procedure

NORTHERN SYDNEY CENTRAL COAST NSW HEALTH

Central Venous Catheters (CVC) - Insertion, Monitoring And Management – Central Coast

Document Number	PR2009_161
Publication Date	28 April 2009
Intranet location/s	Clinical - Pertaining All Areas – Central Venous Access Devices
Summary	A guide for CCH clinicians in the insertion, management and removal of central venous catheters (CVC) including Central Venous Pressure (CVP) monitoring
Author Department	Sue Lamb CLAB Project Officer / CNE – Intensive Care Services CCH Nicole Mangone - CNC Medicine CCH Therese Hart - NUM Vascular Access Team – CCH Michelle Beringer – CNE M2 Gosford Aminta Spare - RN M2 Gosford Brookie Peterson - RN M2 Gosford
Contact (Details)	Sue Lamb - Intensive Care Unit CCH slamb@nccahs.health.nsw.gov Phone: 43 20 3309
Endorsed By	CCH Clinical Practice Review Committee Medical Review: Dr R Cameron CCH Director Intensive Care Dr S Cameron CCH ED Staff Specialist Dr D Keavy CCH Anaesthetist
Sector/Service	Central Coast Health
Audience	All clinicians who will use CVC's in patient management
Date Created	April 2009
Review date	April 2012
Previous Reference No.	**Central Coast CCPM** 7.6; 7.7; 7.8; 7.9; 7.10; 7.11 **Central Coast CPM** 5.15
Related Policy/s	IV Medication Peripherally Inserted Central Catheters – CCH Procedure PR2009_093 - Correct Patient, Correct Procedure, Correct Site PO2006_011 - Safe Blood Collection NSCCHS Policy PR2009_077 - Administration of Blood Products NSCCHS GE2008_032 - Total Parenteral Nutrition CCH
Key Words	Central Venous Access Device, Catheter, CVC,
Status	Active

Title: Central Venous Catheters (CVC) Insertion, Monitoring & Management - CCH

TABLE OF CONTENTS:

1. SCOPE OF PRACTICE 3
2. EXPECTED OUTCOME 3
3. DEFINITIONS 3
4. GENERAL INFORMATION 4
5. INDICATION FOR CVC: 4
6. SITES FOR CVC INSERTION 5
7. CVC COMPLICATIONS AND MANAGEMENT 7
8. INSERTION OF CVC 8
8.1 Policy Statements 9
8.2 Recommendation for Multi-Lumen Use 10
8.3 Equipment 12
8.4 Nursing Actions 13
8.5 “Statlock” Device with pigtail retainer Information 14
8.6 Following CVC Insertion 15
9. CENTRAL VENOUS PRESSURE MONITORING 15
9.1 General Information 15
9.2 Policy Statements 16
9.3 Equipment 17
9.4 Nursing Actions 17
10. MANAGEMENT OF CVC 18
10.1 Policy Statements 18
10.2. CVC Dressing 19
10.2.1 Policy Statements 19
10.2.2 Equipment 19
10.2.3 Nursing Actions 20
10.3 CVC Flushing 22
10.3.1 Policy Statements 22
10.3.2 Equipment 22
10.3.3 Nursing Action 23
10. 4 CVC Line and IV Fluid Bag Changes 25
10.4.1 Policy Statements 25
10.4.2 Equipment 25
10.4.3 Nursing Action 26
10.5 Heparin Locking CVC Lumens 26
10.5.1 Policy Statements 27
10.5.2 Equipment 27
10.5.3 Nursing Action 27
10.6 Taking Blood Samples 28
10.6.1 Policy Statements 28
10.6.2 Equipment 31
10.6.3 Nursing Action 31
10.7 Removal of CVC 32
10.7.1 Policy Statements 33
10.7.2 Equipment 33
10.7.3 Nursing Action 34
11. REFERENCES 35

1. SCOPE OF PRACTICE

This procedure applies to all clinicians providing care to adult patients who require the insertion and management of a Central Venous Catheter (CVC) within Central Coast Health (CCH). Clinicians are required to work within their scope of practice and have the necessary knowledge and competence before attending to any part of this procedure.

2. EXPECTED OUTCOME

A high standard of safe and effective management for patients with a CVC will be provided by attending clinicians. The CVC will be inserted safely by an accredited or appropriately skilled medical officer under strict aseptic conditions. The risk of local or systemic infection related to CVC management will be reduced.

3. DEFINITIONS

A **Central Venous Catheter** (CVC) is an intravascular device with the tip situated in a major vein within the thorax or abdomen i.e. the tip is centrally located. Central lines are classified as either 'centrally inserted' in which case the skin entry point is on the trunk of the patient or 'peripherally inserted' (PICC) where the line is inserted through a limb vein.[1] An alternate term for CVC is Central Venous Access Device (CVAD).

This procedure is for centrally inserted lines only. For PICC procedure see CCH PICC line procedure

Central Venous Pressure (CVP) is the pressure in the superior vena cava near the right atrium. Measurement of CVP can give an approximation of the right-sided cardiac function and haemodynamic status of the patient.[2]

Central Line Associated Bacteraemia (CLAB) refers to a blood stream infection (from a recognised pathogen or potential contaminant) in a patient who has had a CVC inserted and the bacteraemia is not related to infection from another source. [3]

4. GENERAL INFORMATION

A CVC is a commonly used device in hospitalised patients. Indications for a CVC include administration of medication, fluids, nutrition and blood products as well as monitoring of critically ill patients.

Although catheters provide necessary vascular access, the presence of these catheters place patients at risk of catheter-related blood stream infections or central line associated bacteraemia (CLAB) which can be fatal. Methods and techniques used during CVC insertion by medical staff and CVC management by nurses are critically important to preventing CLAB.[4] CVCs are to be reviewed daily, and those that are no longer clinically indicated should be considered for removal.

Refer to Section 7 for information on other potential complications associated with CVCs.

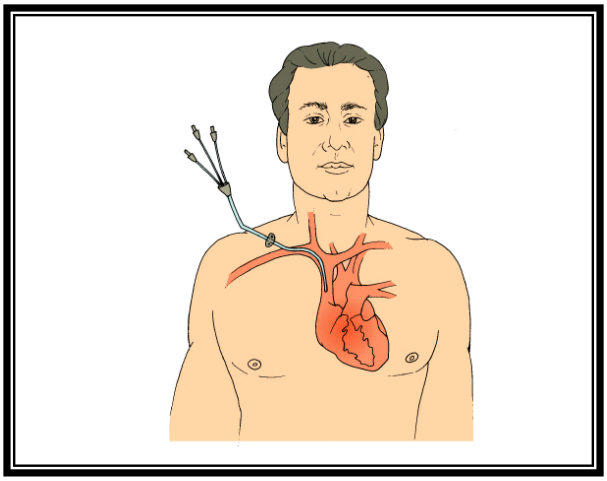


Figure 1: An example of a Central Venous Catheter in right subclavian vein. Alternative sites include internal jugular and femoral vein

5. INDICATION FOR CVC:

- Long-term or multiple intravenous fluid/medication therapies
- Long-term or multiple intravenous antibiotic administration
- Venous access when peripheral veins are small, thrombosed or difficult to find
- Measure central venous pressure (CVP)
- Administer blood or Intravenous fluids in critically ill patients
- Administer total parenteral nutrition (TPN)
- Administer vesicant or irritant chemotherapy

6. SITES FOR CVC INSERTION

Subclavian Vein[5,6]

Advantages	Disadvantages
• Lower infection risk • Easily accessible • Sterile intact dressing easily maintained • Unrestricted arm and neck movement • Reduced risk of catheter displacement once correctly sited	• Risk of air embolism • Risk of Subclavian arterial puncture • Increased risk of large blood loss (haemothorax, haemomediastinum) due to inability to apply pressure • Risk of pneumothorax • Phrenic or brachial nerve injury • Increased risk of complications in patients who have emphysema or who are being mechanically ventilated • Possible tracheal or endotracheal cuff perforation • Thoracic duct injury (left subclavian only)

Internal Jugular Vein[5,6]

Advantages	Disadvantages
• Short and direct access to superior vena cava and R) atrium • Reliable site for correct catheter placement • Catheter displacement unlikely • Lower incidence of arterial laceration or puncture	• Risk of air embolism • Possible tracheal or endotracheal cuff perforation • Risk of pneumothorax (less than subclavian) • Thoracic duct injury (left internal jugular only) • Difficulty with maintaining an intact dressing • Increased risk of infection • Possible carotid artery puncture

Femoral Vein[5,6]

Advantages	Disadvantages
• Readily accessible • Greater ease of insertion in patients with difficult subclavian and jugular access	• **High risk of infection** due to proximity to groin • Difficulty in maintaining an intact sterile dressing • Difficult to locate in obese patients • Thrombosis of femoral vein is a high risk factor for pulmonary embolism • Immobilisation of site is difficult, thereby increasing the risk of catheter displacement • Risk of femoral artery puncture

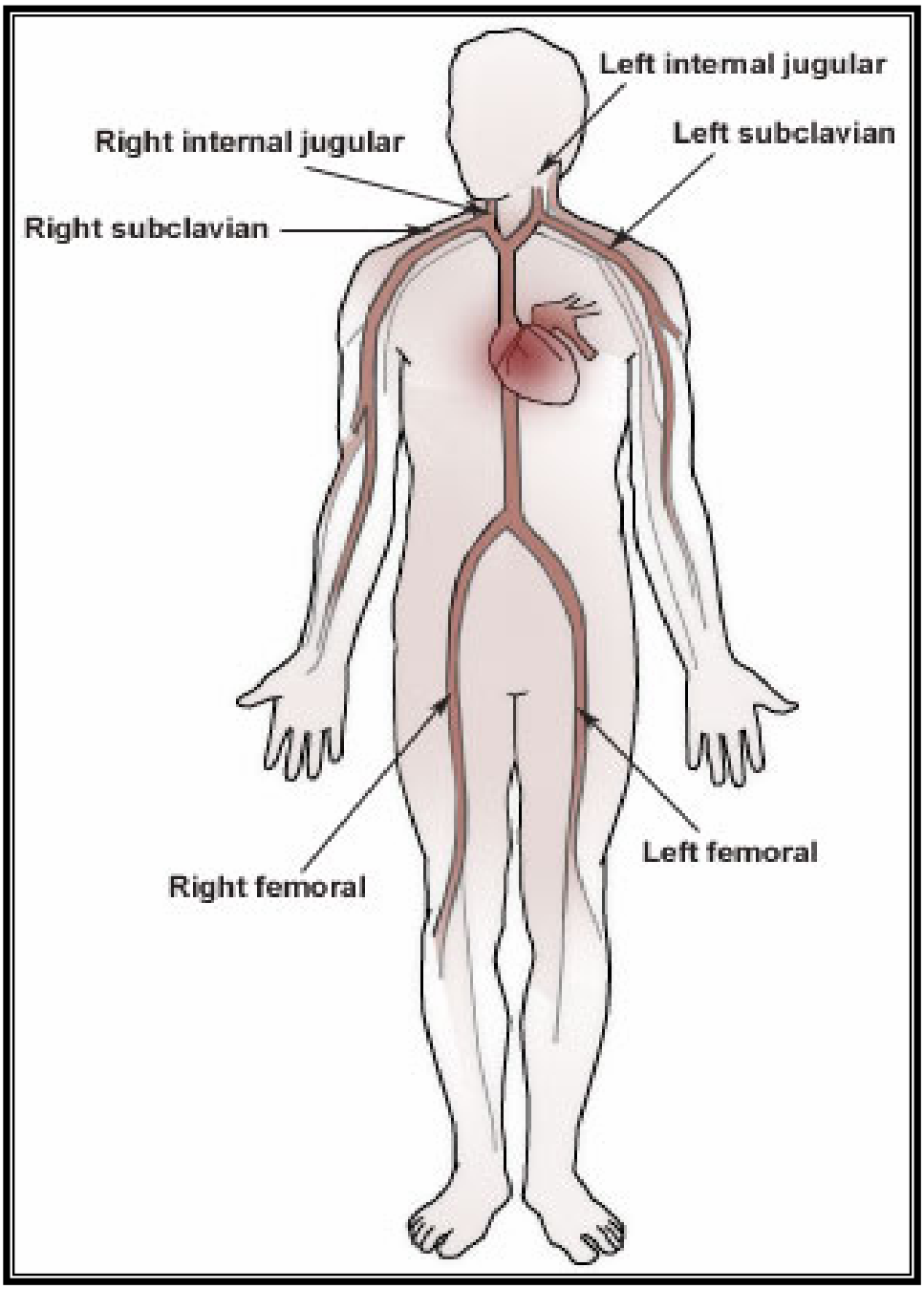


Figure 2: Insertion sites for CVCs

7. CVC COMPLICATIONS AND MANAGEMENT

Complications secondary to CVC insertion are generally divided into two groups, immediate and/or delayed, dependant upon the time they appear in relation to the catheter insertion. Immediate complications are usually associated with catheter placement however, some may develop later. Delayed complications are usually manifested after the catheter has been indwelling for a period of time.[6]

Immediate Complications	**Management**
Arterial puncture	Apply digital pressure until haemostasis is achieved. This is problematic with subclavian artery puncture.
Cardiac arrhythmias	Proceduralist to pull back guide wire. Treat arrhythmia if persists.
Air embolus	Clamp all catheter lumens. Place patient in left lateral position with head down. Administer 100% oxygen. Assess vital signs, pulse oximetry and cardiac rhythm.
Catheter malposition	Remove catheter.
Pneumothorax, haemothorax	Administer oxygen. Obtain Chest X-ray if patient stable. Medical treatment as required ie chest drain insertion.
Nerve injury	As per Medical Officer.
Venous thromboembolism	Remove catheter. Anticoagulation and further investigation and treatment as ordered by Medical Officer.

Delayed complications	**Management**
Catheter-related infections	Remove catheter. Antibiotic therapy as ordered.
Catheter-related thrombosis	Remove catheter. Anticoagulation and further investigation and treatment as ordered by Medical Officer.
Vessel erosion	Remove catheter. Patient to be reviewed by senior Medical Officer.
Pneumothorax, haemothorax	Administer oxygen. Obtain Chest X-ray if patient stable. Medical treatment as required ie chest drain insertion.
Catheter malposition	Remove catheter.

Delayed complications	**Management**
Extravasation	Discontinue infusion. Treatment will depend on the pharmaceutical manufacturer's guidelines, the properties of the extravasated agent and the severity of extravasation. Treatment should be determined prior to catheter removal. Ongoing observation and assessment of the extravasated site.[7]
Air embolus - is an uncommon but potentially catastrophic event that occurs as a consequence of the entry of air into the vasculature.[8] **Signs and symptoms;** dyspnea, tachypnea, light headedness, wheeze, rales, hypotension, tachycardia, substernal chest pain, change in mental status. [8]	Clamp all catheter lumens if catheter still insitu. If CVC has become dislodged occlude insertion site with occlusive / airtight dressing. Notify Medical Officer. Place patient in left lateral position with head down. Administer 100% oxygen. Assess vital signs, pulse oximetry and cardiac rhythm.

8. INSERTION OF CVC

- At **Gosford Hospital,** CVCs are to be inserted in monitored environments such as the Intensive Care Unit (ICU), Emergency Department (ED), Operating Theatres (OT) or Coronary Care Unit (CCU). The Medical Team responsible for the patient will co-ordinate the appropriate staff, equipment, location and timing of the procedure.

- When a general ward area patient at **Gosford Hospital** requires a CVC this procedure will be undertaken in the ICU and all equipment will be provided by the Vascular Access Team (VAT). Ward staff will liaise with ICU and VAT to coordinate patient transfer and any specific requirements (ensure notification of Infection control risks).

- At **Wyong Hospital**, CVCs are to be inserted in a monitored environment, such as the High Dependency Unit (HDU), ED, OT or CCU. The Medical Team responsible for the patient will co-ordinate the appropriate staff, equipment, location and timing of the procedure.

8.1 Policy Statements

Skin Preparation:

- To minimise complications, an assessment of specific patient factors such as pre-existing catheters, anatomic deformity, site restrictions and the relative risk of mechanical complications, should be performed prior to insertion of the CVC.[9]
- Hair at the insertion site should be removed using clippers to improve adherence of the occlusive dressing. Shaving is not recommended. [9]
- Before and after palpating catheter insertion sites the clinician must wash their hands with a soap solution or alcohol-based waterless hand cleaner.[9, 10]
- The insertion site should be physically cleaned (if necessary with soap and water) prior to applying the antiseptic solution and inserting the catheter. [9]
- Chlorhexidine 2% in Alcohol 70% must be used as the antiseptic agent. [4, 9, 11, 12, 13]
- If Chlorhexidine in alcohol is contraindicated due to sensitivity or allergy, use povidone-iodine 10% or sterile normal saline 0.9%. [4, 8, 11, 12]

Scope of Practice

- The insertion of a CVC will be undertaken by an accredited Medical Officer. Resident Medical Officers (RMOs) may undertake the procedure under the direction of an accredited/appropriately skilled Medical Officer and must be assessed as competent by that officer before attempting the procedure without supervision.

General

- Every patient having a CVC inserted in Gosford ICU must have a Central Line Associated Bacteremia (CLAB) form (insertion checklist) completed. Completed forms are placed in the designated CLAB collection box.

- All patients requiring CVC insertion will have cardiac monitoring and oxygen saturation monitoring for the duration of the procedure.

- Immediate access to cardiac resuscitation equipment and drugs is required (due to the high likelihood of induced arrhythmias during insertion of CVC's).[9]

- Adherence to the "CCH Correct Patient, Correct Procedure, Correct Site" Procedure is mandatory for all elective CVC Insertions. See link below.

- The patient must have written and informed consent obtained by the Medical Officer prior to the procedure. In emergency situations verbal consent from the patient or next-of-kin should be obtained and documented in the patient's notes.

- Site selection will be assessed by the Medical Officer before commencing procedure. [9]

- The Medical Officer will (where available) use ultrasound guided access to reduce potential complications associated with the procedure.[9]

- The minimum necessary number of lumens, connectors and ports will be used. [9]

- The sterile set up will be prepared immediately prior to the procedure.[9]

- All staff performing CVC insertions and any other person who enters the sterile field must wear full personal protective equipment (PPE) that includes protective eyewear, cap, mask, sterile gown and sterile gloves.[9]

- The clinician inserting the CVC must wash hands and forearms for at least two minutes using an antiseptic soap solution and dry with a sterile towel before gowning and gloving.[9]

- A nurse or other appropriate clinician will provide assistance during the procedure to ensure asepsis is maintained.[9]

- A chest X-ray will be performed after CVC insertion (excluding femoral CVC).[9]

- The critically ill patient requiring CVP monitoring will have the distal (brown) lumen of the CVC attached to a pressure transducer to confirm there is a venous waveform NOT an arterial waveform.[6, 9]

- The CVC catheter, immediately following placement, will be anchored / secured in two places (skin insertion site and catheter hub) with either sutures or "statlock" device. N.B CVC catheters with insufficient length to accommodate a second anchoring device will be sutured or stat locked at catheter hub for securement.

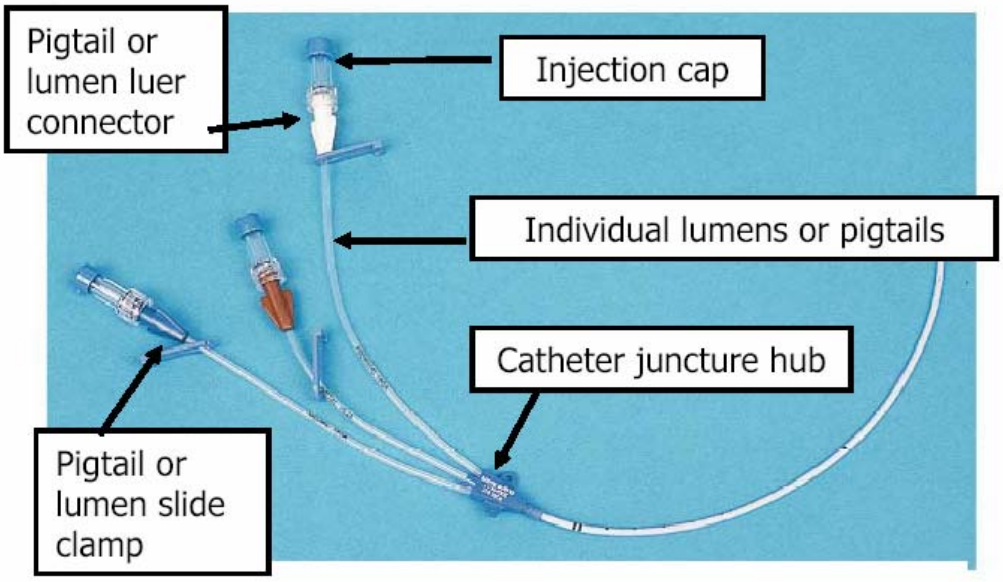
8.2 Recommendation for Multi-Lumen Use

CVCs can be single or multi-lumen. The number of lumens should be carefully considered prior to inserting a CVC. The minimum necessary number of lumens, connectors and ports should be used.[7, 13]

* Each IV line should be clearly labelled for designated use

* Compatibility of infusions and medications must be assured. Medications will be administered according to the NSCCHS & CCH Drug Policies & Procedures located on the NSCCH Intranet.

Figure 3: The parts of a Central Venous Catheter [4]



Recommendation for Double Lumens:

DISTAL	CVP measurement
	Maintenance fluids
	Drug infusions
PROXIMAL	Total Parenteral Nutrition (TPN) / Insulin infusion
	or other drug infusions

Recommendation for Triple Lumens:

DISTAL	CVP measurement
	Maintenance fluids
	Drug infusions
MEDIAL	Total Parenteral Nutrition (TPN) / Insulin infusion
	or other drug infusions
PROXIMAL	Drug infusions

Note: Four and five lumen catheters are available for selected patients (eg. critically ill, haematological patients) after discussion with the Medical Officer and are related to administration of multiple drug infusions.

8.3 Equipment

- Sterile gown
- Sterile gloves
- Hair cap
- Mask
- Protective eyewear
- Large sterile trolley drape
- Large sterile fenestrated patient drape (for head to toe draping)
- Central Venous Catheter
- Sonosite ultrasound unit (where possible)
- Universal pack – containing sterile gloves
- Chlorhexidine 2% in Alcohol 70%
- Gauze squares
- 1% Lignocaine local anaesthetic
- Suture material and/or “statlock” device with pigtail retainer
- 2 x 10mL syringes
- 19g needle
- 23g needle
- needle holder
- 20mLs 0.9% Sodium Chloride
- Stitch cutter
- Blue under-pad
- Sterile, transparent, semi-permeable dressing (eg IV 3000)
- Equipment for Heparin Lock (if required)
- CLAB insertion checklist form (if inserted in ICU)
- Correct Patient, Procedure and Site Time-Out Sticker

Optional (for CVP monitoring)

- Pressure Transducer Giving Set - **replace fenestrated (vented) red cap provided in set with non fenestrated cap. This is to prevent accidental blood loss or air embolus.**
- 1 litre Normal Saline
- Pressure Bag
- Pressure Module and Cable

8.4 Nursing Actions

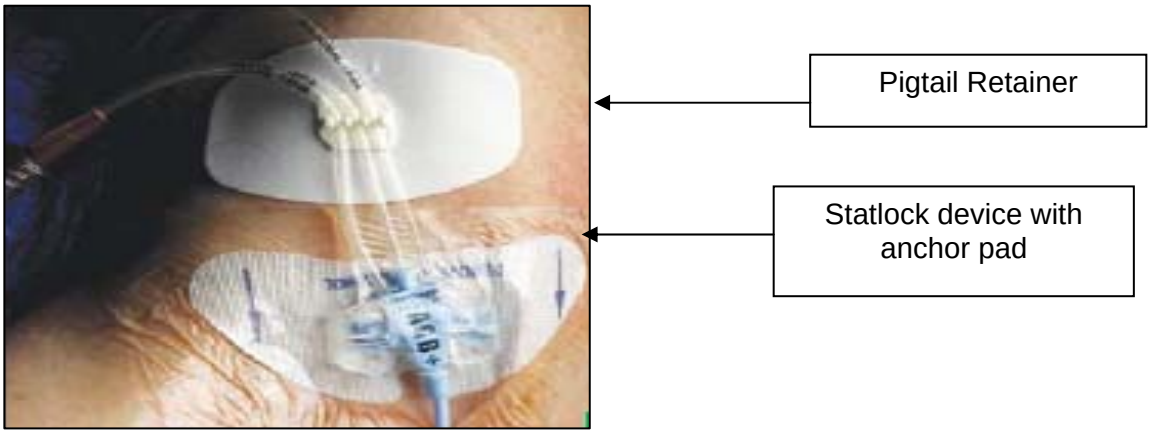
1. Ensure the procedure has been explained to the patient and that the Medical Officer has obtained consent.
2. Attend to team time-out sticker with medical officer ensuring correct patient is having correct procedure on correct site.
3. Wash hands.
4. Prepare insertion site, if necessary, with clippers and /or soap and water.
5. Ensure patient is connected to cardiac and oxygen saturation monitoring.
6. Wipe designated central venous access device (CVAD) trolley with neutral detergent.
7. Drape trolley with sterile trolley drape.
8. Open and add sterile items to sterile field.
9. Pour solution.
10. Open gown and gloves.
11. Assist the medical officer to gown.
12. Provide reassurance and comfort for patient during the procedure.
13. Place underpad under patient and expose the selected site.
14. Ensure cardiac monitor leads are out of the way.
15. Position and prepare the patient with the head of bed slightly lower than feet (Trendelenburg).
16. Open local anaesthetic for medical officer to draw up (MO to check contents).
17. Open normal saline for MO to draw up (MO to check contents) to flush lumens.
18. Assist Medical Officer as required. Ensure asepsis is maintained. If aseptic technique is breeched, inform Medical Officer.
19. If “statlock” device with pigtail retainer available for use, refer to section 8.5 for application technique.
20. If necessary, instruct Medical Officer to position centre of the dressing over the insertion site.
21. Ensure dressing dated using label contained in IV 3000.
22. Prime giving set/s as required for connection to CVC lumens or ensure that lumens are Heparin locked (according to policy). Assist Medical Officer to connect pressure transducer to distal (brown) lumen to confirm venous pressure waveform.
23. Reposition the patient as required and provide general care of patient and equipment following the procedure.

8.5 "Statlock" Device with pigtail retainer Information

- Unless contraindicated for the patient a "statlock" anchoring device with pigtail retainer will be correctly applied to minimise risk of dislodgment of catheter.
- "statlock" devices will be monitored daily for signs of lifting or dislodgment and will be replaced every 7 days or as required.
- The "statlock" will be removed with minimal trauma to the patient.

Application Technique

- Perform hand hygiene and apply gloves.
- Prepare the targeted securement site for stat lock and pigtail retainer with alcohol swab to degrease the skin.
- Use skin prep provided over the same area for skin protection and better adherence – allow skin to dry.
- Continue to prep the skin with tincture of benzoin provided and allow to dry (tacky dry).
- Secure the CVC catheter to "statlock" BEFORE placing "statlock" on skin (Slide "statlock" pad under CVC hub and place suture holes in "statlock" posts. Close door of plastic cradle one side at a time to secure catheter). NB arrow on "statlock" anchoring pad points towards insertion site.
- Peel away "statlock" paper backing one side at a time and place on skin.
- Peel away paper backing of Pigtail retainer and adhere to skin 3-5cms from "statlock". Hold each individual lumen either side of pigtail retainer and apply gentle traction to insert lumen into track.
- Apply second occlusive transparent dressing over "statlock" device.



Procedure for "Statlock" Change/Removal

Alert
If the CVC is not sutured at first anchoring point a 2nd person is required to hold the catheter to prevent accidental dislodgement

- Remove lumens from pigtail retainer.
- Lift plastic doors one side at a time and remove catheter hub.
- The adhesive of the "statlock" anchor pad and pigtail retainer will dissolve with application of an alcohol wipe. Apply an alcohol prep swab to a corner of the anchor pad. **Make sure it is quite moist**. Lift the corner and remove one side of the pad whilst **gently stroking the underside** with the alcohol prep swab.
- If required, apply new "statlock" as above.

8.6 Following CVC Insertion

- Ensure Chest X-Ray ordered and attended to confirm catheter position and exclude pneumothorax.
- Ensure Medical Officer orders I.V. fluids on the appropriate chart. Normal saline or 5% Dextrose may commence at 5mL/hr while waiting for Chest X-Ray. Lumens may also be heparin locked until X-Ray.
- Complete CLAB form (if inserted in Gosford ICU). Completed forms are placed in the designated CLAB collection box.
- Place "time out" sticker in patients health care record.
- Complete nursing documentation of line insertion in patient health care record and nursing care guide.
- Ensure central vascular access device care guide is commenced. For ICU patients ensure ICU Care Guide completed.

9. CENTRAL VENOUS PRESSURE MONITORING

Scope of Practice

A Registered Nurse who is deemed independent in a competency based assessment or can demonstrate recognition of prior learning / Medical Officers may undertake this procedure.

9.1 General Information

- CVP monitoring is used to provide an indicator of right heart function and response to changes in fluid therapy.[2]
- Normal range for CVP is 2-8 mm Hg.[2]

- A series or trend of CVP measurements is necessary to gauge the patient's condition and subsequent therapy. The CVP value should be interpreted in conjunction with the patient's clinical status and history.
- The CVP waveform is the result of the physiological events that occur during the cardiac cycle.
- **"A wave"** represents right atrial contraction.
- **"C wave"** represents the change in pressure caused by bulging of the closed tricuspid valve into the atrium during right ventricular contraction.
- **"V wave"** represents a combination of ventricular contraction and atrial filling.
- **"X descent"** represents atrial relaxation.
- **"Y descent"** is due to atrial emptying as blood enters the ventricle.

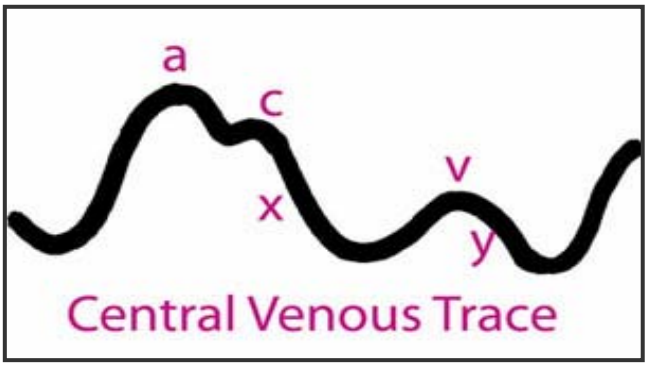


Figure 4: CVP Waveform

9.2 Policy Statements

- The CVP is measured on the distal (brown) lumen of the CVC. [2]
- The CVP measurement may be taken with the patient supine to 45^{o} head elevation [2]. Position of patient during measurement of CVP will be recorded to ensure consistency of readings.
- Frequency of CVP measurement will be determined by patient's clinical condition: ie fluid challenge given or deterioration in patient's condition will require more frequent measurements.
- The waveform may fluctuate with respirations; readings should be taken at end-expiration to minimise the influence of intrathoracic pressure.[2]
- The phlebostatic axis (located at the fourth intercostal space, mid axillary line) is the reference point (right atrium) for all circulatory pressure measurements.[2]

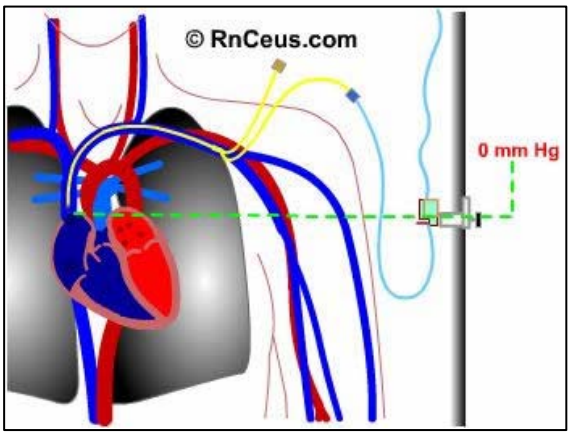


***Figure 5**: Reference point for CVP measurements*

9.3 Equipment

- Pressure module and cable
- Pressure transducer giving set
- 1 litre Normal Saline
- Pressure bag
- Gloves
- Alcohol swab
- Replacement cap if required

9.4 Nursing Actions

1. Attach pressure transducer giving set to distal lumen of CVC using aseptic technique (if not already attached).
2. Ensure appropriate scale is set on the monitor.
3. Provide explanation to patient.
4. Ensure pressure bag is inflated to 300mmHg.
5. Position patient appropriately.
6. Wash hands and don gloves.
7. Turn off any other infusions running through distal lumen.
8. Locate the phlebostatic axis (fourth intercostal space, mid axillary line) and hold the transducer at this point.
9. Turn stop cock off to patient.
10. Remove cap on transducer sample port using non- touch technique. If cap becomes contaminated – replace.
11. Press ‘zero’ on CVP pressure module until ‘beep’ sounds (zeroing to air eliminates the effects of atmospheric pressure from the measured pressure readings).

12. Wait until '(0)' appears at right margin of screen.
13. Return stop cock to the 'off' position (thus open to patient and transducer)
14. Wipe port with alcohol swab and replace cap.[4]
15. Observe monitor screen for waveform and measure CVP on end expiration. Observe the number displayed in right margin of screen.
16. Recommence infusions via the distal lumen if temporarily paused.
17. Document CVP on observation / flow chart and the position of patient.
18. Notify abnormal findings to in charge Registered Nurse or Medical Officer.

10. MANAGEMENT OF CVC

10.1 Policy Statements

- All intravenous drugs are to be administered via a micro infusion set or an in-line burette with an infusion pump. No bolus or push doses of IV medication are to be given via a CVC except in ED, CCU, ICU, HDU OT and Cancer Care Clinic or when a patient from one of these areas is undergoing intrahospital or interhospital transfer.
- A central vascular access device assessment must be documented on the care guide daily and will include assessment of site for erythema, drainage, tenderness, pain, redness and swelling, dressing integrity, suture / "statlock" integrity and length of CVC at skin level. [4] Any abnormalities must be reported to a medical officer.
- The catheter must be assessed for signs of external damage such as splitting at least daily. Any abnormalities must be reported to a medical officer.
- Each catheter lumen will be secured using a "statlock" device pigtail retainer to ensure there is no pulling on the CVC.
- CVCs will be reviewed daily by the medical team & nursing staff, and those that are no longer required should be promptly removed as documented by the medical team.
- Catheter lumens and sampling ports (including needleless injection sites and blood sampling ports) must be wiped with an alcohol swab before and after use to decontaminate and remove any particulate matter. [4]
- Unused CVC lumens must be clamped to prevent air emboli and backflow of blood, protein or lipid solutions. [4]
- If a catheter related complication (see Section 7) is suspected, the catheter should be considered by the medical team for immediate removal. [1, 4]
- CVC lumens not in use will be heparin locked to maintain patency. Refer to section 10.5

10.2. CVC Dressing

Scope of Practice

A Registered Nurse who is deemed independent in a competency based assessment or can demonstrate recognition of prior learning / Medical Officers may undertake this procedure.

10.2.1 Policy Statements

- A sterile transparent semi permeable dressing must be used.[4]
- The dressing will be routinely attended every 7 days or sooner if:
    i. the dressing is not intact;
    ii. there is evidence of inflammation;
    iii. there is excessive accumulation of blood and/or moisture under the dressing. [4]
- Gauze dressing is preferable to a transparent dressing if patient is diaphoretic, or if the site is bleeding or oozing. The gauze dressing will be reinforced with an airtight, occlusive dressing. Gauze dressing will be changed daily, and whenever loose, soiled, or moist.[4]
- 2% Chlorhexidine in 70% alcohol must be used for dressing CVCs.[4, 6] If Chlorhexidine in alcohol is contraindicated due to sensitivity or allergy, use povidone-iodine 10% or sterile 0.9% Sodium Chloride. [4, 8, 11, 12]
- Sterile 0.9% Sodium Chloride should be used to remove dried blood or other fluids from around the catheter, especially under the catheter hub, prior to cleaning with 2% Chlorhexidine in 70% alcohol. [4]
- Do not use antibiotic creams on insertion sites. [4]
- CVC lumens and IV lines must be secured to the patient so that there is no tension applied to the catheter or sutures. [4]

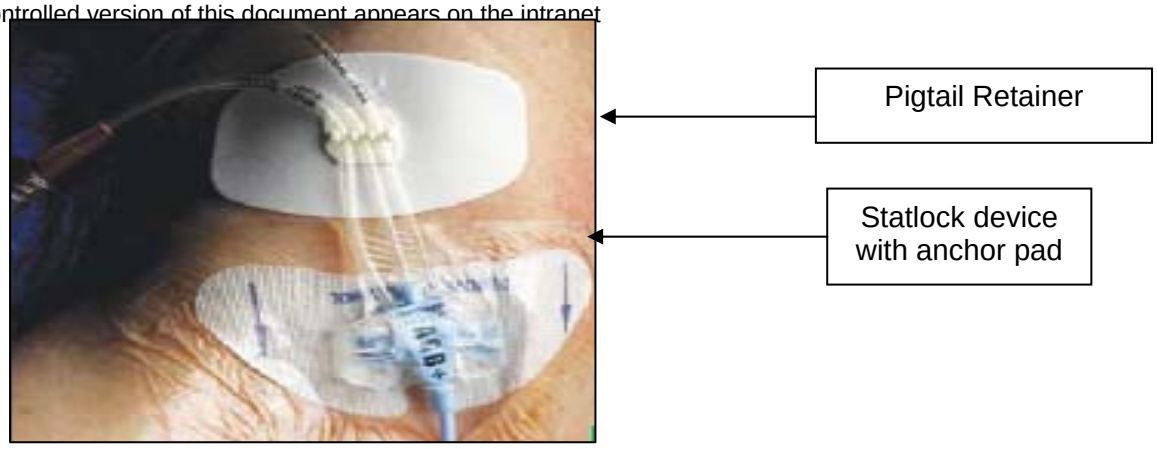
10.2.2 Equipment

- Universal Pack – containing sterile gloves
- Sterile transparent semi permeable dressing (eg. IV 3000)
- 2% Chlorhexidine in 70% alcohol solution (single patient use only)
- 20mLs 0.9% Sodium Chloride
- extra gauze squares if required
- “statlock” Device Pigtail Retainer for CVC lumens – **refer to section 8.5**

10.2.3 Nursing Actions

1. Explain procedure to patient.
2. Position patient supine, ensure patient is comfortable.
3. Wash hands.
4. Clean trolley with neutral detergent.
5. Open universal pack, add gauze squares and pour solutions into dressing tray compartments.
6. Apply clean gloves.
7. Remove old dressing and discard without touching catheter exit site to prevent contamination. Assess insertion site. If site appears infected, take swabs prior to applying solution.
8. Remove gloves and discard.
9. Preform clinical hand wash as per Infection Control Manual.
10. Apply sterile gloves.
11. Prepare sterile field.
12. Using sterile Sodium Chloride remove any dried blood or other fluid from around catheter site and under the hub.
13. Clean around the catheter & skin (approximately to the size of the final dressing) as well as under the catheter hub site with 2% Chlorhexidine in 70% alcohol solution. Cleanse vigorously for at least 30 seconds. Cleansing should be performed using a circular motion moving in concentric circles from the insertion site outward. Repeat this step 3 times using a new swab for each application. [12, 15]
14. Allow site to air dry. Do not wipe or blot. [12, 15]
15. Apply sterile semi permeable dressing, so as not to stretch the patient's skin. Smooth from the centre to the edge. The edges should not be sealed with tape.
16. The dressing must:
    i) be positioned so the catheter insertion site is in the centre of the dressing;
    ii) cover the catheter from the insertion site to the hub
    iii) create a complete seal from the catheter hub through to the insertion site.[4]
17. Secure all CVC lumens using "statlock" Device Pigtail Retainer **(refer to section 8.5).** If pigtail retainer not available ensure each lumen is anchored separately with brown leucoplast tape.

Figure 6



18. All IV lines must be secured to prevent drag on the CVC insertion site & CVC lumens.
19. Document procedure, status of the exit site, length of CVC at insertion site, actions taken, and outcomes for the patient in patient's health care record and on the patient's central vascular access device care plan.

10.3 CVC Flushing

Scope of Practice

A Registered Nurse who is deemed independent (in a competency based assessment or can demonstrate recognition of prior learning) & Medical Officers may undertake this procedure.

10.3.1 Policy Statements

- Routine flushing of a CVC should not be necessary as each lumen should have either a continuous infusion or be heparin locked.[13]
- Flushing of a CVC with 0.9% Sodium Chloride is required:[13]

  a) before and after administration of certain medication, administration of blood and blood products and intermittent therapy

  b) after obtaining a blood specimen

  c) when converting from intermittent therapy

  d) when the device is not in use
- Aseptic technique is essential to prevent contamination of the CVC, thus preventing infection.[13]
- After medication administration, blood withdrawal or administration of blood and blood products the flush volume must be at least 20mLs.[13]
- No smaller than a 10mL syringe is to be used to access a CVC. Smaller syringes exert higher pressure and may cause catheter rupture or dislodge a potential blood clot.[13]
- Excessive force should never be used when flushing a CVC as this could damage the CVC line.[13]
- Flush in a pulsatile technique (push-pause, push-pause) to create turbulence (to facilitate flushing of catheter wall).[12]
- Catheter must be clamped before and after flushing to maintain positive end pressure to minimise reflux into the catheter lumen.[4, 13]

10.3.2 Equipment

- Universal pack – containing sterile gloves
- 2 x 10mL syringes per lumen

- 0.9% Sodium Chloride ampoules
- Sterile drape
- 2% Chlorehexidine in 70% alcohol solution (single patient use only)
- Extra gauze squares if needed
- IV caps

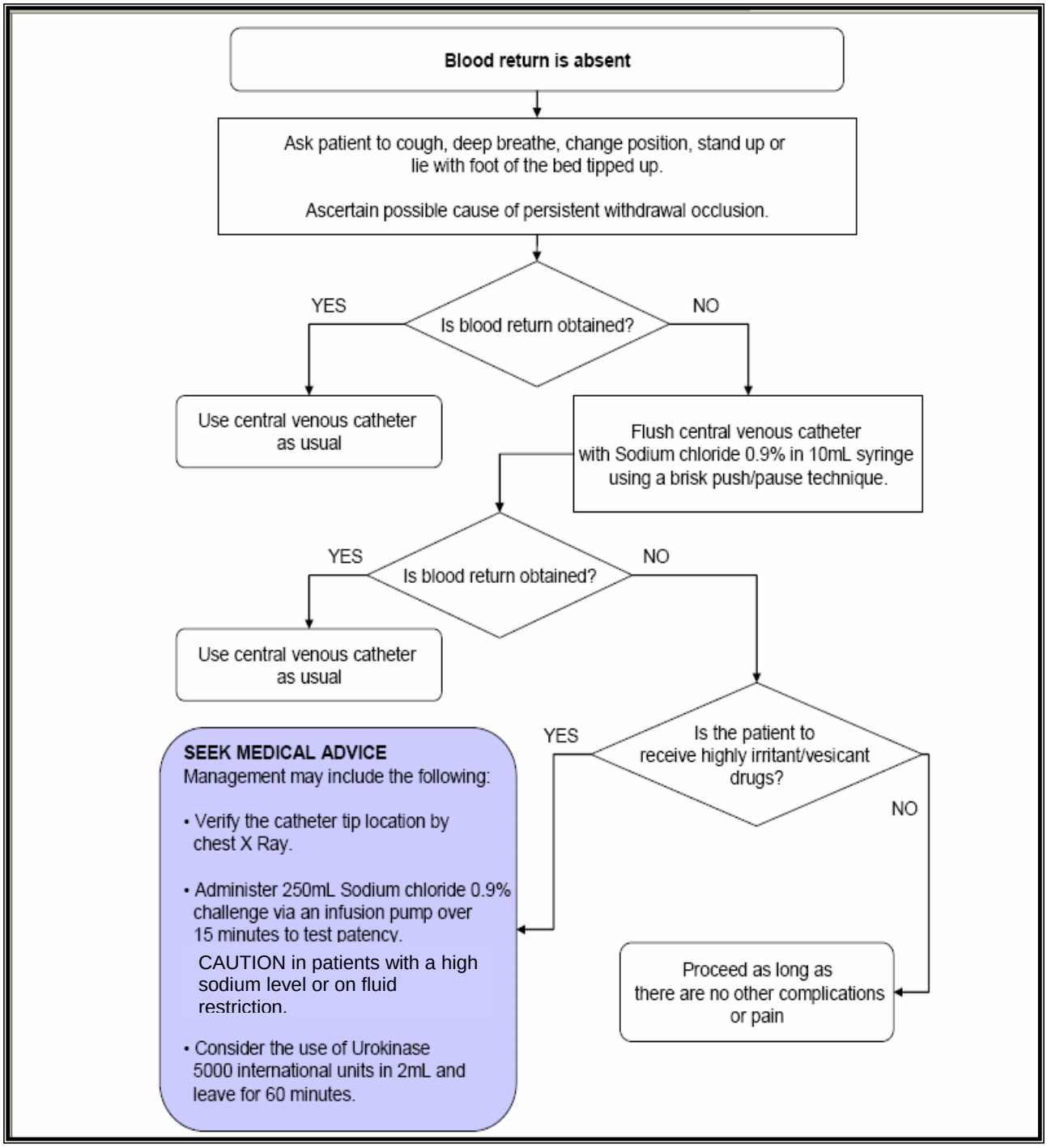
10.3.3 Nursing Action

1. Explain procedure to patient.
2. Position patient supine.
3. Perform clinical hand wash as per infection control manual.
4. Clean trolley with neutral detergent.
5. Open universal pack, add gauze squares and pour solution into dressing tray.
6. Open syringes onto dressing pack.
7. Perform clinical hand wash as per infection control manual.
8. Apply sterile gloves.
9. Draw up 0.9% sodium chloride ampoules into syringes.
10. Grasp CVC lumen with alcohol soaked gauze and clean the connection and further two cm of IV line with the chlorhexidine solution soaked gauze 3 times. Allow to air dry for 2 minutes.
11. Clamp CVC lumen, undo luer lock connection, disconnect current giving set or cap, attach 10mL syringe, unclamp and obtain 5-10mLs of blood. Clamp CVC lumen and discard syringe.
12. Attach syringe with normal saline, unclamp and flush lumen with 10mLs normal saline in a pulsatile technique. Note: it is recommended that 20mLs of 0.9% sodium chloride be used when flushing after medication administration, blood withdrawal or administration of blood and blood products.
13. Clamp CVC and apply new non vented end cap or reconnect infusion.
14. Ensure device is secured appropriately.
15. Document procedure, actions taken, and outcomes in patient's health care record and on CVAD care plan.

ALERT

If blood cannot be aspirated from a lumen please refer to flowchart below.
Do not attempt to inject any solution.

Figure 7: Algorithm for persistent withdrawal occlusion[18]



ALERT

Do not use CVC if confirmation of placement or patency not available. Use alternate venous access. Contact VAT/Medical Officer ASAP

10. 4 CVC Line and IV Fluid Bag Changes

Scope of Practice

A Registered Nurse who is deemed independent in a competency based assessment or can demonstrate recognition of prior learning / Medical Officers may undertake this procedure.

10.4.1 Policy Statements

- Line changes will be undertaken using strict aseptic technique and observing standard precautions.[12, 13]
- Administration sets (including burettes, infusion lines, multiflow adaptors, caps, bungs, extension lines) attached to a CVC will be changed every 96 hours, [8] preferably on Wednesdays and either Saturday or Sunday (Clinicians should follow their Ward/Unit protocol).This excludes blood, blood products & total parenteral nutrition (TPN).
- Administration sets used for blood & blood products (except factor VIII & IX) must be changed every 2 units & upon completion of the transfusion. [14, 15]
- For information regarding administration sets used for factor VIII & IX products please refer to "NSCCHS Blood and blood products – administration of Clinical Use of Blood Products Policy".
- Crystalloid solutions without additives (e.g. 0.9% normal saline, 5% dextrose) will be changed only with administration set (i.e. 96hours), catheter change or when infusion is completed. [4]
- TPN bags and administration sets will be changed every 24 hours.[10] Refer to CCH Total Parental Nutrition guidelines.

- All IV lines must be secured to prevent drag on the CVC insertion site & CVC lumens.
- A volumetric flow device must be used in general ward areas when fluids are being administered through a CVC.

10.4.2 Equipment

- Universal pack – containing sterile gloves
- Extra sterile gauze as required
- Chlorhexidine 2% in 70% alcohol solution
- IV giving set and other devices as necessary
- Appropriate IV solution as charted by medical officer

10.4.3 Nursing Action

1. Explain procedure to patient.
2. Position patient flat with 1 pillow if appropriate or as patient condition allows.
3. Clean trolley with neutral detergent.
4. Perform clinical hand wash as per infection control manual.
5. Open universal pack, add gauze squares and pour solution into dressing tray.
6. Open IV line (and other devices), connect IV solutions and prime lines maintaining sterility of end of lines and place on sterile set up.
7. Perform clinical hand wash as per infection control manual.
8. Apply sterile gloves.
9. Grasp CVC lumen with alcohol soaked gauze and clean the connection of the CVC lumen and further two cm of I.V. line with the chlorhexidine solution soaked gauze 3 times. Allow to air dry for 2 minutes.
10. Clamp CVC lumen, undo luer lock connection, disconnect current giving set or cap
11. Connect new primed giving set in a timely manner, unclamp CVC lumen and commence new infusion at prescribed rate.
12. Ensure device is secured appropriately.
13. Document procedure, actions taken, and outcomes for the patient in patients progress notes and on patient's CVAD care plan.

10.5 Heparin Locking CVC Lumens

Scope of Practice

A Registered Nurse who is deemed independent in a competency based assessment or can demonstrate recognition of prior learning / Medical Officers may undertake this procedure.

10.5.1 Policy Statements

- A Heparin lock must be inserted immediately on cessation of I.V. fluids [10]
- Lumens not in use should have a heparin lock attended twice weekly [10]

Heparin lock for CVC devices					
Device	**Filling volume**	**Amount of Heparin**	**Amount of normal saline**	**Dose/ dilution**	**Instil**
Central line	0.6 mL	1mL of 5000 u/s /5mL	4.0mL	200 u/s/1mL	1mL
Hickman's catheter	3.0 mL	1mL of 5000 u/s /5mL	4.0mL	200 u/s/1mL	3.5mL
PICC	0.6 mL	1mL of 5000 u/s /5mL	4.0mL	200 u/s/1mL	1mL
Vascular port	4.0 mL	1mL of 5000 u/s /5mL	4.0mL	200 u/s/1mL	4.5mL

10.5.2 Equipment

- Universal pack – containing sterile gloves
- Chlorhexidine 2% with 70% Alcohol
- Luer lock Cannula cap
- 3 x 10mLs syringes per lumen being heparin locked
- 0.9% Sodium Chloride 10mLs
- 0.9% Sodium Chloride 5mL (for each lumen)
- Heparin 5000units in 5mL

10.5.3 Nursing Action

1. Prepare the patient and equipment before the procedure according to general instructions.
2. Position patient on back if possible.
3. Wash hands.
4. Open pack, add equipment and pour solution.
5. Clamp CVC off. Turn off IV if infusion is in progress.
6. Wash hands for three (3) minutes. Don gloves.
7. With assistance:

8. (a) Using 10mL syringe, draw up 1mL of Heparin 5,000 units in 5mL for each lumen in separate syringes. Add 4mL of normal saline to each syringe to make 1000units of Heparin in 5mL
   (b) Using 10mL syringe, draw up normal saline for injection in separate syringes for each lumen.
9. Swab connection hub and further 2cm of IV line using chlorhexidine 2% with 70% alcohol and allow to dry. Repeat.
10. Ensure CVC is clamped off and remove CVC cap/infusion.
11. Attach 10mL syringe, unclamp and remove 3mL of blood if lumen has been previously locked. Clamp lumen. Attach 10mL syringe with normal saline for injection to catheter lumen. Unclamp CVC lumen.
12. Gently inject 10mL of normal saline using pulsatile technique. Repeat in each lumen, unclamping to inject. Clamp CVC lumen and remove syringe. Attach 10mL syringe with Heparin, unclamp and inject 1mL. Clamp CVC lumen and remove syringe.
13. Cap CVC with new cap and sign on nurse initiated section of National Medication Chart.
14. Attend to care of the patient and equipment following the procedure.
15. Document procedure in the patient health care record and on CVAD care guide.

10.6 Taking Blood Samples

Scope of Practice

A Registered Nurse who is deemed independent in a competency based assessment or can demonstrate recognition of prior learning / Medical Officers may undertake this procedure.

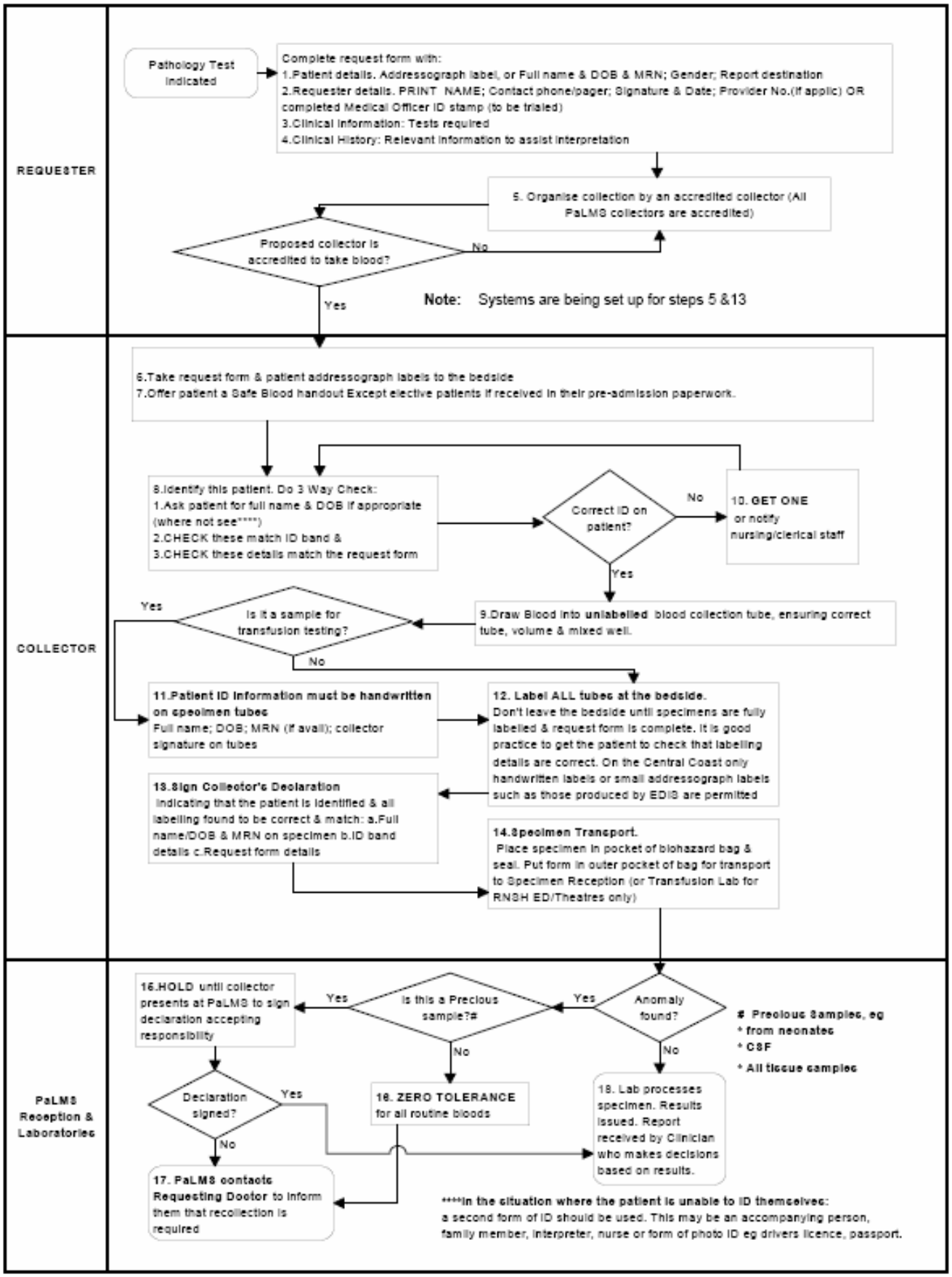
10.6.1 Policy Statements

- While generally not inserted for the drawing of blood a CVC may be used to obtain specimens in patients with difficult venous access. However it is preferable that blood samples are not taken via the CVC as this practice increases the risk of occlusion and infection [12, 16]
- Staff must adhere to the "NSCCHS Safe Blood Collection Policy". See link below.

- Blood samples from the distal port (by preference) may be taken using an aseptic technique[16]
- Never take blood samples from a lumen in which TPN is infusing

- If possible turn off the intravenous infusion ten (10) minutes prior to actually taking the blood, to avoid inaccuracy of test results due to the presence of intravenous additives.
- Discard the first 5mL of blood that is withdrawn from catheter unless blood cultures are being collected. If blood is taken for blood cultures do not discard the first 5mL as it may contain organisms essential for accurate diagnosis of infection. **Note: CVCs should not be used for collection of blood cultures unless at the time of catheter insertion.**

Figure 8: Safe Blood Collection Process for Inpatients[16]



10.6.2 Equipment

- Universal pack – containing sterile gloves
- Protective eyewear
- Chlorhexidine 2% with 70% alcohol
- Luer lock cannula cap
- 0.9% Sodium Chloride10 mL
- Pathology request form
- Vacutainer system with blue adaptor
- Appropriate pathology tubes
- Blood culture bottles if required

10.6.3 Nursing Action

1. Prepare the patient and equipment before the procedure according to general instructions.
2. Ask the patient for full name and date of birth if appropriate.[16]
3. Check patient details, match patient ID bands and request form.[16]
4. Position patient on back if possible.
5. Wash hands.
6. Open pack, add equipment and pour solution.
7. Clamp CVC lumen. Turn off IV if infusion is in progress.
8. Wash hands for three (3) minutes. Dry hands and don gloves.
9. Using 10mL syringe, draw up normal saline for injection.
10. Swab connection and further two cm of I.V. line with 2% chlorhexidine with 70% alcohol and allow to dry. Repeat.
11. Ensure CVC is clamped off and remove CVC cap/infusion.
12. (a) No blood cultures required. Attach a 10 ml syringe, unclamp CVC and remove 5mL of blood, clamp and discard syringe. Attach vacutainer system with blue adaptor. Unclamp CVC and insert the required tubes in the correct order of draw. Clamp CVC and remove vacutainer system with blue adaptor. Attach 10 mL syringe with normal saline, unclamp CVC and flush using a pulsatile technique.

Figure 9: Vacutainer system with blue adaptor

OR

12 b) Blood cultures required. Attach vacutainer system with blue adaptor to CVC lumen, unclamp CVC and attach the aerobic (blue) blood culture bottle. **The blood culture bottles must not be tipped on their side while collecting blood.** Once blood culture bottle has the required 10 mL volume, clamp CVC. Remove bottle. Repeat process for anaerobic (purple) blood culture bottle. If further blood tests are required unclamp CVC and collect tubes in the correct order of draw. Clamp CVC and remove vacutainer system with blue adaptor. Attach 10 mL syringe with normal saline, unclamp CVC and flush using a pulsatile technique.

13. Ensure that all tubes collected are filled to required amount.
14. When you remove a tube from the vacutainer holder, gently invert them several times, except blood culture bottles.
15. Remove syringe and attach new cap (consider need to heparin lock lumen) or reconnect I.V. line, unclamp CVC and restart infusion.
16. Label **ALL** tube(s) at the bedside. Don't leave the bedside until all specimens are fully labelled and request form completed. It is good practice to get the patient (if possible) to check that labelling details are correct.[16]
17. Attend to care of patient and equipment following the procedure according to general instructions.
18. Wash hands and ensure tube(s) and pathology request forms are completed correctly.[16]
19. Sign collector's declaration indicating that the patient is identified and all labelling found to be correct and match [16]
    a. Full name/DOB/MRN on specimen
    b. ID band details
    c. Request form details
20. Place specimen(s) in pocket of biohazard bag and seal. Put request form in outer pocket of bag for transportation to pathology.
21. Document procedure in the patient health record.

10.7 Removal of CVC

Scope of Practice

A Registered Nurse who is deemed independent in a competency based assessment or can demonstrate recognition of prior learning / Medical Officers may undertake this procedure.

10.7.1 Policy Statements

- A CVC may only be removed on the documented order of a Medical Officer.
- Removal of a CVC will be undertaken using an aseptic technique that will minimise the risk of infection.
- Patient is to be positioned supine with head slightly down (if tolerated) during CVC removal. This is to increase the pressure in the large veins to above that of atmospheric pressure, which reduces the risk of aspirating air into the venous circulation.[19, 20]
- The patient must remain in supine position (or Semi-Fowlers if supine not tolerated) for between 30 and 60 minutes following CVC removal. [20]
- The removal of a CVC and the presence of the intact tip must be noted in the patient's health record.
- If a blood stream infection is suspected as the result of a CVC, **blood cultures must be attended and the CVC tip sent for culture following removal** (refer to note below).
- Following CVC removal, the site must be sealed with an airtight dressing which remains insitu for at least 24 hours to reduce the risk of late air embolism. [19]
- Following removal, the CVC site will need daily review and dressing until healed.

Note: **Optimal Blood Culture Collection [3]**

- A blood culture set comprises 2 bottles (1 aerobic and 1 anaerobic).
- Collect 2 blood culture sets from separate venepunctures (not via existing central or arterial line).
- 10mLs of blood is required for each bottle (avoid over-filling).
- Disinfect skin and top of blood culture bottles with alcohol (1 minute).
- Use aseptic technique (sterile gloves, no touch technique).

10.7.2 Equipment

- Universal pack –containing sterile gloves
- Goggles, plastic apron
- Extra packet of gauze
- 2% Chlorhexidine in 70% alcohol solution
- Occlusive dressing
- Stitch cutter
- Non-sterile gloves

If the catheter tip is to be sent for culture add:

- 1 yellow top sterile specimen jar
- Sterile scissors

10.7.3 Nursing Action

1. Explain procedure to the patient.
2. Wash hands.
3. Prepare equipment.
4. Turn off IV infusions if not already attended.
5. Position the patient supine with head slightly down (if tolerated).
6. Don plastic apron, goggles and non-sterile gloves.
7. Remove the old dressing and discard with gloves. **DO NOT** remove giving sets from catheter.

ALERT

If the insertion site is inflamed or discharge present, a swab should be taken for culture prior to cleaning the site and removal of CVC.

8. Wash hands for two minutes. Don sterile gloves.
9. Clean the insertion site as if attending a CVC dressing. **Do not clean if tip is to be cultured.**
10. Remove the sutures / "statlock" and pigtail retainer securing the CVC.
11. Grasp the CVC near the skin exit site.
12. Instruct patient to perform valsalva manoeuvre (forcibly exhaling against a closed airway after deep inspiration). Removal in patients who cannot hold their breath should be timed to coincide with the start of exhalation. Removal should be timed to mid-inspiration in mechanically ventilated patients. These manoeuvres ensure that a positive intrathoracic pressure exists during line removal & minimizes the risk of air embolus.[2, 19, 20]
13. Apply gentle continuous traction until catheter is removed.

ALERT

During catheter removal, resistance should be minimal. If significant resistance is met do not proceed and notify Medical Officer.

14. Apply immediate pressure to the exit site with sterile gauze until bleeding has ceased.
15. Inspect CVC tip to ensure it has all been removed and report any cuts or breaks in the catheter to Medical Officer.

16. If CVC tip to be sent for culture, cut off the terminal 2cm with sterile scissors and place in labelled yellow top specimen container. Forward to microbiology with completed pathology request form.
17. Apply occlusive dressing.
18. Document CVC removal in the patient health record.
19. Check catheter site dressing to ensure no bleeding is evident.

11. REFERENCES

1. Healthcare Infection Control Special Interest group (HICSIG)

2. Darovic, G (2002) Hemodynamic Monitoring: Invasive and Noninvasive Clinical Application. 3rd Ed.W.B.Saunders Co.

3. Definition of central venous catheter-related bloodstream infection

4. ICCMU Nursing Care of Central Venous Catheters in Adult Intensive Care. NSW Health Statewide Guidelines for Intensive Care.

5. Critical Care Area Procedure Manual. Central Venous Pressure Monitoring. CCH procedure

6. Spencer. T (2007). Medical Officers Handbook on Central Venous Catheterisation. Sydney South West Area Health Service.

7. Australian Injectable Drugs Handbook. The Society of Hospital Pharmacists of Australia.

8. O'Dowd, L and Kelley. M Air Embolism. UpToDate online (updated 2008 Sept 8: cited 2008 Nov 28).

9. Working Policy for the Safe Insertion of Central Venous Catheters in NSW Intensive Care Units

10. Centre for Disease Control and Prevention (2002) Morbidity and Mortality Weekly Report. Guidelines for the Prevention of Intravascular Catheter-Related Infections.

11. Pratt, R.J., C.M.Pellowe, et al. (2007) "epic 2: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England". Journal of Hospital Infection

12. Queensland Health - CHRISP I-Care Project - Preventing intravascular device (IVD) related Bloodstream infections (BSI's):

13. Cancer Nurses Society of Australia (2007). Central Venous Access Devices: Principles for Nursing Practice and Education.

14. Australian Red Cross Blood Service. Transfusion Medicine Manual.

15. Australian & New Zealand Society Blood Transfusion. (2004). Administration of Blood Components.

16. NSCCHS. (2008). PO2006_011 -Safe Blood Collection Policy..

17. Rosenthal, K. (2007) Drawing Blood From a CVAD. Nursing Made Incredibly Easy! September/October 21-22

18. Royal College of Nursing (2003) Standards for Infusion Therapy London

19. Peter, D & Saxman, C. (2003) Preventing air embolism when removing CVC's: An evidence based approach to changing practice. Med Surg Nursing. Vol 12 (4).

20. Ingram, P. (2006). The safe removal of CVCs. Nursing Standard. Vol 20 (49). 42 – 46.

Figure 1
http://intensivecare.hsnet.nsw.gov.au/five/images/cvc%20for%20procedure.jpg

Figure 2
http://www.wirralchesterkidney.nhs.uk/images/dialysisline.jpg

Figure 4
http://www.frca.co.uk/images/cvp2.jpg

Figure 5
http://69.73.180.104/imageshost/image/31768.jpeg

Figure 6
http://www.statlock.com/pdf/CV_plus_poster.pdf

Figure 9
http://www.medisave.co.uk/product_thumb.php?img=images/vacu2.jpg&w=110&h=120