non-touch technique throughout the entire procedure (see associated ADHB documents section).
Antibiotic lock	Instillation of a high concentration of an antibiotic for a pre determined dwell time for treatment of a central line infection
Central Venous Catheter (CVC)	For the purpose of this document, the term 'central venous catheter' refers to: <ul style="list-style-type: none"> • Percutaneously inserted central venous catheter (non-tunnelled) • Peripherally inserted central venous catheter (PICC) • Tunnelled cuffed central venous catheter • Subcutaneously implanted vascular device (PortaCath) • Percutaneous and tunnelled apheresis/haemodialysis type catheter (Vas Cath)
'Child'	For the purposes of this document the term 'child' refers to all infants, children and young people under the Child Health Service
CLAB	Central line associated bacteraemia
Ethanol lock	Instillation of ethanol for prevention of CLAB in children with recurrent central line infections
Heparin lock	The instillation of heparin into the CVC lumen, using a positive pressure technique or positive pressure valve, whenever a CVC is not in continuous use
Positive pressure technique	While instilling the last 0.1 mL of solution, clamp the catheter. Disconnect the syringe. The clamp should not be released once the solution is in place. This will maintain a constant even force within the CVC lumen to prevent any reflux of blood back into the CVC. This technique is not required when a positive displacement valve is in situ (see below)
Positive displacement valve (Also known as a positive pressure valve or positive bolus valve)	Instil solution. Disconnect the syringe. Clamp the catheter. On removal of the syringe from the valve, a bolus of fluid is displaced out the end of the catheter to help clear the catheter lumen and prevent retrograde flow of blood into the catheter. A positive displacement device is to be used for all PICC catheters and only as clinically indicated for any other central line
Recommended cleaning solution	2% Chlorhexidine/70% alcohol. This is available as either, solution, wipes or swab sticks. 10% povidone iodine, alcoholic tinctures of iodine, 70% alcohol alone or 2% chlorhexidine alone are acceptable if there is a contraindication to one or other component

<p>Recommended dressing</p>	<p>A transparent, high moisture vapour transmission rate dressing (e.g. Tegaderm IV or IV 3000 1 Hand).</p> <p>The use of an alternative transparent high moisture transmission rate dressing may be considered for patients with allergy to above or sensitive skin (e.g. Mepore IV or Polyskin).</p> <p>The use of a chlorhexidine dressing (e.g. Biopatch or Tegaderm CHG) may be considered for individual patients identified as high risk of CLAB in collaboration with the paediatric infectious disease team.</p> <p>The use of a more absorbent transparent dressing (e.g. Opsite Postop Visible) may be considered for:</p> <ul style="list-style-type: none"> • Immediate post operative dressing for tunnelled CVCs and PICCs • Serous/blood ooze from percutaneous CVC site
<p>Recommended flush volume</p>	<p>The volume of the flush solution (0.9% sodium chloride) should be equal to twice the volume of the catheter and add-on devices with a maximum volume of 10ml.</p>
<p>Turbulent flow flushing technique</p>	<p>Using a ‘push-pause-push’ technique while flushing a CVC with 0.9% sodium chloride e.g.</p> <ul style="list-style-type: none"> • Following administration of a medication • Prior to connection of an administration set • Following the withdrawal of a blood sample • Prior to heparin locking <p>This technique will create a turbulent flow within the CVC lumen assisting in the prevention of fibrin deposits and drug precipitation.</p>

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4. CVC catheter types

Category		Characteristics
<p>Short Term maximum 10 days – 2 weeks</p> <ul style="list-style-type: none"> • Percutaneously inserted • Non tunnelled • Single or multiple lumen <p>e.g. Arrow</p>	<p>Temporary Central Line</p> 	<ul style="list-style-type: none"> • Suitable for acute care needs, e.g. operating theatre, intensive care • Direct entry into vein associated with increased risk of complications when used on a longer term basis • Antimicrobial coated and impregnated catheters may be considered for individual patients identified as high risk of CLAB in collaboration with the paediatric infectious disease team
<p>Medium Term Catheters weeks – months</p> <ul style="list-style-type: none"> • Peripherally inserted central catheter (PICC) • Inserted via basilic or cephalic vein • Single or double lumen 	<p>PICC Line</p> 	<ul style="list-style-type: none"> • Suitable for medium term use in some patient groups e.g. home antibiotic therapy • Reduced risk of infection compared to short term catheters
<p>Long Term Catheter months - years</p> <ul style="list-style-type: none"> • Tunnelled, cuffed catheters • Single or double lumen <p>e.g. Hickman or Broviac</p>	<p>Tunneled Catheter</p> 	<ul style="list-style-type: none"> • Used when long term and frequent access is required • Catheter is tracked subcutaneously to entry site of chosen vein and a dacron polyester fibre cuff is placed approximately 2cm from exit site in order to reduce risk of infection and to secure line

<p>Long Term Catheter years</p> <ul style="list-style-type: none"> • Subcutaneous venous access device (SVAD) • implantable venous port <p>e.g. Port-a-Cath</p>	<p>Implantable Venous Port</p>  <p>incision made to insert catheter</p> <p>catheter tubing under the skin</p> <p>port chamber (under skin)</p> <p>incision to insert port</p> <p>tip of catheter tubing in large vein near heart</p>	<ul style="list-style-type: none"> • Used when cyclical access required • Minimal maintenance between use • Avoids repeat catheter insertion and associated anaesthesia • May be compatible with CT power injector
<p>Large Bore Catheter</p> <ul style="list-style-type: none"> • Percutaneous catheter e.g. Medcomp, Gamcath, Mahurkar • Tunnelled catheter e.g. Medcomp, Quinton permacath 	<p>Short term</p> <p>Long term</p>	<ul style="list-style-type: none"> • Indicated for specific therapy e.g. haemodialysis, apheresis or continuous renal replacement therapy

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5. CVC placement, pre and post operative maintenance

All children and their families need to be appropriately prepared for the placement of a CVC. This includes, an explanation to the child and family regarding the pre operative preparation, procedure and postoperative management.

Percutaneous and peripherally inserted CVCs may be inserted in either the operating rooms or the Paediatric Intensive Care Unit (PICU) -see associated ADHB documents section. Tunnelled cuffed and subcutaneously implanted CVCs are always inserted in the operating room.

To decrease the likelihood of CVC infection ensure the insertion bundle and checklist (CR4030 – see associated ADHB documents section) is followed whenever a CVC is inserted.

Central venous catheter insertion bundle

- i. Optimal catheter site selection;
- ii. Hand hygiene;
- iii. Chlorhexidine skin antisepsis;
- iv. Maximal barrier precautions.

Optimal catheter site selection

The risk and benefit of both infectious and non-infectious complications, reason for the catheter and likely duration of use must all be considered on an individual basis when determining which CVC insertion site to use for infants and children.

There is some evidence that the subclavian vein is associated with a lower risk of CLAB compared to the jugular site with no difference in haemothorax, pneumothorax or vessel occlusion. However, recent paediatric thrombosis guidelines recommend CVCs should not be sited in subclavian or femoral sites, particularly where there is a high risk of thrombosis. Clinician experience and skill is usually greater with the internal jugular and femoral sites.

Other factors also need to be considered when determining which site to use, e.g. the internal jugular vein is the site of choice for central haemodialysis catheters (tunnelled or non-tunnelled) because of the consequences of subclavian stenosis or thrombosis.

Hand hygiene

To decrease the likelihood of CVC infections, proper hand hygiene using an alcohol based hand product or an antiseptic soap and water is required. When caring for CVCs, appropriate times for hand hygiene include:

- Before putting on and after removing gloves
- Before and after palpating catheter insertion site prior to commencing the aseptic procedure

- Before and after any CVC manipulation

Further information on appropriate hand hygiene technique can be accessed at the Hand Hygiene website (see supporting evidence section).

Chlorhexidine skin antisepsis

Application of a cutaneous antiseptic solution that will effectively disinfect the site of insertion before placing a CVC is an important method of preventing catheter-related infection. Skin antisepsis with chlorhexidine gluconate provides better antisepsis than other antiseptic agents.

The preferred approach is to use a single patient application of 2% chlorhexidine gluconate in 70% isopropyl alcohol and allow to dry prior to inserting the CVC. However, 10% povidone iodine, alcoholic tinctures of iodine or 70% alcohol are acceptable if there is a contraindication to chlorhexidine gluconate.

Optimal skin antisepsis for the neonatal population is unknown as the evidence is inconclusive. While one study found that 0.5% chlorhexidine/70% isopropyl alcohol was no more effective than 10% povidone-iodine, another study suggested that 0.5% chlorhexidine/70% alcohol was superior to 10% povidone iodine. An antiseptic should be used with the choice of agent based on clinical judgement.

Maximal barrier precautions

A key component of the bundle is to apply maximal barrier precautions in preparation for line insertion. Mermel et al demonstrated that the odds ratio was 2.2 times greater for infection without maximal barrier precautions, while Raad et al demonstrated a 6.3 times greater likelihood for infection without maximal precautions.

For the person inserting the CVC, maximal barrier precautions means:

- cap
- mask
- sterile gown
- sterile gloves

For the patient:

Cover the patient, as much as is safe to do so, with a large sterile drape with a small opening for the site of insertion. Ensure an adequate sterile field is provided to ensure that the catheter or guide wire is not exposed to contamination during the insertion procedure. If an ultrasound is used to guide insertion of the catheter, the probe should be inserted into a sterile sleeve.

Compliance with maximal barrier precautions is a shared clinical responsibility. Clinicians inserting a CVC should stop the procedure, if safe to do so, if a healthcare professional assisting with the procedure highlights a breach in aseptic technique including inadequate hand hygiene, skin antisepsis or maximal barrier precautions.

Healthcare staff members are to document the procedure on the CVC Insertion checklist (CR4030) to ensure adherence to the bundle components at the time of CVC placement and for ongoing audit and feedback on adherence to infection prevention practices.

Exceptions to insertion bundle practice

In acute resuscitation circumstances, where a patient's life is at risk and urgent CVC placement is required, adherence to all elements of the insertion care bundle may not be possible. Strict adherence to the insertion bundle may actually compromise patient wellbeing by delaying the establishment of venous access.

Whilst the bundle represents established best practice, its application in acute resuscitation situations needs to be based on clinical judgement. Breaches of best practice in such situations should be recorded and notified to the medical team caring for the patient, and the CVC should be replaced with a device inserted according to best practice as soon as it is safe and practical to do so.

To prepare a child for insertion of a CVC in the operating room:

- Ensure the child goes to the operating room in clean clothes or pyjamas
- Ensure the child is fasted as per Starship guidelines
- Complete the pre-operative checklist
- Ensure that pre-anaesthesia assessment has been completed by the child's guardian
- Ensure informed consent for the procedure has been obtained by medical staff members
- Ensure a full blood count (FBC) has been taken and documented on the anaesthetic form, within the last 24 hours where appropriate
- Ensure that blood has been taken for "Group and Hold" in the instance where blood products may be required
- Ensure that the child's weight and base line recordings have been recorded on the anaesthetic record
- Prepare one parent or caregiver to enter the operating room during anaesthetic induction where appropriate

Management of a child following insertion of a CVC is aimed at ensuring the child has an uneventful recovery from the anaesthesia and procedure, and any complications are detected early and managed appropriately.

- Ensure that the CVC insertion record (CR4030) is completed and added to the patient's clinical record
- Where a PICC has been inserted, ensure documentation of length of PICC is recorded on the insertion form
- Assess and record vital signs on return to the ward and then as the child's condition dictates
- Observe and document status of insertion and exit sites and dressings, on return to the ward and daily

- Prior to using the CVC, ensure correct placement of CVC has been confirmed by x-ray and documented as such by a medical staff member
- If continuous fluids are not in progress ensure that the CVC has a heparin lock according to CVC heparin locking guideline and that subcutaneously implanted CVCs remain accessed as required

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6. Use of infusion pumps with a CVC

To minimise the risk of potential complications from central venous catheter therapy within Starship Children's Health, all children receiving continuous intravenous fluids via a CVC must have their infusion controlled by an infusion pump. The programmed volume to be infused should be set and is not to exceed 2 hours.

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7. Central venous catheter maintenance bundle

The CVC maintenance bundle focuses on the post insertion management of CVCs related to preventing CLAB:

- i. Daily review of line necessity and prompt removal of unnecessary lines;
- ii. Dedicated access for Intravenous Nutrition (IVN), also called parenteral nutrition (PN);
- iii. Access the CVC lumens aseptically;
- iv. Daily review of CVC entry site for inflammation.

Daily review of line necessity and prompt removal of unnecessary lines

It is clear that the risk of infection increases the longer the catheter remains in place and that the risk of CLAB is eliminated once the catheter is removed. A daily review of the CVCs necessity should prevent unnecessary delays in removing catheters that are no longer needed. Where long term catheters are in situ, a schedule for review of necessity is encouraged, e.g. monthly review.

The Centre for Disease Control (CDC) guidelines do not recommend routine replacement of functioning CVCs that have no evidence of local or systemic complications.

All children with a CVC in situ require 4 hourly temperatures to be recorded. A child with a CVC in situ who spikes a temperature $> 38^{\circ}\text{C}$ and has signs of sepsis (chills, rigors, hypotension, or tachycardia) should have 2 sets (sequentially or within 12 hours) of blood cultures taken; one from a peripheral venepuncture and one from the CVC.

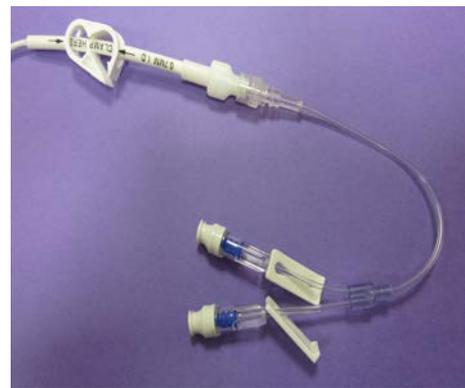
Do not remove the CVC on the basis of fever alone, clinical judgment and further evaluation of the patient is necessary. Consult with the paediatric infectious disease team as appropriate.

Dedicated access for IVN

Intravenous nutrition increases the risk of developing a CLAB. The first preference is for a dedicated single lumen CVC, not previously used for other intravenous medication or fluid. This decision needs to be based on clinical judgment balancing the reduced risk of infection versus the risk of complications of a new catheter.

The second preference is to have a previously unused lumen on a multi-lumen CVC. A lumen dedicated to IVN is recommended to minimise the number of times the lumen is manipulated which reduces the risk of contamination and may decrease the risk of infection.

These preferences may not always be feasible in neonatal and paediatric patients due to lack of venous access and competing demands. In some instances, it is desirable to administer an antibiotic via the IVN lumen. Under these circumstances within Children's Health, it is recommended practice to add a short Y extension to the IVN administration set prior to connecting to the patient, to allow for administration of additional medications without disconnecting the IVN administration set.



Attach IVN/TPN to one needle free access device and administer meds via 2nd access device.

Access the CVC lumens aseptically

Perform hand hygiene using an antiseptic soap and water or an alcohol based hand product before and after any CVC cares.

An aseptic non touch technique is used for all aspects of CVC management (excluding insertion). This includes no artificial nails or chipped nail polish and only a single banded ring to be worn when performing any central line care.

Before accessing catheter hubs or injection ports, cleaning with 2 % chlorhexidine gluconate in 70 % isopropyl alcohol. Allowing sufficient time to dry is important to reduce contamination.

Administration sets and needleless access devices are changed as per guideline

Ensure that no blood has collected and remains around the CVC site or in any of the needleless access connectors.

Ensure that the CVC and administration set is accessed the minimal number of times, e.g. co-ordinate blood sampling with line access for medications.

Ensure that the CVC is secured away from an infant's nappy area.

Daily review of entry site for inflammation

Central catheter site infections may initially go unnoticed. It is clear, however, that the sooner an infection is identified, the more quickly treatment can be initiated.

Ensure that a semi-permeable transparent intravenous dressing is used so that daily review of the insertion site for signs of redness or infection is undertaken. This can prevent unnecessary delays in providing appropriate interventions in patient care. Daily, and with every dressing change, site assessment findings should be clearly documented in the patient's clinical record. Site assessment findings can contribute to a more comprehensive assessment and resultant clinical decision on whether CVC removal is appropriate.

All 4 sides of the dressing should be secure. Transparent dressings are routinely changed weekly or as required when the dressing is compromised or blood is present at exit site. Consider using a more absorbent transparent dressing with high water vapour transmission rate when blood/serous ooze is present at the exit site.

The use of a chlorhexidine impregnated dressing may be considered on an individual basis in consultation with the paediatric infectious diseases team.

8. CVC exit site dressing

- For tunnelled CVCs and PICCs placed in theatre, if a non-transparent dressing is used, ensure the dressing remains intact for 24 hours post insertion. If there is excessive ooze on the dressing, contact the surgical registrar to assess the dressing re further management. After 24 hours, remove the dressing, clean and redress with the recommended transparent dressing. If an absorbent transparent dressing is used initially, this can be left on for a week (or changed as indicated by amount of exudate).
- For percutaneous CVCs and PICCs placed in PICU, usually a transparent dressing is used immediately following insertion
- Transparent dressings are routinely changed weekly or as required where dressing is compromised or blood is present at exit site
- Gauze dressings are changed 24 hourly
- Where dressings are applied that are not the recommended dressing, the frequency of dressing changes are as per manufacturers instruction
- On well healed, tunnelled cuffed CVCs it may not be necessary to apply a dressing. This should be decided and clearly documented on an individual basis
- The neck wound site dressing can be removed once site is healed
- If the child is discharged less than 24 hours post insertion with a non – transparent dressing, arrange for the community nursing service to change dressing within 24 hours of insertion as per dressing management of a CVC exit site guideline

Equipment required

- Non sterile gloves
- Cleaned reusable tray (aseptic field)
- Recommended cleaning solution (refer to glossary)
- Recommended dressing (refer to glossary)
- 0.9% sodium chloride and gauze swabs for cleaning if exudate or blood is present

Procedure

- Follow an aseptic non touch technique throughout the procedure
- Remove previous dressing and discard
- Inspect exit site for signs of infection
- Prepare equipment
- Pick up the distal end of the CVC and clean CVC with recommended wipe from the exit site to the CVC hub and allow to dry
- Clean site with recommended wipe or swab stick using friction and starting from the exit site extending out to the area which should be covered by the dressing
- Allow area to dry and apply recommended dressing
- Ensure that the dressing is sealed around the CVC site. Catheters and extensions can be looped under the dressing for extra security
- Do not apply gauze around the catheter or exit site as this will inhibit vision of the site and alter the moisture transmission rate of the recommended dressing
- Dispose of all waste as per individual area practices

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- Document the date of dressing change, physical condition of the site and any nursing intervention
- Report any signs of infection or changes in skin integrity to a member of the primary medical team

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9. CVC administration set change

To reduce the risk of infection, CVC administration sets are changed:

- On completion of blood products infusion
- Following accidental disconnection
- Every 24 hours if IVN is in progress
- Every 96 hours in all other instances

An intermittent administration set can be changed every 24 hours as long as:

- The intermittent administration set is capped securely with a blind end cap between use
- The needleless access device is cleaned prior to re-connection of intermittent administration set
- The time and date of first use are recorded on the administration set

Equipment required

- Non sterile gloves
- Cleaned reusable tray (aseptic field)
- Recommended cleaning solution
- 0.9% sodium chloride (ampoule or prefilled syringe)
- 10mL syringes and needles as required

Procedure

- Ensure an aseptic non touch technique is used throughout
- Prepare patient and catheter
- Draw up 0.9% sodium chloride or use prefilled syringe.
- Prime new administration set and clamp set
- Clean key parts with recommended cleaning solution
- Disconnect the current administration set or for heparin locked CVC, withdraw previous heparin and discard. Stop the procedure, and inform a member of the primary medical team if a heparin lock (100 or 1000 units/mL) is unable to be withdrawn
- Flush CVC with 0.9% sodium chloride using a 'turbulent flow' technique
- Connect new administration set to CVC
- Place new administration set in pump
- Verify pump settings are appropriate
- Open clamps and commence infusion at prescribed rate
- Ensure that all lines are clearly labelled
- Dispose of all waste as per individual area practices
- Document the date of administration set change in the patient's clinical record and on the administration set

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10. CVC needleless access device change

To reduce the risk of infection, CVC needleless access devices are changed every 96 hours when being regularly accessed in hospital or weekly/monthly if not being regularly accessed in the hospital or being accessed in the community, to coincide with flushing, heparin locking and exit site dressing changes.

Equipment required

- Non sterile gloves
- Cleaned reusable tray (aseptic field)
- Recommended cleaning solution
- 0.9% sodium chloride (ampoule or pre filled syringe)
- 10mL syringes and needles as required

Procedure

- Ensure an aseptic non touch technique is used throughout
- Prepare patient and catheter (ensure clamps are closed)
- Flush new needleless access device with 0.9% sodium chloride
- Clean key parts with recommended cleaning solution
- Remove previous needleless access device and connect new one to CVC
- Dispose of all waste as per individual area practices
- Document the date of needleless access device in the patient's clinical record

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11. CVC heparin locking

When a continuous infusion is not in progress it is necessary to instil a heparin lock to maintain CVC patency. The strength of the heparin will depend on various factors such as, catheter type, the time between heparin instillation, and patient characteristics.

Contraindications for heparin use

Anaphylaxis to heparin.

Heparin strength during regular use:

- All percutaneous CVCs should be accessed, flushed with 0.9% sodium chloride and locked with heparin 10unit/mL (50units/5mL ampoules) at least 8 hourly
- Where all non-percutaneous CVCs are being accessed more frequently than daily, use heparin 10units/mL (50units/5mL ampoules)
- Where all non-percutaneous CVCs are being accessed daily or less frequently, use heparin 100units/mL (200units/2mL ampoules) except:
 - For haemophilia patients always use heparin 10 units/mL (50units/5mL)
 - For apheresis catheters always use heparin 1000units/mL
- Infants less than 5 kg in PICU and PCC service will have a continuous low dose heparin infusion administered as prescribed via their CVC until removal of the CVC
- All children within the paediatric and congenital cardiac services will have a low rate (TKVO) continuous intravenous infusion via one lumen of their CVC, rather than heparin locking, unless otherwise documented by a medical officer. This is due to the increased risk and potential consequences of thrombosis to these patients because of their abnormal cardiac anatomy
- Children within the paediatric haematology/oncology service generally have a TKVO infusion running

See next page for heparin strength/volume when long term CVC are not in regular use:

Heparin strength/volume when long term CVC are not in regular use:

Type of line	Heparin volume	Heparin strength	
SVAD	2mL	100 units/mL monthly	
Tunnelled	<1yr = 0.5mL (each lumen) >1yr = 1mL (each lumen)	100 units/mL every 7 days	
PICC	<1yr = 0.5mL (each lumen) >1yr = 1mL (each lumen)	100 units/mL every 7 days	
Haemodialysis /Apheresis Catheters	Use intraluminal volumes specified on the catheters. Exact volumes to be used (see table below).	1000 units/ml between therapy up to weekly	
List of haemodialysis/apheresis catheters in use in Starship		Luminal volume	
Uncuffed catheter	Gamcath GDK-610P (6.5fr x 10cm)	A=0.75mL	V=0.78mL
	Medcomp SL12P (8fr x 12cm)	A=0.6mL	V=0.6mL
	Medcomp SL15P (11.5fr x 15cm)	A=0.9mL	V=1.2mL
	Mahurkar 8817 143005 (10fr x 12cm)	A=0.9mL	V=1.0mL
	Mahurkar 8813 817009 (11.5fr x 13.5cm)	A=1.1mL	V=1.2mL
	Mahurkar 88304 150003 (11.5fr x 16cm)	A=1.2mL	V=1.3mL
	Bard niagara slim cath 5553150(12fr x 15cm)	A=1.2mL	V=1.2mL
Cuffed catheter	Medcomp SL18P (8fr x 18cm)	A = 0.8mL	V= 0.9mL
	Medcomp SL24P (8 Fr x 24cm)	A=0.9mL	V= 1.0mL
	Quinton permacath 8834 369001 (10fr x 28cm)	A=0.8mL	V=0.85mL
	Quinton permacath 8817 748001 (12fr x 36cm)	A=1.3mL	V=1.4mL
	Quinton permacath 8817 749001 (12fr x 40cm)	A=1.4mL	V=1.5mL
	Quinton permacath 8831 692001 (12fr x 45cm)	A=1.6mL	V=1.7ml

Equipment required

- Non sterile gloves
- Cleaned reusable tray (aseptic field)
- 10mL syringes and needles as required
- Filter needle (if required for glass ampoule)
- Heparin as prescribed (or as standing order)
- 0.9% sodium chloride as required (ampoule or prefilled syringe)
- Needleless access device
- Recommended cleaning solution

Procedure

- Use an aseptic non touch technique throughout
- Prepare equipment, using an independent double check procedure
- Prepare patient, stopping infusion if in progress and clamp catheter
- Clean key parts
- Disconnect the current administration set or needleless access device (if due to be changed)
- For CVCs locked with heparin 100units/mL and 1000 units/mL, withdraw previous heparin and discard.
- Stop the procedure and discuss with medical staff members if blood/heparin is unable to be withdrawn. DO NOT FLUSH the catheter as this will result in the administration of heparin to the patient
- If required, attach a new needleless access device, flush CVC with 0.9% sodium chloride using a turbulent flow technique
- A positive displacement device is to be used for all PICC and only as clinically indicated for any other central line
- Instil heparin solution using positive pressure technique while clamping the CVC and then disconnect the syringe. If a positive displacement device is in situ, instil heparin, disconnect the syringe and then clamp the line
- Where 100unit/mL or 1000 unit/mL heparin is instilled, clearly label the catheter indicating this
- Dispose of all waste as per individual area practices
- Document the procedure in the patient's clinical record
- Sign medication administration record for the heparin administered

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12. Blood sampling from a CVC

Blood samples can be obtained from a CVC. It is advisable to assess the appropriateness of sampling from the CVC as per individual area practices as some tests are not advised to be taken from CVC lines as follows:

- Serum levels should not be obtained from the same lumen as medication administration
- Coagulation studies should not be obtained from a heparinised lumen
- No samples should be routinely taken from renal dialysis catheters by members of the ward nursing staff

Equipment

- Unsterile gloves
- Cleaned reusable tray (aseptic field)
- 10mL syringes and needle as required
- Sodium chloride 0.9% as required (ampoule or prefilled syringe)
- Recommended cleaning solution
- Labelled specimen containers as required

Procedure

- Use an aseptic non touch technique throughout
- Note: It is recommended that where possible all blood sampling should be taken without breaking the line e.g. via a designated needleless access device. When obtaining a [blood culture](#), use sterile gloves and change the needleless access device immediately prior to aspirating the blood sample (see associated ADHB documents section).
- Prepare equipment, drawing up 0.9% sodium chloride as required or use a prefilled syringe
- Prepare patient, discontinuing any infusions in progress via all lumens
- Clean key parts
- Aspirate initial 2-5 mL and discard. If blood cultures are to be taken, this initial blood draw should be used as the specimen for older children
- Obtain blood specimens as requested (blood culture bottles should be filled first)
- Flush CVC with 0.9% sodium chloride using turbulent flow technique prior to either heparin locking or continuing with infusion
- Ensure no blood remains in the needleless access device
- Dispose of all waste as per individual area practices
- Document the procedure in the patient's clinical record

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13. Accessing a subcutaneously implanted port

When a subcutaneously implanted port is accessed for treatment, non-coring needles are changed every 7 days. When a subcutaneously implanted port is not being used regularly, it is accessed monthly to flush the catheter and replace the heparin lock.

Within Starship, power ports are inserted. These ports are able to with-stand 300 pounds per square inch (psi) and can therefore be used for a power injection of contrast media. However, for a contrast injection to be administered via the port a POWER LOC needle needs to be inserted. The nurse must also attach the sticker provided in the pack onto the extension set which signifies that contrast can be administered.

At all other times a gripper needle is inserted. Both gripper and power loc needles are non-coring and have an extension set attachment.

Equipment

- Non sterile gloves
- Cleaned reusable tray (aseptic field)
- Recommended cleaning solution
- 10mL syringes and needles as required
- Filter needle (for monthly flush and heparin lock)
- Gauze swab (for monthly flush and heparin lock)
- Needleless access device
- Port needle with luer lock extension (e.g. Gripper needle or POWER LOC needle)
- Recommended dressing
- 0.9% sodium chloride (ampoules or prefilled syringe)
- Heparin as prescribed (10units/mL if lock administered more frequently than daily or for haemophilic patient or 100units/mL if monthly heparin lock)

Procedure

- i. Use an aseptic non touch technique throughout the procedure;
- ii. Assemble all equipment;
- iii. Draw up 0.9% sodium chloride (or prefilled syringe);
- iv. Draw up heparin using an independent double check procedure;
- v. Attach needleless access device to the non-coring needle and extension set;
- vi. Prime with 0.9% sodium chloride;
- vii. Leave syringe attached to extension set with remaining sodium chloride solution;
- viii. Prepare patient by removing any clothing that obscures port site and raise the child's arm above head if necessary or position the child as appropriate;
- ix. Remove topical anaesthetic if applicable;
- x. Clean the skin with recommended cleaning solution over implanted CVC site;
- xi. Starting in the centre, use a friction and extend out to the area that will be covered by the dressing;
- xii. Using the non-dominant hand, locate the port rim and stabilize the port with three fingers to stop the port moving under the skin during the procedure;

- xiii. With the dominant hand, insert the needle at a right angle into the middle of the port. Push the needle slowly but firmly through the child's skin into the septum of the PortaCath;
- xiv. Pull back on syringe attached to the extension tubing. This allows blood to flow from the port into the syringe to confirm correct placement of port needle;
- xv. Draw back 2mL and discard. If blood unable to be withdrawn:
 - reposition child
 - reposition needle
- xvi. If blood is still unable to be withdrawn, stop the procedure and discuss with a member of the primary medical team regarding need for radiological examination prior to further action;
- xvii. Once blood withdrawn or position confirmed by radiological examination or member of the primary medical team, remove syringe from extension set and discard. Flush with 10mL of 0.9% sodium chloride using turbulent flow technique;
- xviii. If port is being used more frequently than daily, lock with heparin (10units/mL) as prescribed;
- xix. If port is being used less frequently than daily, lock with heparin (100units/mL) as prescribed;
- xx. Remove wings from port needle and discard. Apply dressing securely and firmly over the port needle, ensuring all edges of dressing are sealed securely to prevent dressing lifting. Younger children may need a securing device (e.g. Flexi track) to prevent accidental needle removal;
- xxi. Record the procedure and confirmation of correct needle placement in the patient's clinical record;
- xxii. If port is being accessed for monthly maintenance only, lock with heparin (100units/mL) as prescribed. The gripper needle should be removed vertically with the non dominant hand stabilising the Port. Using gauze swab apply pressure to exit site. Inspect the site and needle. Cover the exit site with a small dressing;
- xxiii. Report any changes to a member of the primary medical team and document in the patient's clinical record;
- xxiv. Dispose of all waste as per individual area practice.

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14. De-accessing a subcutaneously implanted port

To safely remove a needle from a subcutaneously implanted CVC when the needle is being changed every 7 days or following monthly flush and heparin lock replacement.

Equipment

- Non sterile gloves
- Cleaned reusable tray (aseptic field)
- Gauze swabs
- Recommended cleaning solution
- 10mL syringes and needles as required
- Filter needle (for monthly flushing and lock)
- 0.9% sodium chloride (ampoules or prefilled syringe)
- Heparin as prescribed
- Small adhesive dressing (e.g. band aid)

Procedure

- i. Use an aseptic non touch technique throughout;
- ii. Draw up 0.9% sodium chloride or use prefilled syringe;
- iii. Draw up heparin using an independent double check procedure, using a filter needle if a glass ampoule is used;
- iv. Prepare the patient and remove any clothing that obscures the port site;
- v. Loosen the edges of the dressing, leaving the dressing around the non coring needle;
- vi. Attach the syringe of 0.9% sodium chloride to the extension set and, if previously locked with strong heparin, withdraw 2 mL blood/heparin and discard. If blood/heparin unable to be withdrawn:
 - reposition child
 - reposition needle
- vii. If blood/heparin is still unable to be withdrawn, stop procedure and discuss with a member of the primary medical team regarding need for radiological examination prior to further action;
- viii. Once blood withdrawn or position confirmed by radiological examination or member of the primary medical team, remove syringe from extension set and discard. Flush with 10mL of 0.9% sodium chloride using turbulent flow technique;
- ix. Attach the syringe with the prescribed heparin and administer clamping with the final 0.2mL to create a positive pressure within the port;
- x. The non-coring needle and remaining dressing should be removed vertically with the non dominant hand stabilising the Port. Using gauze swab, apply pressure to exit site;
- xi. Inspect the removed needle and site;
- xii. Report any changes to a member of the primary medical team;
- xiii. Cover the exit site with a small dressing;
- xiv. Document procedure in the patient's clinical record;
- xv. Dispose of all waste as per individual area practice.

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15. Complications

a) Potential for strangulation from IV lines

There is a risk to young children 6 months to 5 years of age getting tangled in their IV lines due to turning in bed while asleep. The risk in hospital is ameliorated by hourly IV site and line checks.

Other practices to consider in order to reduce risk include:

- Ensuring that sleeping children are visible (e.g. curtains pulled back).
- Limiting the length of IV tubing
- Ensuring that lines are well secured and that
- Tracking the line down a singlet or PJ top or leg (to exit at the furthest point from the neck)
- Ensuring that the tubing is anchored at a number of points so that it exits at the lower trunk rather than the neck
- Placing the IV pole at the foot end of the bed

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b) Infection

CVCs breach the body's skin defences and are associated with increased rates of bacteraemia, therefore ongoing interventions to reduce the rate of CLAB are especially important. Ensure the daily maintenance bundle and checklist (CR4032 – see associated ADHB documents section) is completed.

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c) Phlebitis

Phlebitis is inflammation of the intima of the vein. There are 3 main causes; mechanical, chemical and infective. For inpatients, all CVC sites should be assessed and documented at least once per shift for signs of phlebitis using the phlebitis score from the peripheral intravenous catheter management RBP (see associated ADHB documents section).

Following PICC insertion, upper arm mechanical phlebitis is common and is evidenced by redness, warmth, and tenderness. This is not an indication to remove the line.

Phlebitis is managed with limb elevation and application of warm heat packs.

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d) Occlusion

Occlusion is the most common non-infectious complication. The majority of occlusions are due to thrombosis. Catheter occlusions can be complete or partial:

Complete: neither infusion nor aspiration is possible through the catheter.

Partial: infusion is possible, but aspiration is not. While lack of blood return or a sluggish flow may indicate a partial catheter occlusion, it may also be indicative of a malpositioned tip and further assessment of the line is necessary.

Catheter occlusion can lead to infiltration, extravasation, infection or venous thrombosis (complete blockage of vein with potential for embolus). To reduce the risk of occlusion:

- Ensure that a heparin lock is administered as prescribed when the CVC is not in continuous use.
- Ensure that all CVCs are flushed with 0.9% sodium chloride following administration of all medications, blood withdrawal and prior to heparin locking.
- Ensure that a turbulent flow flushing technique is carried out.
- Ensure either a positive pressure technique or positive displacement valve is used.
- Ensure that any symptoms of a potential thrombus are identified early and reported to a member of the primary medical team. Symptoms include:
 - Swelling or compromised perfusion to a limb distal to the site of a central line
 - Resistance to infusion
 - Instances where blood cannot be drawn back on a catheter. The line can continue to be used if able to flush and approved by a member of the primary medical team
 - Leaking from the site of a central venous catheter
 - Instances where IV therapy administered via the central catheter is not having the expected affect e.g.:
 - Not achieving therapeutic levels of medication
 - Paralysis medications not working

Initiate early discussion with the primary medical team regarding the need for x-ray or line o-gram.

Manage occlusions as per the fibrinolytic agent administration guideline.

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e) Accidental disconnection of administration set

To manage an accidental disconnection:

- Clamp the CVC proximal to the area of disconnection
- Assess the child's condition and amount of blood loss
- Notify the primary medical team
- Aspirate CVC to ensure blood withdrawal
- Send blood for culture as requested
- Flush line with 0.9% sodium chloride when patency confirmed
- Change administration set

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f) Infiltration and extravasation

Infiltration is the inadvertent administration of non-vesicant medication or fluid into surrounding tissue. Extravasation is the inadvertent administration of vesicant medication or fluid in to surrounding tissue.

Be aware of potential for internal infiltration/extravasation to occur, particularly with left femoral percutaneous catheters or due to a misplaced/dislodged implanted port needle. Pain/discomfort may be a key sign as swelling may initially be difficult to detect. Be vigilant when administering potential vesicants e.g. cytotoxic therapy, parenteral nutrition.

To reduce the risk of infiltration and extravasation:

- Carry out and document an hourly site assessment, using the Infiltration score from the peripheral intravenous catheter management RBP, (see associated ADHB documents section) and catheter security
- Do not obtain blood pressure recordings on a patients arm with a PICC in situ
- Consider the use of vests and mittens on infants and small children

If infiltration/extravasation is suspected:

- Stop infusion
- Notify the primary medical team immediately

If CVC falls out completely:

- Apply pressure to the vessel entry site; for percutaneous and PICC lines this will be the same site as the catheter exit site. For tunnelled catheters, this site will be different to the CVC exit site. Refer to [CVC catheter types](#)
- Obtain medical assistance immediately

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g) Rupture of CVC

To reduce the risk of catheter rupture:

- Use 10 mL syringes or larger when accessing a CVC so that no undue pressure is exerted on the CVC
- Ensure that the CVC is protected from sharp objects, twisting, stretching and tension placed on the line

If CVC rupture occurs:

- Clamp the CVC proximal to the area of rupture
- Lie patient on left side, head down
- Notify the primary medical team immediately
- Do not remove CVC without a senior medical staff members' advice

If able to be repaired, obtain a CVC repair kit from the Starship operating rooms. Repair kits are designated for the particular catheter brand, size and lumen (e.g. Broviac 4french brown lumen).

CVC repair should only be undertaken by:

- Designated trained and experienced nursing staff members (including CNA)
- Surgical registrar

Document any CVC complications and interventions carried out in the patient's clinical record.

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h) Air embolism

An air embolism in a CVC is a medical emergency. Notify the primary medical team if the child becomes:

- Tachycardic
- Dyspnoeic or
- Exhibits other signs of an air embolism

Initiate resuscitation and call a paediatric code blue as required

To reduce the risk of air embolism:

- Ensure that all CVC administration sets have luer lock connections. Ensure that all CVC administration set connections are secure at the commencement of each shift, and checked a minimum of 4 hourly and following administration set change
- Ensure that administration sets are primed prior to connection to CVC
- Ensure that a CVC safety kit containing 1 pack of gauze swabs and 2 clamps, is available in close proximity at all times
- Ensure that the CVC is protected from breakage or rupture, which may result in air entering the line
- Instruct the child and family to notify nursing staff members immediately if air is seen in the administration set

If air is present in the administration set:

- Clamp the catheter and stop the infusion
- Position the child supine with head down
- If able, aspirate the air from the administration set using a syringe via the needleless access port (remove the set from the pump and use the manual control to allow fluid and air to run into syringe)
- Recommence the infusion, monitoring the child closely
- If unable to aspirate the air, change the administration set

If air is present in the CVC:

- Clamp the catheter and stop the infusion
- Position the child on their left side with head down and attempt to aspirate the air from the CVC immediately
- Observe for possible causes of air in line e.g. split or cracked catheter. Ensure the catheter is clamped closer to the patient than any split/crack if present

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16. Antibiotic/ethanol lock administration

a) Antibiotic lock

An antibiotic lock is the installation of a high concentration (well above MIC of organism) of an antibiotic, to which the causative organism is susceptible, into the catheter lumen.

An antibiotic lock is used to **treat** central line associated blood stream infections in long term CVC with no signs of exit site or tunnel infection for which catheter salvage rather than catheter removal is the goal.

The decision to initiate antibiotic lock therapy is a collaborative decision by the primary medical team, the paediatric infectious diseases service and the paediatric pharmacist. The paediatric infectious diseases team in collaboration with the paediatric pharmacist will determine the appropriate solution, dwell time and duration of therapy. An antibiotic lock is used as part of a regime to treat active infection and salvage the catheter. The antibiotic lock should be used in conjunction with systemic antimicrobial therapy.

An antibiotic lock may be considered for:

- Recurrent infections
- Multiple previous lines with limited vascular access
- Polymicrobial infections
- Unable to change catheter (e.g. patient with haemophilia)

Contraindications for antibiotic locks

- Infants less than 6 months, including neonates
- Non-patent lumens
- Pocket, tunnel or exit site infection
- Anaphylaxis to antibiotic
- Abnormal renal function test for aminoglycoside locks

Dwell time and duration of antibiotic locks

The ideal dwell times for antibiotic lock solutions has not being established. Currently within ADHB, antibiotic locks can be dwelled for 1 hour every other day or left in the line between use for up to 24 hours. Dwell times should not usually exceed 48 hours between installations of lock solution because antibiotic concentration may reduce rapidly over time.

Children undergoing haemodialysis, the lock solution with the addition of heparin (standard heparin lock concentration) can be renewed after every dialysis session (refer to associated ADHB documents section).

For multi-lumen catheters, ideally all lumens should be locked at the same time. If this is not possible the antibiotic lock should be instilled into alternating lumens every 24 hours.

Antibiotic locks should rarely be used longer than 14 days.

- Antibiotic locks must be prescribed on the medication chart as gentamicin 5mg/mL line lock or vancomycin 5mg/mL line lock, which lumens to instil antibiotic into, volume of lumen, and dwell time. Administration of the lock is documented on the medication chart.

Gentamicin 5mg/mL line lock

Equipment

- Cleaned reusable tray (aseptic field)
- Non sterile gloves
- Gentamicin 40mg/mL (2ml) ampoule
- Sodium chloride 0.9% ampoule
- 10mL syringes and needles as required
- Sodium chloride pre-filled syringe

Procedure for making gentamicin 5mg/mL line locks

Wear gloves. Aseptic technique must be used at all times.

- i.* Draw up 1 mL from a gentamicin 80mg/2mL ampoule into a 10mL syringe using a filter needle. Discard remaining gentamicin.
- ii.* Attach a new drawing up needle to the syringe & make up to 8mL with sodium chloride 0.9%. This gives 8mL of gentamicin 5mg/mL
Use the lock syringes immediately after making up. Discard any remainder. Do not store. If the patient has two lumens the same syringe may be used for both lumens.

Vancomycin 5mg/mL line lock

Vancomycin 15mg/3mL lock syringes are available from pharmacy. If not used immediately, syringes must be stored in the medication refrigerator. If the patient has two lumens the same syringe may be used for both lumens.

Procedure for instillation of antibiotic locks

- i.* Use an aseptic non touch technique throughout the procedure
- ii.* Ensure the CVC is clamped
- iii.* Attach a 0.9% sodium chloride prefilled syringe to the needleless access device on the end of the CVC
- iv.* Unclamp the CVC and gently flush with 0.9% sodium chloride to ensure catheter patency
- v.* Change syringes and instil volume of antibiotic lock equivalent to the intraluminal volume of the catheter (see table below). The required volume is inserted into one

- or two lumens as prescribed. If patient has two lumens the same syringe may be used for both doses
- vi. Clamp the CVC and leave solution within the lumen for the prescribed dwell time. Clearly label the lumen with medication instilled and time of instillation. Do not use lumen during the dwell time period;
 - vii. After prescribed dwell time has elapsed the lock solution must be withdrawn. Attach clean syringe and withdraw 3-5mL and discard;
 - viii. Flush with 0.9% sodium chloride using a turbulent flow technique. Instil heparin lock or connect IV administration set as required.

Other antibiotic locks

Other antibiotic locks may be used as clinically indicated. The choice of appropriate lock solution will depend on reasons for use, isolate and susceptibility pattern, systemic antibiotic and underlying host factors. The paediatric infectious diseases team in collaboration with the paediatric pharmacist will determine the type of agent, dwell time and duration of therapy.

Type of line	Volume
SVAD	1mL
Tunnelled	0.5mL
PICC	0.5mL
Haemodialysis/Apheresis Catheters	Use intraluminal volumes specified on the catheters. For the exact volumes to be used, see chart above.

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b) Ethanol lock

An ethanol lock is used to **prevent** central line associated blood stream infections in children with recurrent infections with limited vascular access that require long term CVC use and have no evidence of active infection. A number of studies including paediatric patients have shown that 70% ethanol can effect biofilms and treat CLABs and prevent recurrence.

The decision to initiate ethanol lock therapy is a collaborative decision by the primary team, the paediatric infectious diseases service and the paediatric pharmacist. The paediatric infectious diseases team in collaboration with the paediatric pharmacist will determine the appropriate solution, dwell time and duration of therapy.

Children on long term IVN may have 70% ethanol locks prescribed by the paediatric gastroenterology service as per the Starship Intravenous Nutrition Clinical Guidelines (see associated ADHB documents section).

An ethanol lock may be considered for:

- Recurrent infections
- Multiple previous lines with limited vascular access
- Polymicrobial infections
- Unable to change catheter (e.g. patient with haemophilia)

Contraindications for ethanol lock

- Anaphylaxis to ethanol solution
- Polyurethane catheters
- Subcutaneous vascular access device (port)
- Abnormal liver function test
- Heparin

Dwell time and duration of ethanol locks

The dwell time of ethanol locks has not being fully established. Currently within ADHB, dwell times of a minimum of 2 and maximum of 6 hours are used. The duration of use of ethanol locks is unclear but their use should be reviewed at 30 days. For patients on intravenous nutrition, longer dwell times have being used. Ethanol is usually used once weekly but for patients on intravenous nutrition daily locks are sometimes used.

- Ethanol locks must be prescribed on the medication chart as ethanol 70% line lock, which lumens to instil ethanol lock, volume of lumen, and dwell time. Administration of the lock is documented on the medication chart.

Ethanol 70% line lock

Equipment

- Cleaned reusable tray (aseptic field)
- Non sterile gloves
- Ethanol 100% ampoule
- 10mL water for injection
- 10mL syringes
- Blunt drawing up needle
- Filter needle
- 0.9% sodium chloride as required (or prefilled syringe)
- Recommended cleaning solution

Procedure for making ethanol 70% line lock

Wear gloves. Aseptic technique must be used at all times.

- i. Draw up 5mL from an ethanol 100% ampoule into a 10mL syringe using a filter needle.
- ii. Attach a new needle to the syringe and make up to 7mL with water for injection. This gives 7mL of ethanol 70% (approximately)

Procedure

- i. Use an aseptic non touch technique throughout the procedure
- ii. Ensure the CVC is clamped
- iii. Attach a syringe with 0.9% sodium chloride to the needleless access device on the end of the CVC
- iv. Unclamp the CVC and gently flush with 0.9% sodium chloride to ensure catheter patency
- v. Instil volume equivalent to the intraluminal volume of the catheter (refer to table below) into one or two lumens as prescribed.
- vi. Clamp the CVC and leave solution within the lumen for the prescribed dwell time. Clearly label the lumen with medication instilled and time of instillation. Do not use lumen during the dwell time period;
- vii. After prescribed dwell time has elapsed, attach syringe and withdraw 3-5mL and discard;
- viii. Flush with 0.9% sodium chloride using a turbulent flow technique. Instil heparin lock or connect IV administration set as required.

Type of line	Volume
Tunnelled	0.5ml (each lumen)
PICC	0.5ml (each lumen)
Haemodialysis/Apheresis Catheters	Use intraluminal volumes specified on the catheters. For the exact volumes to be used, see chart above.

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17. Fibrinolytic agent administration

If partial or complete occlusion of a CVC is due to kinking, malposition, medication precipitation or lipid occlusion, these cannot be resolved by the administration of a fibrinolytic agent and should be ruled out as a potential cause of occlusion prior to instillation of a fibrinolytic agent.

Assess ability to aspirate/flush line while turning the child's head to the opposite side, elevate their arm, ask the child to cough or bear down in a valsalva manoeuvre, place the child's head down or change the port needle.

Occlusion of renal haemodialysis catheters should be managed by the renal haemodialysis team.

If a long term CVC is partially or completely occluded due to thrombosis or fibrin, patency may be restored with the instillation of a fibrinolytic agent. The fibrinolytic agent **must be withdrawn** and discarded at the end of the prescribed dwell time.

Alteplase must only be administered in consultation with the patient's primary consultant and must be prescribed on the patient's medication chart.

Caution should be exercised with patients who:

- have any condition for which bleeding constitutes a significant hazard
- have had recent severe bleeding
- have had recent major trauma
- have active ulcerative GI disease
- have had a recent stroke
- are receiving warfarin therapy where INR > 1.3
- have had heparin administered on same day or APTT > 45
- have a platelet count < 80

Caution should be exercised in the presence of known or suspected infection in the catheter.

Equipment

- Cleaned reusable tray (aseptic field)
- Non sterile gloves
- Recommended cleaning solution
- 10mL syringes and needles as required
- 0.9% sodium chloride as required (ampoule or prefilled syringe)
- Fibrinolytic agent as prescribed (alteplase 1mg/mL)

Procedure

- i. Establish that the occluded CVC cannot be made functional by conventional methods, e.g. re-assess position of catheter, attempt to flush with heparinised saline;
- ii. Establish that there are no contra-indications to administration of a fibrinolytic agent e.g. history of bleeding disorders;
- iii. In general, attempts at unblocking CVCs should be done during pharmacy opening hours. If the CVC blocks 'after hours', it may be necessary to attain temporary peripheral venous access to maintain therapy until the following morning. If unblocking the CVC after hours is deemed critical to maintaining the patient's therapy, contact the on-call pharmacist via the Clinical Nurse Advisor (CNA);
- iv. Obtain a pre prepared alteplase 1mg/mL syringe using usual pharmacy process. 3mL of alteplase 1mg/ml in 10mL syringes are aseptically manufactured in advance and are frozen at -20°C. The cold chain must be maintained during transportation. Syringes are thawed by leaving in room temperature for 10minutes and must be used straight away and never refrozen;
- v. Use an aseptic non touch technique throughout the procedure;
- vi. Draw up 0.9% sodium chloride in a 10mL syringe or use a prefilled syringe;
- vii. Clamp the CVC lumen and clean the catheter with recommended cleaning solution from the hub towards the patient for approximately 10 cm and allow to dry;
- viii. Disconnect the needleless device or IV administration set;
- ix. Attach the 10mL syringe containing 0.9% sodium chloride and attempt to gently aspirate blood/fluid from the CVC or to flush CVC;
- x. If CVC remains occluded attach the 10mL syringe containing the fibrinolytic agent;
- xi. Using a gentle alternation of irrigation/aspiration over a few minutes, attempt to instil the fibrinolytic agent. The fibrinolysis agent should be instilled slowly to allow it to cover the walls of the catheter;
- xii. Volume to be instilled is the volume of the lumen;

Type of line	Max volume
SVAD	1mL
Tunnelled	0.5mL (each blocked lumen)
PICC	0.5mL (each blocked lumen)

- xiii. DO NOT FORCE the fibrinolytic agent into the catheter lumen;
- xiv. If the fibrinolytic agent is unable to be instilled, stop the procedure and advise the primary medical team for further guidance;
- xv. Once the fibrinolytic agent is instilled, clamp the CVC and leave in situ for 2 hours. Ensure the catheter is clearly labelled as having alteplase instilled. In case of emergency, a shorter dwell time may be attempted but a dwell of at least 30 minutes is recommended;
- xvi. Using a 10mL syringe, attempt to aspirate fibrinolytic agent in 3-5 mL of blood. If aspiration is unsuccessful, advise the primary medical team for further guidance. It may be necessary to leave the fibrinolytic for a longer dwell time (up to 24 hours). DO NOT FLUSH the catheter as this will result in the administration of the fibrinolytic medication to the patient;

- xvii. If aspiration is successful, withdraw and discard 3-5mL. Flush CVC with 0.9% sodium chloride using turbulent flow technique and resume infusion or heparin lock CVC using positive pressure technique, as per CVC heparin locking guideline;
- xviii. Consider application of a positive displacement needleless device;
- xix. Dispose of all waste as per individual area practice;
- xx. Record procedure in the patient's clinical record and medication chart.

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18. Non-cuffed CVC removal

All non-cuffed CVCs can be removed by ward nursing staff members. All cuffed CVCs e.g. Hickman lines, must be removed in the operating room.

Equipment

Cleaned reusable tray (aseptic field)
Recommended cleaning solution
Non sterile gloves
Gauze swabs
Recommended dressing
Paper tape measure (as required)

Procedure

- i. Use an aseptic non touch technique throughout;
- ii. Discontinue any infusion if in progress and clamp CVC;
- iii. Remove CVC site dressing and discard;
- iv. Clean exit site with recommended cleaning solution and allow to dry;
- v. Remove suture if present and remove the CVC, by withdrawing with caution ;
- vi. Apply pressure to the site with a gauze swab for 5 minutes;
- vii. Assess catheter for completeness and notify the primary medical team with any concerns. Note: All PICCs are measured and the total length of the removed catheter is checked against the recorded insertion length;
- viii. If requested, cut CVC tip into sterile container and send to the laboratory for culture;
- ix. Cover site with recommended dressing;
- x. Dispose of all waste as per individual area practices;
- xi. Record removal, any specimens sent and status of site in the patient's clinical record;
- xii. Remove the dressing after 24 hours and assess the site. A dry dressing may be used until site healed. Where possible, review site on a daily basis.

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19. Discharge planning

Children with long term access; PICC, tunnelled catheters or implanted ports may be discharged home with the central line in situ. If a child is going from hospital to the community with a CVC in situ, it is important that planning is commenced early. If the home environment and social circumstances are assessed by the multidisciplinary team as suitable and safe, some families may perform CVC procedures at home. If required, commence working through Home IV Therapy Checklist (CR4767 - see associated ADHB documents section).

Documentation of education regarding the management of CVC by child/family/caregiver in the community must be clear and accurate. All documentation, e.g. catheter size, date of insertion, date for access device and dressing change, length of PICC as appropriate, must be completed and community support referrals sent. Ensure family/caregivers have access to appropriate supplies, including thermometer.

The child/family/caregivers must be competent with all routine cares and procedures to care for a CVC at home prior to discharge:

- Involve the child/family/caregivers in the care of the CVC as early as possible
- All teaching should be done in conjunction with the parent teaching booklets (see associated ADHB documents section)
- Ensure child/family/caregivers level of knowledge regarding the management of the CVC, following education, is appropriate.
- Encourage the child/family/caregiver to perform procedures as they demonstrate competency with the CVC
- Ensure all child/family/caregiver teaching and competency is documented in the patients clinical record and the Home IV Therapy Training Record (CR3784 - see associated ADHB documents section) is completed and signed as required

Every child/family/caregiver must be given the appropriate education with regard to infection issues. Ensure the child/family/caregiver can demonstrate:

- The importance of hand washing
- The importance of early detection of infection
- Accurate observation of CVC site for signs of redness, swelling, exudate or excessive pain
- How to take the child's temperature daily
- An awareness of the importance of notifying the ward or prearranged contact if the child's temperature is $>38.0^{\circ}\text{C}$

As appropriate, the child/family/caregiver is given appropriate education with regard to administration of medications and/or line changes. Ensure that the child/family/caregiver can demonstrate medication administration as per Antibiotic Therapy at Home (see associated ADHB documents section):

- Aseptic non touch technique
- Preparation of medications

- Administration of medications (bolus or infusor as required)
- Heparin lock as per CVC guidelines
- Safe disposal of equipment
- Ensure the child/family/caregiver is aware of signs of adverse reactions and can act appropriately, by stopping infusion and obtaining advice immediately

Every child/family/caregiver should have the ability to problem solve and trouble shoot in situations that may compromise the integrity of the CVC or place the child at risk.

- Educate on the risks of dislodgement/damage to line and ensure the child/family/caregiver can secure the line appropriately
- Ensure all children who are discharged with a CV have a CVC safety kit containing 1 x pack of gauze swabs, securing tape, blue slide clamp, needleless access device, spare transparent dressing and statlock (PICC), and disposable gloves
- Ensure that the child/family/caregiver understands that in the event of a CVC breakage they must:
 - Clamp CVC with line clamp or blue slide clamp from safety pack
 - Notify the ward or designated contact immediately to discuss the further action required such as attendance for patient review and/or repair of line.

Ensure that the child/family/caregiver understands that in the event of CVC falling out they must:

- Apply direct pressure
- Notify the ward or designated contact immediately to discuss the further action required
- Ring for ambulance if excessive bleeding

Ensure that in the event of being unable to flush the CVC the child/family/caregiver can:

- Reposition the child, head down and retry
- Notify the ward or designated contact immediately to discuss the further action required

Ensure the child/family/caregiver knows how to contact support services:

- District/community/shared care nurse
- Ward or designated contact person
- Ambulance

Ensure Home IV Therapy Agreement record (CR8877 - see associated ADHB documents section) is signed prior to discharge. Original is kept in the clinical records and a copy is given to the family.

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20. Supporting evidence

- Centers for Disease Control and Prevention. [Guidelines for the prevention of intravascular catheter related infections, 2011](#)
- Chalmers, E., Ganesen, V., Liesner, R., Maroo, S., Nokes, T., Saunders D., & Williams, M. (2011) [The investigation, management and prevention of venous thrombosis in children](#), British Journal of Haematology, 154(2):196-207).
- Choi, M., Massicotte, P., Marzinotto, V., Chan, A. K., Holmes, J. L., & Andrew, M. (2001). [The use of alteplase to restore patency of central venous lines in pediatric patients](#): A cohort study. The Journal of Pediatrics, 139(1), 152-156
- Droste, J., Jeraj, H., McDonald, A., & Farrington, K. (2003) [Stability and in vitro efficacy of antibiotic-heparin lock solutions potentially useful for treatment of central venous catheter related sepsis](#). Journal of Antimicrobial Chemotherapy, 51:849-55
- Health Quality and Safety Commission. [Hand Hygiene New Zealand](#)
- Health Quality and Safety Commission. [Prevention of Central Line Associated Bacteraemia](#)
- Hooke, C. (2000) [Recombitant Tissue Plasminogen Activator for Central Venous Access Device Occlusion](#). Journal of Pediatric Oncology Nursing, 17(3), 174-178
- Jacobs, B. R., Haygood, M., & Hingl, J. (2001). [Recombinant tissue plasminogen activator in the treatment of central venous catheter occlusion in children](#). The Journal of Pediatrics 139(4), 593-595
- Mermel et al. IDSA [Guidelines for intravascular Catheter related Infection](#). CID 2009; 49:1-45
- Onland, W., et al. (2006) [Ethanol-lock technique for the persistent bacteraemia of long term intravascular devices in paediatric patients](#). Archives of Pediatric & Adolescent Medicine, 1049-53
- Raad, I.I., Hohn, D.C., Gilbreath, B.J., et al. (1994). [Prevention of CVC-related infections by using maximal sterile barrier precautions during insertion](#). Infect Control & Hospital Epidemiology, 15(4 Pt 1):231-238.
- Robinson, J., et al. (2005) [Stability of heparin and physical compatibility of heparin/antibiotic solutions in concentrations appropriate for antibiotic lock therapy](#). Journal of Antimicrobial Chemotherapy, 56:951-3
- Rowley, S. (2001). [Aseptic non – touch technique](#). Nursing Times, 97 (7), VI – VIII.
- Royal College of Nursing (2005) [Standards for Infusion Therapy](#). RCN, London
- Safdar, N. & Maki, DG. [Use of vancomycin containing lock or flush solutions for prevention of bloodstream infection associated with central venous access devices; a meta-analysis of prospective randomised trials](#). CID 2006; 43:474-84
- Sanders, J., et al. (2008) [A prospective double blind randomized trial comparing intraluminal ethanol with heparinised saline for prevention of catheter associated bloodstream infection in immunosuppressed haematology patients](#). JAC 62:809-15
- Target CLAB ZERO collaborative <http://koawatea.co.nz/campaigns/target-clab-zero/>

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21. Associated ADHB documents

- [Aseptic Non-Touch Technique - RBP](#)
- [Blood Components & Blood Products Administration](#)
- [Central Venous Catheter \(CVC\) Care in Adults](#)
- [Central Venous Catheters \(CVC\) in Children - Antibiotic Therapy at Home](#)
- [Fibrinolysis of Central Venous Catheters - Alteplase - renal](#)
- [Gentamycin-Heparin Lock for Central Venous Haemodialysis Catheters - renal](#)
- [Hand Hygiene](#)
- Intravenous Nutrition
- [Medications - Administration](#)
- [Medications - Cytotoxic & Hazardous - Extravasation](#)
- [Peripheral Intravenous Catheter Management - Adult & Paed](#)
- [PICU Central Venous Access guideline](#)
- [Standard Precautions](#) – Infection Control

- [Blood Culture Guideline Poster](#)

Clinical forms

- CR4030: Central Line Associated Bacteraemia (CLAB) Insertion Bundle Checklist
- CR4032: Central Line Associated Bacteraemia (CLAB) Maintenance Bundle Checklist Continuation Sheet
- CR8877: Agreement for IV Antibiotic Therapy
- CR4767: Health Home IV Therapy Checklist
- CR3784: Home IV Therapy Training Record

Parent information

- [PICC and Antibiotic Bolus](#)
- [PICC and Antibiotic Infusion](#)
- [PICC and Antibiotic Infusor Therapy](#)

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22. Disclaimer

No guideline can cover all variations required for specific circumstances. It is the responsibility of the health care practitioners using this ADHB guideline to adapt it for safe use within their own institution, recognise the need for specialist help, and call for it without delay, when an individual patient falls outside of the boundaries of this guideline.

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23. Corrections and amendments

The next scheduled review of this document is as per the document classification table (page 1). However, if the reader notices any errors or believes that the document should be reviewed **before** the scheduled date, they should contact the owner or the [Clinical Policy Advisor](#) without delay.

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