Central Venous Catheters

Learning Resource for Critical Care Nursing Staff

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Aims and objectives

The learner will be able to:

- Describe the indications for Central Venous Catheter insertion.
- Demonstrate visible and safe positioning of Central Venous Catheter.
- Describe the rational for transducing the Central Venous Catheter via a pressure bag and the knowledge of the rationale behind zeroing of central line.
- Demonstrate the ability to calibrate the Central Venous pressure transducer
- Demonstrate safe practice when changing Central Venous Catheter dressing in accordance with Unit policy.
- Describe potential complications of Central Venous Catheters
- Describe preventive strategies to prevent Central Venous Catheters complications
- Demonstrate safe practice when removing a Central Venous Catheters in accordance with Unit policy
Central Venous Catheterisation (CVC):

A Central Venous Catheter (CVC) is an invasive line that is placed in a large vein. The tip of the catheter lies within the proximal third of the superior vena cava, the right atrium, or the inferior vena cava. A CVC is made up of multiple lumens, each lumen is independent of each other. Each lumen exits into the bloodstream at different points along the line\(^1\).

Indications for insertion include:

- The need to monitor the Central Venous Pressure.
- Poor venous access.
- Fluid replacement therapy.
- The need to administer multiple infusions.
- Total Parenteral Nutrition.
- Administration of irritant drugs such as inotropes and vasopressors\(^1\).

CVC placement

The sites most commonly used are:

- Internal Jugular vein - Most popular as straightforward access into the superior vena cava
- External Jugular vein - rarely used
- Subclavian vein - lowest risk of CVC infection. However increased risk of pneumothorax during insertion
- Femoral vein - associated with highest risk of infection\(^1\).

CVC site selection – points to consider:

1. Internal jugular: most popular as straightforward access into SVC and has a high success rate.
2. Femoral: there is an increased risk of infection at this site compared with other sites The femoral site should be avoided where possible\(^3\). The femoral veins remain a reliable central venous access site, particularly under urgent or emergency situations\(^34\). Femoral cannulation also presents the risk of deep venous thrombosis.
3. The subclavian route offers the lowest risk of infection compared with other central line sites. It should be avoided for dialysis catheter insertion due to risk of subclavian vein stenosis. If arterial puncture should occur, the site has least ability to control bleeding. Least suitable insertion site for patients with potentially severe lung pathology due to the risk of pneumothorax. Least suitable site for patients with uncorrected coagulopathy, as it is associated with greater risk of uncontrollable haemorrhage.

Ideal position of central line

- Ideal position is lower Superior Vena Cava, cavoatrial junction or upper right atrium.
Procedure for insertion:

- The patient should be given adequate information prior to inserting the catheter.
- Full aseptic technique is used for insertion.
- The patient is placed head down (trendelenburg) at an angle of approximately 20°. The head-down position minimises the risk of air embolus and may also assist to dilate the target veins.
- The patient’s head is turned away from the site of insertion if subclavian or jugular vein.
- Insertion of CVC can be performed by land marking but ultrasound guidance is recommended as the preferred method for insertion of CVC. As this allows for visualisation of the vein.
- The relevant anatomy and landmarks are identified and the skin is prepared with an Chloraprep for 30 seconds. Sterile drapes are then applied around the selected site.
- Adequate local anaesthesia is required. Some patients may require sedation for insertion.
- The preferred technique of insertion is referred to as the Seldinger method. This involves locating appropriate vein, puncturing the vein by needle, a guide wire is passed through the needle. The needle is removed, a dilator is passed over the guide wire, then the CVC is threaded over the guide wire.
- The depth to which the CVC is placed depends on the site of insertion and the patients build. The right internal jugular is usually placed at 12-14cm, left internal jugular 14-16cm. The subclavian is usually 14-16cm depending on insertion point. Femoral is usually 16-20cm.
- Blood cultures may also be taken as soon as the CVC is in place.
- All lumens are aspirated and flushed with Normal Saline to ensure the CVC is in the correct place and to prevent blockage of the lumen.
- The proximal port is reserved for CVP measurement. A transducer and 3 way port is applied to this port. Bionnectors are applied to each of the remaining lumens.
- The patient may resume head-up position once the central line has been successfully inserted.
- The central venous line is then secured to the skin using 2/0 black silk/suture
- The site is dressing with Biopatch and occlusive dressing
- Radiological confirmation of the position of the catheter tip must be undertaken.
- CVC insertion bundle needs to be completed and inserted into patients notes.
Care of the CVC

- The CVC site must be assessed at least once on a daily basis to assess for any potential complications.6
- The care of the CVC site must be performed using aseptic technique and observing Standard Infection Control Precautions, and should coincide with dressing changes.7
- Bionectors are applied to each port. The number of access points is kept to a minimum.10
- Decontaminate the bionector hub: **scrub the hub for 30 seconds** prior to each use with chlorhexidine (green clinell) wipe and allow to air dry normally 15-30seconds.9
- Change bionnector every 7 days.11
- If the patient is receiving TPN this lumen should be labelled for TPN, no other infusion can be given via this lumen while TPN is being infused. TPN administration sets should be changed every 24 hours.10

CVC site dressing

The central line must be secured with a sterile transparent, semi-permeable dressing.4

The dressing should be changed if the dressing:

- is ineffective in securing the CVC.
- is not keeping the CVC site clean
- if the CVC is kinked under the dressing
- The dressing should be changed at least every 7 days.4
- The date that the dressing has been changed should be documented on the dressing.9

“CVCs are the leading cause of device-related bacteraemia or catheter related blood stream infection (CRBSI), which are a major cause of morbidity, increased severity of illness and prolonged hospital stay.”(Scottish Intensive Care Society, 2012 page 4.)
Maintaining Patency

NB Always use aseptic technique when accessing the CVC

Do not administer drugs or fluids unless the line is fully patent. Fully patent means that:
- Visible CVP waveform trace represents patent proximal lumen.
- The lumen can be flushed easily.
- There is flashback of blood.

If the lumen is not fully patent, see Managing patency problems.

Assessing for patency:
- Test for flashback of blood before administering IV medications but note that you should not discard blood unnecessarily.
- It is recommended that a syringe smaller than 10 mls should not be used. To prevent excessive pressure being exerted on the lumen which might cause it to rupture. Smaller syringes exert greater pressure. But please note that syringe size alone is not sufficient to prevent rupture. “When resistance is felt, if more pressure is applied to overcome it, catheter fracture could result regardless of the syringe size.”
- To assess for flashback:
  - attach a 10 ml syringe containing 5mls 0.9% normal saline into the lumen, flush a couple of mls into the line and then withdraw. As soon as you see a trace of blood in the lumen or syringe flush the rest of the normal saline into the lumen using push pause technique.

Patency Problems

Patency problems are common in CVC and include:
- no flashback of blood when aspirating the lumen
- sluggish flow
- complete blockage of lumen.

Possible causes
- clotted blood in the catheter (most likely cause)
- fibrin sheath
- malpositioned catheter
- drug precipitation
- build up of lipids (Total Parenteral Nutrition).

Managing Patency Problems
- No flashback of blood
  - Ask the patient to take deep breaths and try changing the patient position. Flush briskly using 10mls normal saline.
- Catheter flow is sluggish
  - Ask the patient to take deep breaths and try changing the patient position. Flush briskly with 10mls normal saline.

Preventing Patency Problems: good flushing techniques
- The device should be flushed at established intervals (before and after each drug) to promote and maintain patency and to prevent the mixing of incompatible medications. The patency of the device should be maintained using the correct techniques such as positive pressure and pulsatile flush.
- The volume of the flush solution should be equal to at least twice the volume of the catheter and add-on devices usually 5ml.
- Use a brisk 'push-pause' flushing technique routinely when flushing the catheter - i.e. flush briskly, pausing briefly after approximately each ml of fluid. The 'push-pause' technique causes turbulence within the catheter, which helps to flush away any debris and prevent occlusion of the lumen.
- Clamp the line while the final ml of the flush is being injected. Maintaining positive pressure helps prevent blood entering the catheter after flushing, which might lead to occlusion or thrombus formation.
Central Venous Pressure (CVP)

Definition: Central Venous Pressure reflects venous return to the heart and cardiac function. It is not a measure of blood volume but allows assessment of the ability of the right heart to accept and deliver blood\(^1\).

Normal CVP and understanding CVP
The normal CVP value is 0-5mmHg in a spontaneously breathing patient and 5-10mmHg in ventilated patient due to the use of Positive End Expiration Pressure (PEEP) and Continuous Positive Airway Pressure (CPAP). CVP measurements must not be interpreted on their own, but viewed alongside the patient’s full clinical picture. Serial measurements and the resulting trend provide valuable information. If the patient is well perfused, good end organ function, haemodynamically stable then the measurement of low CVP will not be treated\(^1\).

The diagram below illustrates the typical waveform of a properly positioned central venous catheter in a patient with normal venous pressure:

The normal CVP waveform has 3 positive deflections. These are referred to as a, c and v waves, which correspond to specific atrial events in the cardiac cycle:

- The **a wave** reflects atrial contraction and follows the p wave seen on the ECG.

- The downslope of this is called the **x descent** and represents atrial relaxation.

- The **c wave** represents the bulging of the closed tricuspid valve into the right atrium during ventricular contraction. The c wave is small, and is often not always visible, but corresponds to the QRST interval on the ECG.

- The **v wave** represents atrial filling and increased pressure against the closed tricuspid valve in early diastole.

- The downslope of the **v wave** is referred to as the **y descent** and represents the fall in pressure as the tricuspid valve opens and blood flows from the right atrium to the right ventricle\(^1\).
The CVP is influenced by several factors:

1. Venous return – this is blood returning to the right atrium which is delivered via the superior vena cava, the inferior vena cava and the coronary veins.

2. Right heart compliance – right ventricular compliance is the change in end-diastolic pressure with change in ventricular volume. In a healthy heart, volume administration does not cause a dramatic rise in end-diastolic pressure; the ventricle is compliant.

3. Intrathoracic pressure – mechanical ventilation creates a positive pressure within the thoracic cavity which impedes venous return.

4. Patient position – technique and position must be consistent each time a measurement is taken. The zero point is level with the mid-axillary line in the 4th intercostal space.

A low CVP reading usually indicates loss of fluids:

- Haemorrhage/Hypovolaemia
- Excessive diuresis

A high CVP reading may be due to:

- Cardiac failure – eg. right ventricular failure or mitral valve incompetency.
- Hypervolaemia – (more complex) – eg. excessive fluid infusion.
- Lumen occlusion or obstruction – eg. catheter against vessel wall.

The Central Venous Monitoring system consists of 4 main parts:

1. The indwelling/invasive catheter.
2. The transducer which receives the signal from the tubing and converts it into electrical energy.
3. The flush system which maintains catheter patency.
4. The bedside monitor which displays the waveform.

Flush system:

- A bag of 500ml heparinised saline is used to prime the flush-system and is inserted into a pressure infuser cuff. Some patient’s CVC may be kept patent with Normal Saline due to their platelet count.

- The bag is pressurised to 300mmHg for adults which infuses 3ml/hr and pressurised to 150mmHg for paediatrics which infuses 1.5ml/hr.

- This infusion solution must be prescribed and checked by two nurses against the designated prescription sheet before administration.

- Further checks should be made at each shift handover to ensure that heparinised saline is being administered and that the transducer system is maintained under continuous pressure at 300mmHg.

- There is a need to check that there is sufficient fluid remaining in the bag – this may be more difficult to visualise during night hours or where there is reduced lighting.
Preparing the Monitor & Tubing System:

Improper systems can cause erroneous measurements of hemodynamic indices, which can potentially invalidate a patient’s entire hemodynamic profile.

Priming the TruWave transducer

The procedure is based on the Royal Marsden procedure and the best practice guidance from TruWave. However, the procedure has been adapted after risk assessment. TruWave recommend non-vented caps to reduce the risk of air entering the transducer. This means the non-vented caps are removed every time the transducer is zeroed. This may potentially increase the risk of infection due to the cap not remaining sterile during zeroing which then may contaminate the non-vented cap and introduce bacteria into the transducer. For this reason, the vented caps that are provided by TruWave will be used instead of non-vented caps.

Explain and discuss the procedure with the patient.

Standard (universal) precautions and an aseptic technique must be adhered to.

Wash hands using a bactericidal handrub

Remove transducer from packaging ensuring aseptic technique. Ensure all connections are secure.

1. Insert transducer on to transducer ramp

2. De-air and prime the transducer giving set

3. Keeping the IV bag inverted spike the bag with the fluid administration set

4. Keeping the IV bag inverted open the roller clamp on the fluid administration set. Open the vent port by turning the stopcock towards the pressure tubing, leave the vented cap on at present.

5. Keeping the IV bag inverted gently squeeze air out of the IV bag with one hand, while pulling snaptab, flush with the other hand. Until the bag is empty of air IV bag and until the trip chamber is filled to half way with fluid.
6. Gravity fill the TruWave transducer system. Insert the IV bag into infusor bag do not inflate at present. Pull flush tab flush to deliver the flush through the giving set and out of the vented port and the vented cap. Once the fluid has reached the vented port close the vent port by turning the stop clock towards the cap

7. Holding the giving set at a 45 degree upright angle pull the fast tab to flush the remainder of the line until the flush has reached the end of the line

8. Inflate the pressure bag to 300mmHg

9. Fast flush the giving set by pulling the fast tab. While pulling the fast tab, tap on the stop clock to remove any residual air bubbles

10. Now scrub the proximal lumen for 30 seconds with chlorhexidine (green clinell) wipe and allow to air dry before connecting the TruWave giving set to CVC. Ensuring aseptic non-touch technique.

11. Now attach the transducer to the monitor. Then zero as described below

Pictures courtesy of TruWave, 2015
Video of how to setup transducer is available at:
Click on in-service video
Zeroing the CVP

The CVP transducer must be set at the appropriate level in relation to the patient in order to measure \( \text{cvp} \) correctly.

- For calibration the transducer must be level with the \textit{right atrium} \(^1\).
- The phlebostatic axis must be identified. Using the mid clavicle as a guide, locate the fourth intercostal space and follow this space across the chest wall to the mid axillary line\(^2\).
- The patient can be lying flat or their head not elevated by more than 45 degrees (The right atrium and the phlebostatic axis remain constant up to a 45 degree angle) \(^2\).  
- If patient is nursed on a lateral position, it is then difficult to determine the exact/true phlebostatic axis. For this reason, measurements are not considered as accurate in lateral positions compared to those taken with a patient lying supine\(^2\).

1. Position the patient as above. Turn the stop clock towards the pressure tubing.

2. On the monitor access the zero function. Press zero and confirm that the waveform and numerical value show as zero.

3. Close the stop clock by turning the stop clock towards the vented cap.
Why use the proximal port for CVP monitoring?

- If CVC accidentally migrates from its site, the CVP waveform trace may change or may completely disappear as the proximal exit point is nearest the skin surface\(^{25}\).
- Any unusual swelling or leakage of fluid from CVC site must be reported immediately\(^{25}\).
- Never ignore infusion pump high resistance alarms: first attempt to aspirate port and then attempt manual bolus of normal saline. High resistance alarms may suggest dislodgement\(^{23}\).
- Failure to report any of the above could result in unwanted complications e.g. subcutaneous emphysema\(^{25}\).

Troubleshooting loss of CVP waveform:

Loss of CVP waveform may be noted on monitor and this may indicate dislodgement, clot, kinking, transducer malfunction or improper catheter location. A normal CVP trace should fluctuate appropriately with respiration and cough\(^{28}\). Simple troubleshooting measures include the following:

1. Ensure that the pressure bag is maintained under continuous pressure of 300mmHg\(^{21}\).
2. Check that all transducer connections are secure especially the sensor cables\(^{21}\).
3. Undertake zeroing procedure and ensure that auto-scaling has also been performed. Ensure that the 3-way tap is open to flow at the patient-end and also at the level of the transducer itself\(^{21}\).

Troubleshooting if the waveform has been lost

Do the ports flush easily?

A CVC lumen that does not flush or does not allow for the line to be aspirated is more likely kinked or clogged.

A catheter that easily flushes with no resistance but is difficult to aspirate can suggest two potential complications: The application of excessive negative pressure in attempts to aspirate from a lumen may collapse the vein itself or draw the lumen of the catheter against the wall of the vessel\(^{27}\).

Alternatively, the catheter could be in a small venous tributary and not in a central location. Another more troubling possibility is that the catheter is extravascular, the result of erosion or improper initial placement.

Even an initially well-placed catheter may migrate out of place, despite the best suturing and dressing. The markings on the catheter itself can gauge whether the line has migrated either in or out\(^{1}\).

- Is the catheter kinked?
  Internal jugular, subclavian and femoral lines are all subject to kinking both at the skin and within the vessel itself. Suturing may also induce kinking of CVCs.

- Is the catheter clotted?
  The older a catheter is, the more likely it is to be clotted. Slow infusion rates, poorly malfunctioning transducer flush systems, or long intervals between manual flushes may be to blame\(^{13}\).

- What was the intravascular location of the catheter on the last chest film?
  When uncertain, another chest film can be obtained to check its placement. Does it appear kinked on the film? A well-placed catheter should have its tip well within the vein, but outside of the cardiac chambers, as it can erode through atrial and ventricular walls or cause arrhythmias\(^{1}\).
Could the vein be thrombosed?
Perhaps it is not merely clotting of the catheter but of the entire central vein itself. When the vein is clotted, showering of clot material to the pulmonary vasculature (i.e. pulmonary emboli) may occur which can dramatically affect a patient’s haemodynamic and pulmonary status.

Complications associated with central venous catheterisation:
Catheter-related infection – Maintenance of the CVC is as important as the Central Line Insertion bundle. Always take signs of systemic or local infection seriously and refer to a member of the medical staff. Infection may occur either within the catheter or at the exit site or skin tunnel.

Signs and symptoms may include:
Pyrexia, rigor after flushing;
Sore throat;
Generally feeling unwell;
Hypotension, tachycardia and shock

At the exit site/in the skin tunnel:
Redness/oedema;
Pain;
Discharge

As stated
• The CVC should be reviewed daily
• Ensure the CVC dressing is intact
• Ensure dressing is changed at least every 7 days,
• Ensure that 2% chlorhexidine gluconate in 70% isopropyl alcohol is used for cleaning the insertion site during dressing changes
• Ensure that hand hygiene is performed immediately before accessing the line/site
• Ensure that an antiseptic containing 70% isopropyl alcohol is used to clean the access hub prior to accessing – rub the access hub for at least 30 seconds (‘scrub the hub’).

Catheter hubs are accessed more frequently when catheterisation is prolonged, and this increases the risk of CR-BSI originating from a colonised catheter hub rather than the insertion site.

Pneumothorax
Pneumothorax means presence of air in the pleural space between the lungs and the chest wall. It can occur for a number of reasons but is the most common complication with CVC. It results when a needle, guide wire, dilator or catheter inadvertently punctures the lungs during insertion of a central venous catheter. Incidence is 1–4% depending on the experience of the operator, site or technique. It is more common with the subclavian approach due to its anatomical proximity to the lung. It is characterised by shortness of breath and sudden onset of chest pain but it may be clinically silent and only be discovered on the chest X-ray performed following the procedure. Pneumothorax may also be diagnosed by ultrasound. Other symptoms include tachycardia, persistent cough and diaphoresis.

Prevention is based on the skill level of the inserting practitioner as well as the use of ultrasound. If symptoms are noted during insertion, the practitioner should stop the procedure. The patient's colour, respirations and pulse should be monitored and oxygen should be administered. In the case of a small pneumothorax, the patient may feel slightly breathless but no intervention is required and the pneumothorax will heal spontaneously. However, a large pneumothorax will necessitate the insertion of a chest drain. N.B remember ABCDE
• **Arterial puncture:**

If this is suspected the needle should be removed and firm manual pressure applied for 5 minutes.

The carotid artery can potentially be punctured as it lies immediately posterior to the internal jugular vein (see opposite). However, to reduce the risk of this occurring, the artery itself is palpated and held beneath the fingers.¹

• **Femoral artery puncture:** the femoral artery can be accidentally punctured due to the close anatomical relationship between the femoral artery and the femoral vein. This can be avoided by using a key for order of structures, that is NAVERL.¹

  N = nerve.
  A = artery.
  V = vein.
  E = empty space.
  L = lymphatics.

• **Air embolism**

Air embolism can occur in conjunction with any entry into the vascular system but commonly occurs at insertion and removal of central venous catheters.³³ For air to enter the vascular system, a pressure gradient between the vascular space and atmospheric air must exist, giving a direct line of access to the blood vessel.³³ The severity of the embolism depends on:

- the volume of air that enters the vessel: there is not an exact volume of air that is significant
- the rate of entry: rapid bolus injection may cause cardiovascular collapse whereas gradual accumulations (of microbubbles) may go unnoticed
- the patient’s position at time of entry: patients sitting upright during removal are at greater risk (passive air entry). Active air entry may occur when using pressure bags or if tubing has not been primed correctly or syringes are not purged of air.³³

Incidence is considered low but the true frequency is unknown, estimated at 1:47 to 1:3000.³⁴

Signs and symptoms are sudden dyspnoea, light-headedness, shoulder and chest pain, tachypnoea, tachycardia and hypotension.³³

Management includes turning the patient onto the left side and in the Trendelenburg position. This is the optimal position as it decreases the gradient between atmospheric air and the vessels and holds the entrapped air in the apex of the right atrium to prevent occlusion of the pulmonary artery.³³

Prevention of air embolism

**During insertion and removal**

- Position supine or Trendelenburg
- Get patient to perform Valsalva manoeuvre
- Use air occlusive dressing for 24 hours

**During use and maintenance**

- Expel air from all IV systems before attaching to the patient
- Use Luer-Lok connections to prevent accidental disconnection of tubing
- Examine equipment for cracks or leaks which may allow ingress of air
- Use infusion devices that have air in line alarms
- Don't allow collapsible IV fluid bags to run dry
Malposition of catheter.\textsuperscript{7,30}

Clinical features of malposition include the catheter appearing longer at the exit site or lack of blood return. Catheter malposition may be asymptomatic; however, the following symptoms may suggest malposition on insertion or when in situ:

- resistance or discomfort during insertion
- bending in the guide wire when removed from the catheter
- ‘ear gurgling’ experienced by the patient with catheter malposition in the internal jugular vein
- arrhythmias when the tip is too far into the right atrium
- partial or complete catheter occlusion
- headache, chest/shoulder pain or back pain with infusion
- reduced infusion rate
- signs of extravasation
- ipsilateral extremity oedema
- backflow of blood into external tubing
- unrelated to increased intrathoracic pressure
- To accurately confirm catheter dislodgement and catheter tip position a chest x-ray should be performed with an AP and lateral view\textsuperscript{7,30}

Removal of central line\textsuperscript{6}

Procedure for removal is shown on page 21

Is it safe to remove the central line? What is happening within the unit/ward? What other procedures are being carried out? Communicate with the rest of the team before removal

Check patient’s coagulation status. If there is an increased risk of bleeding discuss with medical team before proceeding. What is the patient’s platelets count? What is the patient’s INR

The risk of air embolism increases if patient is dehydrated, is unable to lie flat, or has an uncontrolled cough. Assess for these risks.

Stop all infusions and ensure that all lumens are capped off and clamped before removal.

Unless contraindicated (e.g., head injury or respiratory difficulties), lie the patient flat and tip the head of the bed downward to reduce the risk of air embolism (except femoral catheters).

Advise the patient to stay in bed for 30 minutes to allow any bleeding to stop. During this time observe patient for signs of haematoma (i.e., swelling, pain, altered voice, airway obstruction).

The exit site should remain covered with an occlusive dressing for 72 hours following catheter removal due to the risk of late air embolism\textsuperscript{6}.
# Procedure for changing Central Venous Catheter dressing

**Equipment required**
- Trolley
- Personal Protective Equipment (including eye protection)
- Pair of non-sterile gloves
- Sterile dressings pack (containing sterile towel and low-linting gauze, sterile gloves).
- May require sterile gloves as dressing pack sterile gloves are size medium
- Chloraprep (2% chlorhexidine in 70% alcohol)
- Semi-permeable transparent dressing and chlorhexidine dressing (Biopatch or Tegaderm CHG)

**Optional equipment**
- Bacteriological swab

<table>
<thead>
<tr>
<th>Action</th>
<th>Rational</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Explain procedure to the patient.</td>
<td>To ensure patient understands procedure.</td>
</tr>
<tr>
<td>2. Perform the dressing as an aseptic technique</td>
<td>To prevent infection.</td>
</tr>
<tr>
<td>3. Screen the bed. Assist the patient into a supine position, if possible.</td>
<td>To allow dust and airborne organisms to settle before the insertion site and the sterile field are exposed.</td>
</tr>
<tr>
<td>4. Decontaminate hands</td>
<td>To reduce the risk of cross-infection</td>
</tr>
<tr>
<td>5. Clean trolley, if not clean, clean with detergent wipes and dry. Then clean with 70% isopropyl alcohol impregnated wipes</td>
<td>To reduce the risk of cross-infection</td>
</tr>
<tr>
<td>6. Place all equipment required for the dressing on the bottom shelf of a clean dressing trolley. Take the trolley to the patient's bedside, disturbing the screens as little as possible.</td>
<td>To reduce the risk of cross-infection and to minimize airborne contamination</td>
</tr>
<tr>
<td>7. Put apron on</td>
<td></td>
</tr>
<tr>
<td>8. Attach waste disposal bag to side of trolley below the level of the top of the trolley</td>
<td>So that contaminated material are below the level of the sterile field</td>
</tr>
<tr>
<td>9. Open the sterile dressing pack onto the top of the trolley.</td>
<td>To reduce contamination of contents.</td>
</tr>
<tr>
<td>10. Open the other sterile packs, tipping their contents gently onto the centre of the sterile field.</td>
<td>To reduce risk of contamination of contents</td>
</tr>
<tr>
<td>11. Decontaminate hands</td>
<td>Hands may have become contaminated by handling the outer packs, and so on</td>
</tr>
<tr>
<td>12. Apply non sterile gloves- remove CVC dressing ensuring that central line site is not contaminated</td>
<td>So dressing can be removed easily.</td>
</tr>
<tr>
<td>13. Take off gloves, decontaminate hands</td>
<td>To minimise the risk of infection</td>
</tr>
<tr>
<td>Step</td>
<td>Action</td>
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<td>------</td>
<td>------------------------------------------------------------------------</td>
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<tr>
<td>14</td>
<td>Put on sterile gloves</td>
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<tr>
<td>15</td>
<td>Inspect site for signs of exudate or inflammation. If swab is required obtain swab before cleansing CVC site. Inform medical staff</td>
</tr>
<tr>
<td>16</td>
<td>Clean site with chloraprep using back-and-forth strokes with friction. Allow area to dry prior to applying the dressing.</td>
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<tr>
<td>17</td>
<td>Place the sterile field near the CVC site</td>
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<tr>
<td>18</td>
<td>Apply dressing &amp; mould it into place to avoid folds.</td>
</tr>
<tr>
<td>19</td>
<td>Document date and time on dressing</td>
</tr>
<tr>
<td>20</td>
<td>Dispose of waste in appropriate container.</td>
</tr>
<tr>
<td>21</td>
<td>Remove gloves and decontaminate</td>
</tr>
<tr>
<td>22</td>
<td>Document date and time of dressing and any relevant changes at the insertion site in the patient's records.</td>
</tr>
</tbody>
</table>
**Procedure for blood sampling from Central Venous Catheter**

### Essential equipment
- Trolley
- Personal Protective Equipment (including eye protection)
- Sterile dressings pack (containing sterile towel and low-linting gauze, sterile gloves).
- May require sterile gloves as dressing pack sterile gloves are sized medium
- Bionnector
- X2 green Clinell (2% chlorhexidine)
- Vacuum system adaptor
- Appropriate blood bottles
- X2 10mls of normal saline 0.9%
- X2 10 sterile syringes (1 for patency and discard, 1 for flushing)
- X2 red drawing up needles

*If taking Gentamycin or Vancomycin level etc do not take blood sample from that lumen that the drug has been infused. As this has been shown to contaminate the sample*

<table>
<thead>
<tr>
<th>Action</th>
<th>Rational</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Explain procedure to the patient.</td>
<td>To ensure patient understands procedure.</td>
</tr>
<tr>
<td>2. Perform the blood sampling as an aseptic technique</td>
<td>To prevent infection.</td>
</tr>
<tr>
<td>3. Screen the bed. Assist the patient into a supine position, if possible.</td>
<td>To allow dust and airborne organisms to settle before the insertion site and the sterile field are exposed.</td>
</tr>
<tr>
<td>4. Decontaminate hands</td>
<td>To reduce the risk of cross-infection</td>
</tr>
<tr>
<td>5. Clean trolley, if not clean, clean with detergent wipes and dry. Then clean with 70% isopropyl alcohol impregnated wipes</td>
<td>To reduce the risk of cross-infection and to minimize airborne contamination</td>
</tr>
<tr>
<td>6. Place all equipment required for the blood sampling on the bottom shelf of a clean dressing trolley. Take the trolley to the patient’s bedside, disturbing the screens as little as possible</td>
<td></td>
</tr>
<tr>
<td>7. Put apron on</td>
<td></td>
</tr>
<tr>
<td>8. Attach waste disposal bag to side of trolley below the level of the top of the trolley</td>
<td>To that contaminated material is below the level of the sterile field</td>
</tr>
<tr>
<td>9. Open the sterile dressing pack onto the top of the trolley.</td>
<td>To reduce contamination of contents.</td>
</tr>
<tr>
<td>10. Open the other sterile packs, tipping their contents gently onto the centre of the sterile field.</td>
<td>To reduce risk of contamination of contents</td>
</tr>
<tr>
<td>11. Decontaminate hands</td>
<td>Hands may have become contaminated by handling the outer packs, and so on</td>
</tr>
<tr>
<td>12. Put sterile gloves on</td>
<td>To minimise the risk of infection</td>
</tr>
<tr>
<td>13. Draw up 5mls of 0.9% normal saline into a sterile syringe and 5mls into another sterile</td>
<td>To minimise the risk of infection</td>
</tr>
<tr>
<td>Step</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>14.</td>
<td>“Scrub the hub” thoroughly with a 2% chlorehexidine in 70% alcohol swab. Allow to dry for up to 30 seconds.</td>
</tr>
<tr>
<td>15.</td>
<td>Place the sterile field near the CVC site to create a clean working area.</td>
</tr>
<tr>
<td>16.</td>
<td>Attach 10 ml syringe with 5mls of 0.9% sodium chloride, flush with two mls of 0.9% sodium chloride and then aspirate and discard 5mls of blood. Ask the patient to take deep breaths and try patient different positions if blood flow is sluggish. Dead space of the distal lumen is 0.5mls. To remove blood, heparin and intravenous fluids from the ‘dead space’ of the catheter.</td>
</tr>
<tr>
<td>17.</td>
<td>Attach vacuum system adaptor and aspirate the required blood samples in correct order of blood draw. It is not necessary to clamp the lumen between bottle samples. To prevent contamination of samples and contamination of lumen.</td>
</tr>
<tr>
<td>18.</td>
<td>Clamp catheter once all the bloods have been aspirated and detach vacuum system adaptor. To prevent air embolism.</td>
</tr>
<tr>
<td>19.</td>
<td>Remove the Bionnector and Scrub the hub” thoroughly with a 2% chlorehexidine in 70% alcohol swab. As blood has passed the valve of the Bionnector this may increase the risk of infection, the Bionnector needs to be replaced.</td>
</tr>
<tr>
<td>20.</td>
<td>Attach syringe with 5mls of 0.9% sodium chloride, release clamp. Flush using a push–pause method and end with positive pressure. The 'push-pause' technique causes turbulence within the catheter, which helps to flush away any debris and prevent occlusion of the lumen. Maintaining positive pressure helps prevent blood entering the catheter after flushing, which might lead to occlusion or thrombus formation.</td>
</tr>
<tr>
<td>21.</td>
<td>Fold up the sterile field, place it in disposal bag. Remove gloves. Seal disposal bag before moving the trolley. Dispose of the equipment in the appropriate containers. To minimise the risk of infection.</td>
</tr>
<tr>
<td>22.</td>
<td>Decontaminate hands. To minimise the risk of infection.</td>
</tr>
<tr>
<td>23.</td>
<td>Label blood samples with the patient's name, number, date of birth, etc. at patient's bedside and send them to the laboratory with the appropriate forms.</td>
</tr>
<tr>
<td>24.</td>
<td>Document the procedure in the patient’s records. To ensure adequate records and to enable continued care of device and patient.</td>
</tr>
</tbody>
</table>
Procedure for removing a Central Venous Catheter

Central venous catheters are removed if complications develop or when no longer required

**Essential equipment**
- Trolley
- Personal Protective Equipment (including eye protection)
- Non-sterile pair of gloves
- Sterile dressing pack (containing sterile towel and low-linting gauze, sterile gloves)
- May require sterile gloves as dressing pack sterile gloves are sized medium
- Occlusive dressing
- Sterile scissors
- Small sterile specimen container
- Stitch cutter
- Chloraprep (2% chlorhexidine in 70% alcohol)

**Optional equipment**
- Bacteriological swab

You will need assistance to remove the central line

<table>
<thead>
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<tbody>
<tr>
<td>1. Explain procedure to the patient.</td>
<td>To ensure patient understands procedure.</td>
</tr>
<tr>
<td>2. Perform the removal of CVC as an aseptic technique</td>
<td>To prevent infection.</td>
</tr>
<tr>
<td>3. Screen the bed. Assist the patient into a supine position, if possible.</td>
<td>To allow dust and airborne organisms to settle before the insertion site and the sterile field are exposed.</td>
</tr>
<tr>
<td>4. Decontaminate hands</td>
<td>To reduce the risk of cross-infection</td>
</tr>
<tr>
<td>5. Clean trolley, if not clean, clean with detergent wipes and dry. Then clean with 70% isopropyl alcohol impregnated wipes</td>
<td></td>
</tr>
<tr>
<td>6. Place all equipment required for the removal CVC on the bottom shelf of a clean dressing trolley. Take the trolley to the patient's bedside, disturbing the screens as little as possible</td>
<td>To reduce the risk of cross-infection and to minimize airborne contamination</td>
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<td>7. Put apron on</td>
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<td>8. Attach waste disposal bag to side of trolley below the level of the top of the trolley</td>
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<td>Hands may have become contaminated by handling the outer packs, and so on</td>
</tr>
<tr>
<td>12. Apply non-sterile gloves and remove dressing ensuring that central line site is not contaminated</td>
<td>To minimise the risk of infection</td>
</tr>
<tr>
<td>13. Decontaminate hands</td>
<td>To minimise the risk of infection</td>
</tr>
<tr>
<td></td>
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<tr>
<td>---</td>
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</tr>
<tr>
<td>14.</td>
<td>Put sterile gloves on</td>
</tr>
<tr>
<td>15.</td>
<td>Inspect site for signs of exudate or inflammation. If swab is required obtain swab before cleansing CVC site. Inform medical staff</td>
</tr>
<tr>
<td>16.</td>
<td>Clean site with chloraprep using back-and-forth strokes with friction. Allow area to dry prior to applying the dressing.</td>
</tr>
<tr>
<td>17.</td>
<td>Place the sterile field near the CVC site</td>
</tr>
<tr>
<td>18.</td>
<td>Cut and remove any sutures securing the catheter</td>
</tr>
<tr>
<td>19.</td>
<td>Ask your assistant to place the patient in the Trendelenburg position (head slightly lower than feet) if patient clinical status allows</td>
</tr>
<tr>
<td>20.</td>
<td>Hold the catheter with one hand near the point of insertion and pull firmly and gently. As the catheter begins to move, press firmly down on the site with the swabs. Maintain pressure on the swabs for about 5 minutes after the catheter has been removed.</td>
</tr>
<tr>
<td>21.</td>
<td>Check the tip is intact</td>
</tr>
<tr>
<td>22.</td>
<td>Carefully cut off the tip (approximately 5 cm) of the catheter using sterile scissors and place it in a sterile container for microbiological investigation</td>
</tr>
<tr>
<td>23.</td>
<td>When bleeding has stopped (approximately 5 minutes), cover site with a small gauze pad and a transparent dressing.</td>
</tr>
<tr>
<td>24.</td>
<td>Fold up the sterile field, place it in disposal bag. Remove gloves. Seal disposal bag before moving the trolley. Dispose of the equipment in the appropriate containers</td>
</tr>
<tr>
<td>25.</td>
<td>Decontaminate hands</td>
</tr>
<tr>
<td>26.</td>
<td>Label CVC tip with the patient's name, number, date of birth, etc. at patient's bedside and send them to the laboratory with the appropriate forms.</td>
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**If air embolism occurs or is suspected- the patient should be positioned in the left lateral trendelenburg position (this assisting to directing the air bubble away from the pulmonaic valve) and see medical assistance immediately. Remember ABCDE**
Summary of prevention of infection measures

- Hand hygiene must be performed before the commencement of all line maintenance/access procedures.

- Alcohol hub decontamination: this must be performed before each hub access/drug or fluid administration.

- Central line dressings: these are changed at least every 7 days or when no longer intact or if it becomes wet or soiled/or moisture collects under the dressing.

- Chlorhexidine gluconate 2% (Chloraprep): this is used for cleaning the insertion site during dressing changes.

- Review need for intravascular devices daily and document. Assess and document daily the need for continued use of the CVC.

- Remove ALL venous catheters that are NO longer required as soon as possible. ALL lines eventually become infected and may cause life threatening sepsis.

- Remove intravascular devices that are a potential infection source promptly after establishing other vascular access.

- Monitor the patient’s temperature and pulse for signs of catheter-related bloodstream infection (sustained temperature >38°C) associated with line usage.
**What is BioPatch?**

The BioPatch blue sponge disc is designed to help reduce infections. The disk contains chlorhexidine gluconate (CHG) which is an antiseptic. CHG decreases the growth of many micro-organisms and bacteria under the dressing.

A catheter is a direct way for prescribed fluids to enter the bloodstream. As the catheter goes through the skin, there is also a potential path for bacteria which live on the skin to enter the bloodstream and cause an infection. It is therefore, essential to protect the catheter insertion site and try to reduce the chances of infection.

**Precautions:** BioPatch should not be placed over infected wounds. It is not intended to be used as a treatment of device-related infections. BioPatch are a preventive measures not a reactive measure.

**Warning:** For external use only. Do not allow this product to contact the eyes, ears, mouth or mucous membranes.

**Where can BioPatch be used?**

BioPatch is designed to reduce the number of bacteria and other micro-organisms living on the skin around the insertion site of catheters. Locally BioPatch are used on central venous catheter, arterial catheters and dialysis catheters.

**Blue side to the sky?**

When you put on the BioPatch you must be able to see the blue side. BioPatch will not be effective if you cannot see the blue side.

**When should I change the BioPatch?**

BioPatch should be changed as necessary. Dressing changes should occur at a minimum of every 7 days. If there is a lot of blood or fluid coming from the wound, the BioPatch will need to be changed more often.

**Frequently asked questions:**

1. **What if a skin reaction develops?** Adverse reactions to CG such as rashes are rare; if any such reactions occur discontinue immediately and discuss with medical staff.

2. **Can the BioPatch be re-used if the top dressing becomes loose or is removed?** If this occurs, the BioPatch should be removed and a new patch applied.

3. **Is BioPatch latex free?** Yes, the patch is latex free. All raw materials used in the manufacturer of BioPatch, including all components and packaging materials, do not contain any rubber latex or dry natural rubber latex.

4. **Why does BioPatch turn yellow and does this affect how it works?** The yellowing of the product is due to ageing of the polyurethane foam. This does not change how effective it is.

5. **Can BioPatch be used on pregnant women?** Can it be used while breast feeding? There is no information available regarding the use of BioPatch in pregnant or lactating women.
How to apply the BioPatch:

1. Clean the skin area using a Chloraprep sponge applicator.

2. Place the BioPatch around the catheter, making sure that the BLUE side is facing up (you can see the blue side).

3. Place the BioPatch dressing around the catheter/pin site so the catheter rests on or near the slit on the BioPatch dressing. The edges of the slit must touch to make sure it works properly. Assure complete contact between the skin and the BioPatch dressing.

4. Place a clear dressing over the catheter and BioPatch.

Changing the BioPatch:

5. Change the patch as necessary. Dressing changes should occur at a minimum of every 7 days. Dressing changes will be needed more frequently if a lot of blood or fluid is coming from the wound.

6. To remove the dressing, pick up the corner of the clear dressing and stretch away from the catheter, holding the catheter in place. (Dressing will partially lift). Peel back until resistance is felt. Repeatedly stretch and peel as necessary until the dressing is removed.

7. The BioPatch dressing will remain attached to the clear dressing and will come away from the skin as you remove the clear dressing.
Some DO’s and DON’TS:

**DO** secure the catheter at least 1” (2.5cm) from insertion site. This allows proper placement of BioPatch.

**DO** slightly align the radial slit off centre from the line

**DO** ensure edges of slit touch. This assures efficacy.

**DON’T** place white side up. Antimicrobial white side must face skin. If wrong, change immediately.

**DON’T** allow slit edges to straddle catheter. Edges of slit must touch to ensure efficacy.

**DON’T** secure catheter too close to entry point. This will prevent improper placement of BioPatch.

**DON’T** place BioPatch on catheter. BioPatch must have complete contact with skin to ensure efficacy.
References


