# Trust Policy / Guideline for the Management of: Condition or Procedure in Adults and / or Children (title needed on every page)

A clinical policy recommended

<table>
<thead>
<tr>
<th>For use in:</th>
<th>All wards and departments within the Acute Trust caring for adults with temporary central venous catheters</th>
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</thead>
<tbody>
<tr>
<td>By:</td>
<td>All staff involved in central line care</td>
</tr>
<tr>
<td>For:</td>
<td>Any adult requiring a short term central venous catheter</td>
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<td>Division 2</td>
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<tr>
<td>Compliance links: (is there any NICE related to guidance)</td>
<td>NICE No 49: 2002 – Guidance on the use of ultrasound locating devices for placing central venous catheters</td>
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<tr>
<td>If Yes – does the strategy/policy deviate from the recommendations</td>
<td>No</td>
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<td>of NICE?</td>
<td>If so, why?</td>
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Quick reference guideline

This policy is for use for ADULTS with TEMPORARY central venous access.

There are six sections:

1. Temporary Central Venous Catheter Insertion
2. Immediate Post Insertion Central Venous Catheter Care
3. Post Insertion Check Chest X-Ray
4. Central Venous Catheter Care
5. Central Venous Catheter Removal
6. Potential Central Venous Catheter Complications

The Appendices include:

Appendix A: Norfolk & Norwich Central Venous Catheter Insertion Pack Contents
Appendix B: Central Venous Catheter Tip Position Aid

This policy does not cover the insertion of peripherally inserted central catheters or central lines in children and should be read in conjunction with the following available via the Trust Intranet:

- Trust Policy for the Preparation of a Central Venous Catheter for Connection to and Disconnection from Haemodialysis, Haemodiafiltration and Plasma Exchange Therapies Trustdocs Id 1562
- Trust Protocol for the Insertion of a Mid-Line Catheter for the Provision of Intravenous Therapy for Adult Patients with Cystic Fibrosis (CF) Trustdocs Id 7309
- Trust Guideline for the Management of Total Parenteral Nutrition (TPN) in Adults Trustdocs id 1166
- Trust Guideline for the Management of Central Line Management in Children (except patients who have Portacaths for Oncology and Haematology Conditions) Trustdocs id 1529
- Trust Policy for the Management of Central Venous Access Devices in Adults’ Trustdocs id 8390

Objective/s
This policy has been written to standardise the care of adults with short-term central venous access within the Acute Trust. This standardisation will promote safe practice, facilitate surveillance and reduce the incidence of central venous catheter related morbidity and mortality including infection, bleeding and malposition.
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Rationale

There are 3 broad areas in which this policy is likely to improve CVC related practice:

- Safe insertion with maximal barrier precautions
- Post insertion CVC tip position check and documentation
- Infection Prevention and Surveillance

The overall emphasis is on improving patient safety.

The NHS campaign for reducing healthcare related infections has introduced two high impact interventions (HIIs) related to central venous catheter management (1). HIIs are an evidence-based approach that relate to key clinical procedures or care processes that can reduce the risk of infection if performed appropriately. They have been developed to provide a practical way of highlighting the critical elements of a particular procedure or care process (a care bundle), the key actions required and a means of demonstrating reliability. This policy has adapted the recommendations from these HIIs for local use.

A recent report by the National and Confidential Enquiry into Patient Outcome and Death into parenteral nutrition highlighted the importance of CVC management in the context of patient safety. This report has made recommendations for CVC practice which are incorporated into this policy (2).

The policy is evidence based where possible and the consensus of opinion of healthcare professionals frequently involved with CVC use.

The generic term Central Venous Catheter (CVC) refers to a catheter that is threaded into the central vasculature. There are 3 broad types:

- Temporary CVCs inserted through the internal jugular (IJV), subclavian (SCV) or femoral veins.
- Peripherally Inserted Central Catheters (PICC). Inserted via the cephalic, basilic or brachial veins.
- CVCs may be tunneled under the skin (tunneled line) where their use is required for upwards of 10 days

PIC catheters have a lower incidence of infection than temporary CVC lines inserted via the IJV, SCV or femoral veins. They are the preferred method of central venous access for children and their insertion and care is not covered by this guideline. Trust guideline for the management of central lines in children (Paed1 version 4). Trustdocs id1529
Tunneled lines include Hickmann lines and Groshong lines. The catheter is tunnelled subcutaneously and exits the skin a short distance from the site of vein puncture. These lines are placed in Theatre or Interventional Radiology and are most frequently used for chemotherapy administration. The insertion and care of tunneled lines is not covered by this policy.

This policy should be used by all healthcare professionals caring for patients requiring temporary central venous access. It should be used in conjunction with Trust guidance for drug administration and parenteral nutrition (PN) management.

If treatment is required for a longer duration then consideration should be given to changing from temporary to a long term line (PICC or tunnelled line).

Broad recommendations

A temporary CVC is one inserted for the purposes of:

1. To monitor central venous pressure (CVP) in critically ill patients
2. To provide venous access for patients in whom peripheral access is difficult
3. To administer large volumes of fluids or blood products
4. To administer parenteral nutrition (PN)
5. To administer drugs which cannot be given peripherally
6. For dialysis, ultrafiltration and plasma exchange and haemodiafiltration**

** CVCs intended for haemodialysis should ONLY be managed by trained nurses who have completed renal competencies. CVCs intended for haemodialysis should not be used for other purposes (e.g. infusions, administration of drugs) without permission from the renal team, except in medical emergencies by those familiar with CVC use. Dressings should be changed as necessary, following the appropriate guideline. The use of CVCs for haemodialysis is not covered by this guideline. Please see Haemodialysis CVC guideline 'Renal 2 Trustdocs Id 1562.'

CVC Change

There is no evidence to support the routine change of a CVC based on the number of days it has been in situ. Catheters should be checked daily for signs of infection and adequacy of dressing. This should be documented on the CVC care plan Trustdocs Id 11183.

If line change is required then a new site is preferable to the practice of rewiring an existing line. It is accepted that in some circumstances rewiring is unavoidable.

1. Temporary Central Venous Catheter Insertion

Short-term CVC insertion must be undertaken by trained medical staff who are signed off as competent to perform the procedure.

Hospital Location
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CVC insertion must only be undertaken in the following acute care areas:

- Operating Theatre Complex
- Critical Care Complex (CCC)
- Resuscitation room of the Emergency Department
- Acute Care Bay (ACB) on the Acute Medical Unit (AMU)
- Coronary Care Unit

The preferred location for CVC insertion is Theatres.

Requests for CVC insertion in Theatre should be reviewed by the Consultant responsible for the patient. The request should be discussed with the on-call Anaesthetist (bleep 0900). It is the responsibility of the referring team to liaise with the Anaesthetist regarding the urgency of CVC placement and relevant preparation for Theatre. The patient will then be added to the Emergency Operating List by the requesting team.

It is expected that CVCs inserted in Theatre as emergency cases will be inserted by the Anaesthetist on-call. Non anaesthetic clinicians wishing to insert CVCs in theatre should expect to be supervised, as appropriate to their experience, and assisted by an Operating Department Practitioner (ODP). This will be at the discretion of the Anaesthetist on call. The person responsible for inserting the CVC should ensure a CVC care plan and surveillance forms are printed from ORSOS and left with the patient healthcare record. These forms should be handed to ward staff on transfer of the patient.

The patient’s MRSA status should be checked prior to insertion according to the Trust Guideline for the Screening of MRSA ref: CA2043/C2. Advice is available from the microbiologist - Trustdocs Id 6798

Central Venous Catheter Choice

- Single lumen catheters where available should be used unless multiple lumens are required.
- Parenteral Nutrition (PN) should be delivered via a single lumen catheter or by a single lumen of a multi-lumen catheter that should be dated and labelled to that effect and used only for PN.
- Critically ill patients admitted directly to the Operating Theatre as for emergency surgery who require central venous access, and are expected to be admitted to the CCC, should have quadruple lumen lines inserted. These can be requested from the CCC if not locally available.
Silver impregnated catheters should be considered when the CVC is expected to be in place for > 5 days (3).

**Puncture Site Choice**

This will depend on patient specific factors such as coagulation status, anatomy, previous site use, expected surgical intervention and pattern of injury. The risk of mechanical complications such as bleeding or pneumothorax, and the risk of infection should be considered. The relative risks of the 3 most commonly used puncture sites are compared in Table 1.
Table 1

<table>
<thead>
<tr>
<th>Complication</th>
<th>Internal Jugular Vein (IJV)</th>
<th>Subclavian Vein (SCV)</th>
<th>Femoral Vein (FV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumothorax</td>
<td>Less risk than with SCV site. Increased risk with lower approach.</td>
<td>Highest risk of SCV, IJV and FV.</td>
<td>No risk.</td>
</tr>
<tr>
<td>Infection</td>
<td>Greater risk than with SCV. Less risk than FV.</td>
<td>Less risk that IJV and FV.</td>
<td>Greater risk than SCV and IJV.</td>
</tr>
<tr>
<td>Bleeding</td>
<td>Easy to compress bleeding IJV or carotid artery but risk of airway compromise if gross haematoma develops.</td>
<td>Difficult to compress both venous or arterial bleeding.</td>
<td>Easy compression of venous or arterial bleeding.</td>
</tr>
</tbody>
</table>

Ultrasound Guided Insertion for the Internal Jugular Vein (IJV)

Central venous access has traditionally been achieved using the 'landmark method'. Failure rates up to 35% for initial IJV CVC insertion have been reported (4) with this method. Two dimensional (2-D) imaging ultrasound guidance (USG) allows visualisation of the vein and surrounding structures during IJV insertion and minimises mechanical complications. CVC insertion into the IJV under direct USG is the method of choice and recommended by NICE. This must not compromise the sterile field; a sterile sheath must be available to cover the ultrasound probe.

In emergency situations where ultrasound equipment or expertise is not immediately available, the landmark method should be used.

Ultrasound may be useful to aid insertion for the subclavian or femoral veins.

Maximal sterile barrier precautions

These must be employed by the operator for CVC insertion. This includes all of:

1. Theatre hat
2. Theatre mask
3. Sterile gown
4. Sterile gloves
5. Large sterile drape with an appropriate sized window

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Document: 8391.docx
Copy of complete document available from: Trust Intranet
Preventing Central Venous Catheter related Blood Stream Infection (CVC-BSI)

Patients in the Critical Care Unit should have Octenisan® body wash according to policy. Patients in other areas should be given Octenisan® in line with the MRSA guidance for that specific clinical area. Trustdocs Id 6798

- **Appropriate hand hygiene**

  The use of sterile gloves does NOT eliminate the need for pre-insertion hand hygiene. Hand should be cleaned in line with NPSA 12 steps for hand decontamination and trust hand hygiene policy:
  1. Ensure hands and forearms are socially clean.
  2. Rinse hands and forearms under running water.
  3. Apply liquid antimicrobial soap: Hibiscrub® (4% Chlorhexidine) or Povidine-Iodine
  4. Wash hands and forearms thoroughly.
  5. Rinse well under running water.
  6. Dry hands thoroughly with sterile towel.

- **2% Chlorhexidine gluconate in 70% Isopropyl Alcohol (Chloroprep®) for Skin Disinfection**

  Microorganisms that colonise catheter hubs and the skin surrounding the insertion site are the cause of most CVC-BSIs, the risk of infection increases with the density of microorganisms around the insertion site (5, 6). Cleaning the skin at the insertion site is therefore one of the most important measures for preventing CVC related infection. Trials have proven that chlorhexidine 2% is superior to povidine-iodine or alcohol for skin antisepsis (7). If the patient has a chlorhexidine allergy, povidine-iodine should be used.
  1. Ensure the skin is socially clean before applying antisepsis.
  2. Remove any hair overlying the insertion and dressing site with disposable head clippers or scissors.
  3. Deploy Chloraprep® Stick – allow sponge to soak with fluid.
  4. Clean insertion site with a single Chloraprep® swab for 30 seconds.
  5. Allow site to dry completely (30 seconds) before commencing CVC insertion.

**CVC Insertion Pack**

This pack contains all the necessary equipment for inserting a CVC with the exception of sterile gloves and the CVC itself. The contents are detailed at Appendix A. The packs are available in the acute care areas where a CVC may be inserted.

**Ensuring Patient Comfort**

CVC insertion can be a frightening experience for an awake patient. This is especially true for neck lines where the patient’s face will be covered by a drape and they will be positioned head down. This position can cause those patients with respiratory distress to
deteriorate acutely and worsen their dyspnoea – ensure you keep verbal contact and the patient is appropriately monitored. Pre-existing confusion and agitation is likely to be exacerbated by the procedure – consider having an extra person to provide constant reassurance to the patient. Ensure you use an appropriate dose of local anaesthetic for CVC insertion and remember to anaesthetise the sites where sutures will be placed.

2. Immediate Post Insertion Central Venous Catheter Care

Confirmation of CVC position

i) All lumens must flush and aspirate easily. The technique for checking this should avoid drawing blood through the entire external lumen and into the needle free connector.

ii) Transduction of the distal lumen of the CVC should reveal a clear central venous trace.

iii) A CXR should be ordered to assess for the position of the CVC and evidence of complications.

Dressings

The central line must be firmly secured with the dressing and the insertion site must be easy to assess. The dressing in the CVC Insertion pack should be applied to dry clean skin. The use of ‘sandwich’ type dressings is not recommended.

Bungs

4 needle free connectors are contained in the N&N CVC Insertion Pack. These should be applied to the line and the line flushed with sterile saline prior to its insertion.

Documentation

The central line insertion must be clearly documented in the patient notes. This is best documented on the CVC Care Plan. [http://trustdocs/Doc.aspx?id=11183](http://trustdocs/Doc.aspx?id=11183)

Documentation must include:

- Date
- Time
- Location
- Operator’s Name and Specialty and Grade (and supervision if appropriate)

Copy of complete document available from: Trust Intranet
• Mode of asepsis
• Site of Insertion
• Use of USG
• Difficulty of procedure
• Skin distance marker
• Position confirmation checks
• Your confirmation that the post insertion CXR has been ordered

The *infection control surveillance* form should also be completed and attached to the patient notes. [http://trustdocs/Doc.aspx?id=12046](http://trustdocs/Doc.aspx?id=12046)

### 3. Post Insertion Check Chest X-Ray (CXR)

The CVC must *not* be used until the position of the catheter has been confirmed by CXR. The exceptions to this are CVCs placed pre-operatively in theatre, where patients are *in extremis*, and those inserted within Critical Care where they may be used pending CXR, at the discretion of the Operator.

It is the responsibility of the Doctor who has inserted the CVC to ensure that the check CXR is performed and reviewed. Clinicians checking CXRs for CVC tip position and insertion complications must be competent to do so. The check CXR and CVC tip position should be documented on the CVC Care Plan.

Documentation must include:

- Name, specialty, grade
- Date, time
- Catheter tip position (see Appendix C)
- Absence (or otherwise) of complications

**Catheter Tip Position**

The catheter tip is more likely to be in an acceptable position if the operator takes the time to estimate the optimum length to the skin of the catheter prior to insertion. As a rule of thumb for adults, the external marker for the optimum tip position is 2cm above the lower border of the sternum.

It is accepted dogma that the CVC tip should not lie within the boundaries of the pericardial sac. The printed guidance from the manufacturer that accompanies the CVC highlights this. If the tip lies within the boundaries of the pericardial sac, it risks cardiac tamponade secondary to atrial or ventricular perforation, tricuspid valve damage, arrhythmia and the possibility of coronary sinus placement.

The upper rim of the pericardial reflection cannot be seen on a plain chest radiograph. Assessment of the limit of the pericardial sac on cadavers (8, 9) and in adults using computerised tomography (CT) (10), suggests that the pericardial sac does not extend
above the carina. This has led to the practice of ensuring that the CVC tip is at least ‘above the carina’.

Vessel wall erosion by the CVC tip is a real risk where the catheter lies outside the pericardial reflection. It has been shown that an angle of $>40^\circ$ from the CVC tip to the vessel wall is more likely to cause perforation (11). The left innominate vein makes a steep angle with the superior vena cava (SVC). For this reason perforation is thought to be more likely with left sided than right sided CVCs (12).

A left sided catheter may lie in the left innominate vein proximal to the SVC (see Zone C), or with the tip abutting the right internal wall of the SVC (see Zone B) (Appendix B). It is not possible to distinguish the left innominate to SVC junction on chest radiograph and thus there may be overlap between these two groups. Those with the CVC tip directly abutting the internal wall of the SVC are at a higher risk of vessel perforation (13).

CVCs lying within the right or left innominate vein, whilst having an appropriately reduced tip to vessel wall angle, have a different associated morbidity. Mechanical and chemical irritation can lead to pain on injection and thrombosis. These complications are more likely where the catheter lies in the upper SVC or the innominate veins, particularly on the left side (14). There is a direct relationship between catheter related sepsis and thrombosis (15).

The optimum position is within a large vein, ideally outside the heart and parallel with the long axis of the vein. The tip should not abut the vein or the heart wall end on. There are complications associated with all tip positions. Nevertheless clinicians must be able to justify the position of the CVC tip and document this clearly.

4. Central Venous Catheter Care

If accessing the CVC for any reason (flush, drug administration, blood sampling, infusion change) you must use Aseptic Non Touch Technique (ANTT). The needle free connector should be cleaned with a 2% chlorhexidine gluconate in 70% isopropyl alcohol Sani Cloth® swab and the operator should use ANTT and wear sterile gloves as required.

Infection Surveillance & Microbiological Management

CVC related bloodstream infection (CVC-BSI) is a serious complication of CVC use and is known to significantly worsen patient condition, prolong length of stay and increase the cost of care. All possible measures to reduce the incidence of CVC-BSI should be taken.
The Infection Prevention & Control (IP&C) Audit & Surveillance Team must be informed about all CVC insertions. Theatre insertion recorded on ORSOS will automatically inform the surveillance team who will undertake collection of surveillance data. This is done using the surveillance forms (see appendix E) which should be generated at insertion.

All other insertions outside of CCC should also have a surveillance form completed and IP&C should be informed of the patient. (ext 5847)

CVC-BSI implies that the patient is systemically infected with a micro-organism where the source is known or expected to be the CVC. In these cases the catheter will be colonised with the same micro-organism that is present in the patient’s blood cultures. The micro-organisms that colonise catheter hubs and the skin adjacent to the insertion site are the source of most CVC-BSI.

If you suspect CVC-BSI take blood cultures from the CVC and a further set of percutaneous blood cultures from a peripheral site, NOT the cannula. Remove the CVC and send the tip of the line for culture, completing the suspected infection surveillance form available via the audit surveillance department pages. Then return the surveillance form to the IP&C department.

Do not routinely send CVC line tips for culture. This is reserved for cases of suspected CVC-BSI.

If the insertion site of the CVC looks infected, send a swab for microbiology, culture and sensitivities (M, C & S).

**Flushing the CVC**

This should only be undertaken by staff who are trained in CVC use. CVC blockage predisposes to infection, can increase the incidence of mechanical complication and may shorten the life of the CVC.

Indications for flushing a CVC:

- To maintain or verify lumen patency where the lumen is not in continuous use
- To prevent blood clotting in the lumen after blood has been taken
- To prevent drug interactions within the lumen
- To clear the catheter of a drug

CVC lumens should be flushed with a 10mL (or larger) syringe only. Smaller syringes can exert high pressure which can be dangerous. A push-pause technique should be used to flush the line as this creates turbulence.

Sodium Chloride 0.9% should be used for flushing to confirm that a lumen is patent prior to use, between and after administration of medications and or solutions. Water for injections damages red blood cells and should only be used where it is specifically required to prevent drug interactions.

The needle free connector should be cleaned with a 2% chlorhexidine gluconate in 70% isopropyl alcohol swab and the operator should wear sterile gloves. The volume of the
Flush solution should be equal to at least twice the volume of the catheter and add-on devices (usually 5-10mLs).

Remember: flushing a line will bolus the patient with any drug that is left in the line. If you are unsure whether this may be harmful to the patient, check with the medical staff. This is especially important where inotropes and vasopressors are in use. In this situation you should aspirate the remaining drug from the line and then flush.

**Flushing for Parenteral Nutrition (PN) lumens**

These lumens require flushing with 5mL Hepsal® (10 international units/mL of heparin) if the PN is interrupted. This flush should only be administered if it is prescribed on the patient’s drug chart. *No other concentration or format of heparin is acceptable.*

Where a PN lumen has been flushed with Hepsal® it will remain patent for 3 days and will not require re-flush if PN is recommenced within this time.

**Blood Tests**

CVCs should only be used for blood tests in exceptional circumstances or where CVC-BSI is suspected and blood cultures are being taken. The routine use of CVCs for blood tests increases the risk of catheter infection. If it is necessary to use the CVC for blood sampling then this should be via a dedicated lumen that is labelled. The first 5mLs of blood aspirated should be discarded unless a line infection is suspected when no blood should be discarded. Blood samples should not be taken whilst infusions are running via other lumens. The needle free connector should be cleaned with a 2% chlorhexidine gluconate in 70% isopropyl alcohol swab and the operator using aseptic no touch technique should wear sterile gloves. The line should be flushed with Sodium Chloride 0.9% after the blood sample has been taken.

**Dressing Change**

The dressing should be inspected daily for evidence of peeling away and contamination. This should be documented on the CVC Care Plan. The Trust currently advocates the use of the 3M™ Tegaderm™ IV advanced securement dressing.

Dressings should be changed by a competent practitioner using ANTT.

- Wash hands and dry thoroughly

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• Wear disposable gloves to remove the old dressing completely
• Rewash and dry hands
• Wear sterile gloves
• Clean the insertion site using chloraprep® and allow to dry. If there is blood or debris on the skin clean with Sodium Chloride 0.9% and dry with a sterile towel/swab prior to chloraprep®.
• Apply new dressing

5. Central Venous Catheter Removal

This should only be performed by staff who have demonstrated competency in CVC removal.

1. Check patient coagulation status.
2. Wash hands and apply gloves.
3. Disconnect all infusions.
4. Wash hands and wear gloves.
5. Remove dressing.
6. Repeat hand wash and wear sterile gloves.
7. Clean skin with 2% Chlorhexidine gluconate in 70% Isopropyl Alcohol.
8. Position the patient lying flat. For neck CVCs, tip the bed head down.
9. Use a sterile stitch cutter to removes sutures.
10. Hold the CVC at the insertion point.
11. Ask the patient to perform a Valsalva manoeuvre (ask the patient to take a deep breath and hold it as the line is removed) – simultaneously pull the CVC out.
12. Apply immediate pressure to the insertion site with sterile gauze.
13. Check that the tip of the CVC is intact.
14. Position the patient head up for neck CVC and remain flat for femoral CVC.
15. Apply pressure for 5 minutes and until haemostasis is achieved.
16. Apply a sterile dressing.
17. Document reason for removal, date and time on the CVC Care Plan and central line Surveillance form.
18. Return the surveillance form to Infection Prevention & Control.

Remember, if you are removing the line because you suspect central venous catheter related blood stream infection (CVC-BSI): take blood cultures from the line before removal and send the CVC tip for culture. Send surveillance form as above.

If the CVC tip is not intact contact medical staff immediately. If a defective device is suspected, the Medicines and Healthcare products Regulatory Agency (MHRA) must be informed.
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If the line is being removed because serious malposition has been identified by CXR contact Radiology before removing the line to ensure it is safe to do so.

6. Potential CVC Complications

Complications of CVCs occur under three broad headings. Mechanical complications occur in 5 – 19% patients, infectious complications in 5 – 26% and thrombotic complications in 2 – 26%. Overall 15% of patients who undergo central venous catheterisation may experience a complication (16). The operator and those involved in CVC care must be aware of potential complications and their management. The overall incidence of failed cannulation and complication is strongly related to operator experience (17). Complications are also strongly associated with failed attempts (18) – it follows that if the operator is not the most experienced member of the team, and the cannulation is difficult, they should seek help early.

Thrombosis

More common where the tip of a neck CVC lies high (right or left innominate veins) and femoral CVCs are at most risk. The presence of thrombosis increases the risk of infection and will hinder future attempts at central venous access.

Management

- Do not site central venous lines into vessels where thrombosis is evident on ultrasound examination.
- Reposition CVCs lying high in the right or left innominate veins.
- Avoid the femoral route for central venous access where possible.
- Remove lines where thrombosis is evident.

Central Venous Catheter related Blood Stream Infection (CVC-BSI)

CVC related bloodstream infection (CVC-BSI) is a serious complication of CVC use and is known to significantly worsen patient condition, prolong length of stay and increase the cost of care. All possible measures to reduce the incidence of CVC-BSI should be taken.

Management

i) Principles for avoiding infection:

- Avoid the femoral site where possible.
Be aware of the factors that increase the risk of infection. E.g. administration of parenteral nutrition, the use of multi-lumen catheters, use of 3-way taps.

Employ maximum sterile barrier precautions for insertion.

Always wash and dry hands and wear sterile gloves before handling the CVC.

Keep the number of people handling the line to a minimum.

ii) Suspected or confirmed CVC-BSI

- Take a set of blood cultures from the CVC and a simultaneous peripheral set.
- If exit site infection is evident then send a swab for M,C & S.
- Remove the CVC.
- Send the CVC tip for culture.
- If re-site is required this should occur at a different insertion site.
- Inform the Infection Prevention and Control Team.
- Complete the infection surveillance form.
- Treat patient for sepsis as appropriate. [link]

Mechanical

- Arterial puncture

This is a common complication the incidence of which is reduced by the use of ultrasound guidance for insertion. Puncture may be recognised on insertion of the needle by the pulsatility and colour of the blood. This is not always straightforward in patients who are grossly hypoxic and hypotensive.

Management

Needle puncture

- Remove the needle.
- Apply firm pressure to the site for at least 10 minutes or until haemostasis has occurred.
- Position the patient head up for carotid or subclavian artery puncture.
- If you suspect arterial puncture with the needle but are unsure, send a sample for immediate gas analysis and compare with a peripheral arterial sample.

Arterial cannulation with CVC

- Confirm arterial placement using pressure transduction and blood gas analysis.
- If the catheter can be removed easily – do so and apply immediate pressure, continue for at least 10 minutes or until haemostasis has occurred.
- Position the patient head up for carotid or subclavian artery puncture.
- If any force is required to remove the catheter do not continue attempting to remove it – request urgent senior support and discuss with the on call Thoracic Surgeon.

- Pneumothorax
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The patient may present with immediate respiratory distress caused by pneumothorax or pneumothorax may be identified by the post insertion check CXR.

Less commonly haemothorax and chylothorax can occur.

- **CVC Displacement**

  The most common cause for a CVC being ‘pulled out’ is because it was poorly fixed, poorly dressed or the patient has become agitated and has removed it themselves. If a catheter has become partially removed it is highly likely that it is contaminated – it should be removed as per the CVC removal guidance. Where a CVC has been completely removed accidentally, pressure should be applied to the insertion site and a check should be made for the presence of the CVC tip.

  Displacement can be prevented by ensuring the CVC is adequately sutured at 4 points. If sutures become loose, request medical assessment for re-suture. Ensure that the catheter is securely dressed – this should be checked daily. Where patients are agitated, and they are deemed to be at risk of removing their CVC, every effort should be made to ensure that the patient does not have easy access to infusion lines etc and that the dressing or catheter position are not causing obvious distress.

- **Vascular perforation**

  This may occur on insertion with the needle, guide-wire, dilator or CVC itself. Expanding haematoma may be seen. Catastrophic haemorrhage can occur; attention must be paid to the patient’s coagulation status.

  Less commonly, vascular perforation may occur at the CVC tip when a catheter has been in position for some time. This is more common where hyperosmolar and irritant substances are being infused (e.g. parenteral nutrition) and the patient is likely to present with signs of acute haemorrhagic shock.

- **Cardiac Complications**

  The most common cardiac complication is arrhythmia occurring as the guide-wire is threaded as the tip may irritate the myocardium. Ensure ECG monitoring is in place before inserting a CVC and that a colleague is available to monitor the ECG trace on insertion of the guide-wire. Ventricular ectopics are the most common morphology - these will stop on retraction of the guide-wire.
Ventricular arrhythmia can occur and should be managed with immediate guide-wire retraction and Advanced Life Support (ALS) guidelines.

Pericardial tamponade can occur as a result of guide-wire perforation and or infusion of medication into a CVC position in the pericardium.

- **Air embolism**

This occurs when air is entrained into, or injected into, the CVC. The air travels into the right heart chambers and causes a mechanical obstruction preventing blood from moving from the right ventricle into the pulmonary vasculature. The signs of air embolism are:

- Cyanosis
- Respiratory distress
- Severe chest pain
- Cardiovascular collapse

**This is a medical emergency**. Summon immediate senior medical assistance, position the patient on their *left side* in a *head down* position and ensure all lumens are closed and no further air is being entrained or injected. If there is obviously air within the CVC, aspirate it from the catheter. If the patient is in cardio respiratory arrest, commence advance life support (ALS) as per the guideline – the chest compressions may assist with breaking up the air lock.

The risk of air embolism is reduced by ensuring head down position when inserting and removing CVCs, meticulous attention to ensuring air is not injected or infused into CVCs.

7: **Clinical audit standards**

To ensure that this policy is compliant with the above standards, the following monitoring processes will be undertaken:

- All CVC insertion and ongoing care is audited via the High Impact Intervention care bundles by the ward areas. This data is reported monthly via the IP&C monthly report, the Trust board report, the IP&C dashboard, map and email reports.
- CVC infection surveillance is undertaken via the surveillance forms and data is held on a database by IP&C, and reported quarterly to the Hospital Infection Control Committee and via the IP&C monthly report.
- MRSA Bacteraemia, MSSA bacteraemia and EColi bacteraemia surveillance is carried out using the HPA surveillance systems. These are reported nationally by all Trusts.

These audits are fed back to the clinical area at the time of audit and action plans are raised for less than 80% compliance.

The audit results will be sent to the Acute Care Forum Chair who will review the results and make recommendations for further action. (Not sure whether this happens- does this person receive the IP&C monthly report of not please contact so he/she can be added).
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8: Summary of development and consultation process undertaken before registration and dissemination

The authors listed above drafted this guideline on behalf of Dr Tim Leary (Medical Lead Critical Care) who has agreed the final content. During its development it was has been circulated for comment to members of the acute care forum.

This version has been endorsed by the Clinical Guidelines Assessment Panel (CGAP).

9: References


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Appendix A

You will need the central line and sterile gloves in your size. Your assistant will need to supply you with:

**Sterile saline 20mLs**
**1% lignocaine 10mLs**

Norfolk & Norwich Central Venous Catheter (CVC) Insertion Pack contents

Theatre hat
Face mask

Sterile hand towel
Sterile gown (standard extra large)
3mL Chloroprep (2% chlorhexidine 70% isopropyl alcohol)
Drape 110cm x 110cm with 60cm x 60cm clear window

120mL gallipot
Swab gauze
Green needle (21G x 1.5”)
Orange needle (25G x 5/8”)
Retractable scalpel
Sharps pad
2 x 10mL Luer syringe
1 x 5mL Luer syringe
Mersilk suture
4 x Smartsite needle free connectors

20g Ultrasound Gel sachet
Clear plastic ultrasound probe cover
2 x latex free rubber bands
CVC dressing
Diagram of the heart and great veins.

Zone A: Superior vena cava (SVC) and proximal right atrium (RA).
Zone B: Junction of the brachiocephalic (innominate) vein and the SVC.
Zone C: Brachiocephalic (innominate vein).

The optimum position is within a large vein, ideally outside the heart and parallel with the long axis of the vein.