**NURSING GUIDELINES FOR CENTRAL VENOUS (NON-TUNNELLED) CATHETERS (CVC)**

<table>
<thead>
<tr>
<th>Version Number</th>
<th>V2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Issue</td>
<td>February 2017</td>
</tr>
<tr>
<td>Reference Number</td>
<td>PICCGCS-02-2017-ET-V2</td>
</tr>
<tr>
<td>Review Interval</td>
<td>3 yearly</td>
</tr>
</tbody>
</table>
| Approved By | Signature: Fionnuala O'Neill  
Title: Nurse Practice Coordinator  
Date: February 2017 |
| Authorised By | Signature: Cormac Breathnach  
Title: Consultant Intensivist  
Chair Clinical Guidelines Committee  
Date: February 2017 |
| Author/s | Name: Eileen Tiernan  
Title: Clinical Coordinator, Graduate Diploma  
Critical Care Nursing (Children) |
| Location of Copies | On Hospital Intranet and locally in department |

### Document Review History

<table>
<thead>
<tr>
<th>Review Date</th>
<th>Reviewed By</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Document Change History

| Change to Document | Reason for Change |
Introduction

Central Venous Access Devices (CVAD), is a broad term used to include many catheter types which are inserted into a peripheral/central vein in the body to deliver medications or other therapies to children.

A catheter has one end positioned outside the body while a port is surgically placed under the skin and requires a special needle to access it.

The most common CVADs include:

- Peripherally Inserted Central Catheter inserted into one of the peripheral veins in the upper arm.
- Central Venous Catheter
- Implanted ports inserted into the subclavian or vein or jugular and attached to a fluid reservoir placed in a surgically created subcutaneous pocket in the upper chest or into an arm vein.
- Hickman / Broviac Catheter
- Permcath-Vascath Catheter
- Umbilical Venous Catheter
Contents

1.0 Introduction .......................... 2

2.0 Commonly used reference tables .......................... 4
   a. Table 1... Skin Asepsis prior to peripheral or central line insertion .......................... 4
   b. Table 2...Guide to CVAD choice and the duration of usage .......................... 6
   c. Table 3...Blood discard volumes and Flush volumes for CVAD .......................... 6

3.0 Introduction to Central Venous Catheter (CVC) .......................... 7

4.0 Assisting with the Insertion of a CVC .......................... 8

5.0 Care of a CVC .......................... 13
   - Change of CVC Dressing .......................... 15
   - CVC Care Bundle .......................... 18

6.0 Removal of a CVC .......................... 19

7.0 References .......................... 27

8.0 Appendices .......................... 31
Table 1. Skin Asepsis prior to Peripheral and Central Line Insertion by Clinical Staff in OLCHC.

S.A.R.I. Guideline 2009- for prevention of infection associated with CVC or peripheral line insertion recommends chlorhexidine gluconate 2% in 70% isopropyl alcohol (in a single patient use application) in adults & children ≥ 2 months.

<table>
<thead>
<tr>
<th>Indication</th>
<th>Product</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skin cleansing prior to peripheral canula insertion</strong></td>
<td>Sanicloth®</td>
<td>↑</td>
</tr>
<tr>
<td><strong>Skin cleansing prior to CVC insertion</strong></td>
<td>OR</td>
<td>2% chlorhexidine gluconate in 70% isopropyl alcohol</td>
</tr>
<tr>
<td><strong>Device cleaning (e.g. hubs)</strong></td>
<td>Chlorhexidine 2% Alcohol (Ecolab) 200ml bottle</td>
<td>↓</td>
</tr>
</tbody>
</table>

For infants < 2 months old the recommendation is 0.5% Chlorhexidine in aqueous solution

<table>
<thead>
<tr>
<th>Indication</th>
<th>Product</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin cleansing prior to peripheral and central line insertion in infants &lt; 2 months old (Corrected age)</td>
<td>Sterexidine 200® 150ml bottle</td>
<td>contains 0.5% Chlorhexidine Glucanate w/v in aqueous solution</td>
</tr>
</tbody>
</table>

NB: Use in premature babies:
In immature neonates (e.g.: below 30 weeks gestation), gently dab the product onto the skin for 10 seconds & allow the skin to dry in air. Avoid ‘up & down, back & forth movement as gentle friction can damage immature stratum corneum of neonates. After the procedure, the skin should be cleaned with sterile water and dried thoroughly.

NOTE:
Povidone Iodine 10% (*Videne® or Betadine®*) may be used in patients with a history of chlorhexidine sensitivity. Povidone Iodine 10% (*Videne® or Betadine®*) should no longer be used prior to performing lumbar puncture. Use appropriate chlorhexidine product listed above instead.
The routine use of antimicrobial or antiseptic ointments around CVC insertion sites at the time of insertion or during dressing changes is not recommended
<table>
<thead>
<tr>
<th>Type of Line</th>
<th>Type of access</th>
<th>Location</th>
<th>Length of usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERIPHERALLY INSERTED CENTRAL CATHETER PICC</td>
<td>• Short-term venous access devices</td>
<td>• Brachial, cephalic, median-cubital or scalp vein placement</td>
<td>0 days to 6 weeks or as indicated</td>
</tr>
<tr>
<td></td>
<td>• Inserted under local anaesthetic</td>
<td>• Single or multiple lumens</td>
<td></td>
</tr>
<tr>
<td>MIDLINE</td>
<td>• Short-term venous access devices</td>
<td>• Brachial, cephalic, median-cubital or scalp vein placement</td>
<td>0 days to 6 weeks or as indicated</td>
</tr>
<tr>
<td></td>
<td>• Inserted under local anaesthetic</td>
<td>• Single or multiple lumens</td>
<td></td>
</tr>
</tbody>
</table>

Midlines can be used for antibiotic therapy, and fluids, blood transfusions, although not for concentrated TPN intended to use for centrally located catheters. So midline catheters should not be used for any solution containing greater than 10 percent dextrose or 5 percent protein, or any vesicant or caustic solution.

| Central Venous Catheter                       | • Short term central device inserted under general anaesthetic | • Single or multiple lumens • Right or left internal jugular usually preferred • Sutured in place | 7-10 days                              |

| TUNNELLLED HICKMAN OR BROVIAC                 | • Known to the children in OLCHC as “Freddy”                | • Infraclavicular placement • Single or multiple lumens • Dissolvable sutures are used. • Dacron cuff. Can be felt under the skin. • Inform medical staff if the Dacron cuff is visible, as this is an indication that the catheter has moved. | indefinite                              |

| IMPLANTED VENOUS ACCESS PORT (IMPLANTOFIX)    | • Totally implanted venous access device                | • Intradermal • Dome-shaped • Incision scar often seen across, above, or below the dome • Palpable | indefinite                              |
### Table 2. Guide to CVAD Choice and the Duration of Usage

<table>
<thead>
<tr>
<th>Line type</th>
<th>Age</th>
<th>Blood discard volume</th>
<th>Suggested Flush volume for pre and post line use</th>
<th>Heparin dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Umbilical Venous Catheter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; 1 year</td>
<td>1 ml</td>
<td>0.5 ml</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>1-3 years</td>
<td>2.5 ml</td>
<td>0.6</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>&gt; 3 years</td>
<td>3.5 ml</td>
<td>0.8</td>
<td>10 units/ml</td>
</tr>
<tr>
<td>Non tunnelled Permcath/Vascath</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; 1 year</td>
<td>N/A</td>
<td>0.5-1 ml</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>1-3 years</td>
<td>2.5 ml</td>
<td>1-2.5 mls</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>&gt; 3 years</td>
<td>3-5 ml</td>
<td>3-5 mls</td>
<td>10 units/ml</td>
</tr>
<tr>
<td>Central Venous Catheters</td>
<td>&lt; 1 year</td>
<td>1 ml</td>
<td>As per surgeons</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>1-3 years</td>
<td>2 ml</td>
<td>As per surgeons</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>&gt; 3 years</td>
<td>3-5 ml</td>
<td>As per surgeons</td>
<td>10 units/ml</td>
</tr>
<tr>
<td>Hickman/Broviac</td>
<td>&lt; 1 year</td>
<td>1 ml</td>
<td>As per surgeons</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>1-3 years</td>
<td>2 ml</td>
<td>As per surgeons</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>&gt; 3 years</td>
<td>3-5 ml</td>
<td>As per surgeons</td>
<td>10 units/ml</td>
</tr>
<tr>
<td>Implantofix</td>
<td>&lt; 1 year</td>
<td>N/A</td>
<td>1 ml -2.5 mls</td>
<td>10 units/ml</td>
</tr>
<tr>
<td></td>
<td>1-3 years</td>
<td>N/A</td>
<td>1 ml - 2.5 mls</td>
<td>10 units/ml but Use 100 units/ml when on Discharge for patients</td>
</tr>
</tbody>
</table>

### Table 3. Flush volumes for CVADS

- Inserted via the umbilical vein in the umbilical cord, with the tip of the catheter positioned at the junction of the inferior vena cava (IVC) with the right atrium. It is above the diaphragm and beyond the liver at T9-T10
- Permcath are non-tunnelled long term lines used for haemodialysis or plasmapheresis.
- Vascaths are temporary non tunnelled lines used for maximum of three weeks for haemodialysis and haemofiltration or plasmapheresis

- Blood discard volume
- Suggested Flush volume for pre and post line use
- Heparin dose
withdrawn from an Implantofix.

<table>
<thead>
<tr>
<th></th>
<th>&lt; 1 year</th>
<th>1ml</th>
<th>0.5-1ml</th>
<th>10 units/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 3 years</td>
<td>N/A</td>
<td>1ml-2.5mls</td>
<td>10 units/ml</td>
<td></td>
</tr>
</tbody>
</table>

**Umbilical Venous Catheters**

<table>
<thead>
<tr>
<th></th>
<th>&lt; 1 year</th>
<th>1ml</th>
<th>0.5-1ml</th>
<th>10 units/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 years</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>10 units/ml</td>
</tr>
<tr>
<td>&gt; 3 years</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>10 units/ml</td>
</tr>
</tbody>
</table>

**Permcath-Vascath**

<table>
<thead>
<tr>
<th></th>
<th>&lt; 1 year</th>
<th>1ml</th>
<th>0.5-1ml</th>
<th>See guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 years</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>See guideline</td>
</tr>
<tr>
<td>&gt; 3 years</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>See guideline</td>
</tr>
</tbody>
</table>

Antibiotic locks must be given using the Pharmacy guideline as per OLCHC formulary app.

### 3.0 Introduction and Definition

A Central Venous Catheter (CVC) is a catheter placed in a large vessel within the thoracic cavity. The tip usually terminating in the superior or inferior vena cava or right atrium. These guidelines refer in particular to non-tunneled CVCs which are commonly seen in Paediatric Intensive Care Unit (PICU) patients.

**Indication for CVC**
- Delivery of drugs i.e. inotropes, vasodilators.
- Allows monitoring of CVP
- Rapid infusion of intravenous fluids / blood products.
- Blood sampling and venous blood gas
- TPN
- No peripheral access
- Administration of irritant drugs / less risk of infiltration. i.e. calcium, vancomycin etc.

**Types of Catheters**

**Arrow Double Lumen**
- 4 Fr - 5 cms
- 4 Fr - 13 cms

**Triple Lumen**
- 4 Fr - 8 cms
- 4 Fr - 13 cms
- 5.5 Fr - 8 cms
- 7 Fr - 20cms

- Made of polyurethane
Complications

- More common in paediatrics than adults
- Potential benefits outweigh risks i.e. no peripheral venous access
- CVP monitoring

4.0 Assisting with the Insertion of a Central Venous Catheter

Equipment

- Special CVC pack (contains suture material)
- Arrow Paediatric 2-lumen or Multi-lumen Central Venous Catheterisation Set (size as per anaesthetist / intensivist)
- Clinell (2% chlorhexidine) swaps
- Theatre gown
- Face mask
- Sterile gloves,
- Sterile nail brush (chlorhexidine 4%)
- Sterile drapes
- Fenestrated drape i.e. unidrape
- Face visor or goggles
- Heparin saline flush i.e. (10 i.units/ ml)
- Sterile 0.9% Normal Saline for Injection
- Syringes and withdrawal cannula
- Antiseptic Cleansing Solution:
  - Chlorhexidine gluconate 2% / 70% isopropyl alcohol solution > 2months
  - 0.5% chlorhexidine in Aqueous Solution < 2months
- Opsite IV 3000 dressing
- Mepore strips (to frame CVC dressing)
- CVC Audit Form
- Needlefree devices (one for each lumen / exit port of CVC)

**Optional**
- Ultrasound
- Sterile probe cover
- Additional sterile guidewire

<table>
<thead>
<tr>
<th>ACTION</th>
<th>RATIONALE EVIDENCE AND REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A central venous (non-tunneled) catheter is inserted usually in theatre or the Paediatric Intensive Care Unit (PICU) by the anaesthetist / Intensivist.</td>
<td>Universal precautions (Department of Health 2007, OLCHC, 2010a, 2011).</td>
</tr>
<tr>
<td>Aseptic Non-touch Technique (ANTT) – Level 1 is required for this procedure, which requires a surgical scrub. Visor / Goggles recommended.</td>
<td>(O’Grady <em>et al.</em> 2011, OLCHC 2013, Loveday 2014)</td>
</tr>
</tbody>
</table>

**Pre Procedure Safety**
Resuscitation equipment, including oxygen and suction should be available.

**Monitoring**
Heart rate and respirations on cardiac monitor
Oxygen saturations with pulse tone on
Non-invasive blood pressure or intra-arterial blood pressure

**Sedation / Analgesia**
Infants and children are fully sedated and ventilated children may require muscle relaxants as per anaesthetist / intensivist.

**Position**
The infant / child is position in a 30 degree Trendelenburg position, with a roll under their neck (Figure 2).
Turn head slightly away from site (RIJ site preferred).

![Image of child position for neck cannulation of CVC.](image)

**Figure 2:** Child position for neck cannulation of CVC.

The insertion site i.e. internal jugular vein is exposed and cleared of any clothing.

Ensure any hair is clipped back and away from insertion site.

**Procedure**

Clean dressing trolley with 70% isopropyl alcohol swabs i.e. Alcowipe and allow to air dry.

Assemble all equipment on bottom shelf of the trolley.

Decontaminate hands Aseptic Non-Touch Technique (ANTT) Level 2.

Assist anaesthetist / Intensivist to lay out dressing (RCN 2010).

To create clean working surface.

To prevent cross infection (OLCHC 2010a, 2013).

To be prepared for the procedure and prevent
field and prepare equipment for the procedure.

Attach small yellow bag to side of the trolley below the sterile field level.

Insertion site and skin around which will be covered by drapes is cleaned with:

- Chlorhexidine gluconate 2% / 70% isopropyl alcohol solution > 2 months.
- Chlorhexidine 0.5% in Aqueous Solution i.e. Sterexidine 200® < 2 months

Apply antimicrobial disinfectant solution, rubbing with friction using ‘back and forth’ strokes for 30 seconds.

Allow to air dry for minimum 30 seconds - 2 minutes.

**NB:** In the preterm infant < 30 weeks gestation, the solution should be gently dabbed onto the skin and allowed to air dry. Avoid ‘up and down’ and ‘back and forth’ movements. After the procedure the skin should be cleaned and dried with Sterile Water for Injection.

**NB:** In a patient with a history of Chlorhexidine allergy, Povidone Iodine 10% i.e. Videne® or Betadine® is the solution of choice. Observe cardiac monitor during insertion of guidewire / catheter, note any arrhythmias’

The central line is secured in position using black silk sutures by the anaesthetist.

A sterile, transparent semi-permeable Opsite 3000 dressing is placed over the insertion site.

**Post Procedure**

A Chest X-Ray is routinely ordered and reviewed by the anaesthetist following CVC insertion.

unnecessary breaks.

To prevent contamination of contents (Dougherty and Lister 2015).

Chlorhexidine gluconate is the most effective agent for skin cleansing. (DH 2010, O’Grady et al. 2011, OLCHC 2012).

To decontaminate the skin effectively (RCN 2010, Dougherty and Lister 2015).

To ensure antisepsis is achieved, RCN 2010).

Gentle friction can damage the immature stratum corneum of the immature infant OLCHC 2012).

Tachyarrhythmia may be due to line moving into right ventricle and requiring withdrawing.


Anaesthetist/Intensivist will confirm CVC placement and position. Distal tip of CVC should be in lower third of SVC or right atrium. Also to
Dispose of clinical waste and sharps appropriately i.e. yellow bag / sharps bin.

Clean dressing trolley.

Leave the child in a comfortable position.

Remove gloves and wash / decontaminate hands.

Document date, time of insertion, type of catheter and condition in nursing notes.


To ensure comfort (Dougherty and Lister 2015).


To maintain accountability by ensure accurate documentation of the procedure and continuity of patient care (NHO 2011, NMBI 2015a).

Complications During Insertion

- Air Embolism
- Haemothorax (vessel pierced, increased risk with subclavian route)
- Pneumothorax (pleura pierced, especially with IJV / subclavian veins)
- Pleural or Mediastinal Effusion (danger of laceration /perforation of vessels)
- Arrhythmias (especially if catheter moves into the right ventricle).
- Pericardial Tamponade (rare)
- Catheter migration, tip moves out of position and erodes heart wall
- Haemorrhage
- Arterial Cannulation
- Chylothorax. (Thoracic duct injury especially if catheter moves into right ventricle)
- Nerve Damage

exclude malposition of catheter to small vessels / knotting and rule out pneumothorax and other complications.
5.0 Care of a Central Venous Catheter (CVC)

- Infection (local and systemic) especially S. epidermis (on hands)
- Thrombosis/ emboli (higher the risk the longer the catheter is insitu)
- Dislodgement / migration
- Catheter knotting / kinking / occlusion

<table>
<thead>
<tr>
<th>ACTION</th>
<th>RATIONAL EVIDENCE AND REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Integrity</strong></td>
<td>Maintain a close system</td>
</tr>
<tr>
<td></td>
<td>Ensure a bionnector is on each port and clamp lumen if not in use.</td>
</tr>
<tr>
<td></td>
<td>Change weekly using Aseptic Non Touch Technique (ANTT) (Level 2).</td>
</tr>
<tr>
<td></td>
<td>Administration sets / syringes with a Leur-lok™ connection should be used to secure to the</td>
</tr>
<tr>
<td></td>
<td>bionnector.</td>
</tr>
<tr>
<td></td>
<td>When moving / repositioning the infant / child be vigilant to prevent pulling on CVC.</td>
</tr>
<tr>
<td><strong>Administration of Medicine / Fluids</strong></td>
<td>An (ANTT) Level 3, is used to access the CVC line which has a bionnector in situ.</td>
</tr>
<tr>
<td></td>
<td>Clamp the CVC line before opening a port</td>
</tr>
<tr>
<td></td>
<td>Disinfect bionnector with Clinell (2% Chlorhexidine) swap and allow to dry 2 minutes, prior to accessing CVC lumen.</td>
</tr>
<tr>
<td></td>
<td>Aspirate line for blood return prior to administrating medication / fluids.</td>
</tr>
<tr>
<td></td>
<td>(Feil 2012). Needles-free system provides a closed system which reduces risk of air entering. It also reduces the risk of cross infection (OLCHC 2013, Feil 2012, Dougherty and Lister 2015). They are more secure and minimises the risk of accidental disconnection and risk of air embolism (RCN 2010, Braun 2011, Dougherty and Lister 2015). To minimize the risk of air embolism (Feil 2012).</td>
</tr>
<tr>
<td></td>
<td>To minimize risk of air embolism (Feil 2012).</td>
</tr>
<tr>
<td></td>
<td>(RCN 2010). To confirm CVC line patency (RCN 2010).</td>
</tr>
</tbody>
</table>
| Maintaining Patency of CVC | Thrombotic occlusions account for 58% of CVC line occlusions. Heparin Saline flush solution is the recommended solution for maintaining CVC line patency. (RCN 2010, ACCP 2012).

Volume should be equal to or double the dead space of catheter and any add on device.

Ensure adequate flush of 0.9% Normal Saline for Injection as clinically indicated following all medication / fluids administered via CVC.

Use pulsated flushing technique (1 ml) at a time.

| Blocked CVC | Precipitate can occur due to inadequate flushing of CVC between incompatible medications (Dougherty and Lister 2015).

Inform anaesthetist / intensivist who will check position of CVC on chest x-ray.

Anaesthetist / Intensivist may order local thrombolytic therapy as per OLCHC Hospital Formulary x 2 doses as clinically indicated.

Observe for clinical signs of thrombosis i.e. swollen limb.

A Doppler ultrasound may be ordered as clinically indicated.

| Leaking CVC | To create turbulence within the cvc lumen to remove any debris from wall, by maintaining a positive pressure (Pratt et al. 2007).

Aspirate all lumens of CVC to check for patency.

Inform anaesthetist who will check position of CVC on chest x-ray.

| Monitoring for Line Infection | To ensure timely medical treatment (Dougherty and Lister 2015, OLCHC 2010b, OLCHC 2012b).

Document date insertion (inform anaesthetist if > 7 days).

Inspect insertion site at beginning of each shift for signs of phlebitis (swelling, erythema and pain) and for signs of infection (fever, raised wcc, low platelets, pain/ tenderness at site). Document assessment in nursing notes or IntelliVue Clinical Information

| Nurse Practice Committee | February 2017 |
Portfolio (ICIP).

Inform Medical team if suspect sepsis
Central and peripheral blood cultures may be requested for culture and sensitivity.

CVC dressing should allow clear visualisation of the insertion site and be secure with no lifting
Change dressing a minimum of every 7 days.

Redress insertion site as soon as possible if soiled, oozing, lifting or contaminated PRN

**CVC Anti-thrombotic Line Prevention**
All neonates / infants >2 kgs – 10 kgs with CVC have prophylactic heparin (UFH) infusion @ 10 i.units/kg/hour via CVC.

*NB:*
- Commence infusion 6 hours post-operatively if no bleeding
- Stop infusion 4 hours prior to removal of intracardiac lines/ pacing wires.

This dressing allows observation of exit site when applied correctly. It is also moisture permeable, preventing collection of moisture under the dressing (O’Grady et al. 2011, Loveday et al. 2014, NICE 2014).

To prevent infection.

To prevent CVC thrombosis (ACCP 2012, OLCHC 2012b).

---

5. a) **Changing a CVC Dressing**

<table>
<thead>
<tr>
<th>ACTION</th>
<th>RATIONAL EVIDENCE AND REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect insertion site at beginning of each shift.</td>
<td></td>
</tr>
<tr>
<td>Changed CVC minimum of every 7 days or more frequently if lifting, oozing, bleeding or contaminated.</td>
<td>(O’Grady et al. 2011).</td>
</tr>
<tr>
<td>Ensure extra care and vigilance with femoral insertion sites.</td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Explain procedure to child as appropriate.</td>
<td>To relieve fear, anxiety and foster trust understanding and cooperation for the procedure (Hockenberry and Wilson 2015).</td>
</tr>
<tr>
<td>Decontaminate hands</td>
<td>To create a clean working surface (OLCHC 2017).</td>
</tr>
<tr>
<td>Clean dressing trolley with 70% isopropyl alcohol swabs i.e. Alcowipe and allow to air dry. Assemble all equipment on bottom shelf of the trolley.</td>
<td>To prevent cross infection. Standard precautions (OLCHC 2010a, 2013, Loveday <em>et al.</em> 2014).</td>
</tr>
<tr>
<td>Wash hands Aseptic Non-Touch Technique (ANNT) Level 2</td>
<td>To be prepared for the procedure and prevent unnecessary breaks.</td>
</tr>
<tr>
<td>Lay out dressing field and prepare equipment for the procedure.</td>
<td>To prevent contamination of contents (Dougherty and Lister 2015).</td>
</tr>
<tr>
<td>Attach small yellow bag to side of the trolley below the sterile field level.</td>
<td>Standard precautions (OLCHC 2011a, Loveday <em>et al.</em> 2014).</td>
</tr>
<tr>
<td>Remove Opsite IV 3000 dressing.</td>
<td>To ensure a sterile dressing field.</td>
</tr>
<tr>
<td>Decontaminate hands</td>
<td></td>
</tr>
<tr>
<td>Place sterile prep towel under the CVC line</td>
<td></td>
</tr>
<tr>
<td>Inspect insertion site.</td>
<td></td>
</tr>
<tr>
<td>Check site for discomfort, leakage</td>
<td></td>
</tr>
<tr>
<td>Ensure line is sutured securely and there is no traction on the line</td>
<td></td>
</tr>
</tbody>
</table>
Clean site with antiseptic solution:

- Chlorhexidine gluconate 0.2% / 70% isopropyl alcohol solution > 2 months.
- Chlorhexidine 0.5% in Aqueous Solution i.e. Sterexidine 200 ® < 2 months

Apply solution with friction for 30 seconds using ‘back and forth’ strokes.

Solution should be allowed to air dry for 2 minutes.

**NB:** In the preterm infant < 30 weeks gestation, the solution should be gently dabbed onto the skin and allowed to dry to air. Avoiding ‘up and down’ and ‘back and forth’ movements. After the procedure the skin should be cleaned and dried with sterile water.

**NB:** In a patient with a history of Chlorhexidine allergy, Povidone Iodine 10% i.e. Vodene ® or Betadine ® is the solution of choice.

Swab site if clinically indicated. Clean site first and then take swab. Send for Culture and Sensitivity.

Apply new Opsite IV 3000 dressing ensuring insertion site is visible through the dressing and moulding it in place without creases or folds. Frame dressing with mepore strips.

Chlorhexidine gluconate is the most effective cleansing agent. It has a wide spectrum of antimicrobial activity including anti-staphylococcus properties, is less irritant and has a longer residual up to 24 hours (Carret et al 1997, Maki et al. 2006, Department of Health 2007, Sari Infection Control Sub Committee 2009, DH 2010, RCN 2010, INS 2011, NICE 2012, OLCHC 2012a, Morgan 2013, Loveday et al. 2014, Long 2015).

To ensure antisepsis is achieved (Centre for Disease Control and Prevention 2002).

Gentle friction can damage the immature stratum corneum of the immature infant (OLCHC 2012a).


To check for pathogens and ensure timely treatment if required (Dougherty and Lister 2015).

To ensure visibility of insertion site and minimise risk of dressing lifting (Dougherty and Lister 2015).
Figure 3: CVC insertion site dressed with Opsite IV 3000 dressing and framed with mepore strips.

Dispose of clinical waste and sharps appropriately i.e. yellow bag / sharps bin. Clean dressing trolley.

Make the infant / child comfortable.

Remove gloves and wash / decontaminate hands

Document date, time of removal, type of catheter and condition in nursing notes. Include condition of patients skin i.e. redness, swelling, bleeding or discharge.

5b) CVC Care Bundle

Catheter-related blood stream infections (CRBSI) in the ICU are known to be costly, common and potentially be lethal (Pronovost et al. 2006). Reduction in (CRBSI) is known to be a quality of care indicator in Continuous Quality Improvement (CQI) Initiatives.

A CVC care bundle consists of a group of evidence based interventions, which when fully implemented are known to decrease the incidence of CRBSIs and result in improved outcomes. They represent an established standard of care (HCAI / RCPI / HSE 2014).
The care bundle strategies employed in OLCHC include:

1. ANTT - level 2 when handling and accessing CVC
2. ANTT - level 3 when accessing CVC via needle free device
3. Sterile transparent semi-permeable dressing to cover CVC site
4. Assess dressing daily and replace weekly or if damp, loose or soiled
5. Use chlorhexidine 2% (> 2 months) / 0.5% chlorhexidine (< 2 months) for cleaning CVC site
6. Assess CVC necessity daily with prompt removal if not required
7. Assess Total Parental Nutrition (TPN) to enteral nutrition and IV to PO/NG/NJ medication daily

Compliance with CVC Care Bundle

Compliance is measured using an ‘all or none measurement, with a goal of 95% or greater’ (Resar et al. 2012: 5). Should an element of the CVC care bundle be absent, the bundle is incomplete, as there is no option for partial credit to be given (Nolan and Berwick 2006, Van Matre 2006, Department of Health 2007, Resar et al. 2012). Compliance is a product of each elements reliability i.e. if each of the 7 elements is delivered at 90% reliability (90% x 90% x 90% x 90% x 90% x 90% x 90%) then the CVC care bundle is delivered at 48% reliability. 100% compliance occurs when all CVC care bundle elements are performed correctly on every occasion (Department of Health 2007, Resar et al. 2012, HCAI / RCPI / HSE 2014) (Appendix I).

Document compliance with each element of CVC care bundle daily using CVC card bundle check list (NMBI 2015a).

6.0 Removal of a Central Venous Catheter (CVC)

Complications of CVC Removal

1. Haemorrhage / Bleeding
2. Air Embolism (which can be fatal)
3. Catheter Fracture / Embolism
4. Dislodgement of Thrombus / Fibrin Sheath
5. Arterial Complications: Bleeding, compression of Brachial Plexus  (Drewett 2000a)

Equipment

- Dressing trolley
- Sterile dressing pack (includes sterile gloves)
- Chlorhexidine gluconate 2% / 70% isopropyl alcohol solution > 2months or
- Chlorhexidine 0.5% solution < 2 months
- Stitch cutter
- Sterile scissors
- Sterile gauze
- Sterile air-occlusive dressing i.e. Opsite™
- Adhesive remover
- Face Visor / Goggles
- Apron

**Optional**

- Sterile universal specimen pot
- Microbiology request form

### ACTION

The removal of a central venous catheter should only be undertaken by a Registered Nurse who is deemed competent and has the appropriate experience, skills and knowledge. The nurse is responsible for acknowledging the limit of their professional competence.

Ensure 2 nurses present for the procedure.

### Preparation

Check infants/child’s platelet and coagulation status in high risk groups i.e. cardiac patients as medically indicated.

Discuss with medical team when the infant / child is on anticoagulation therapy.

Ensure infant / child is not dehydrated.

Ensure that central venous access is no longer required and alternative intravenous peripheral access have been established for continuing IV

### RATIONAL, EVIDENCE AND REFERENCE

CVC removal is a complex procedure with the potential to result in life threatening complications (RCN 2010, Dougherty and Lister 2015, NMBI 2015b).

To support the infant / child and assist the first nurse removing the CVC (Ingram et al 2006, NMBI 2015b).

Prolonged clotting time will increase the risk of bleeding and haematoma formation post catheter removal (Drewett 2000).

A patient with a low central venous pressure (CVP) due to dehydration / hypovolaemia will more easily allow air to be aspirated into the systemic circulation, resulting in air embolism (Kim et al.1998).

(Dougherty 2015).
therapy / medications.
Flush CVC with 0.9% Normal Saline.
Close slider clamp on each lumen of CVC line. Turn off any 3 way taps.
Ensure warmth, privacy and dignity for the child during the procedure.
Explanation to child / parents as clinically indicated
Ensure adequate analgesia has been administered

**NB: DO NOT remove CVC with infant / child sitting / upright.**

**Procedure**
Decontaminate hands. Procedure is performed at Aseptic Non-Touch Technique (ANTT) level 2.
Clean dressing trolley with 70% isopropyl alcohol swab i.e alcowipe and allow to air dry.

To ensure all medications have been delivered (Dougherty 2015).
To prevent inadvertent delivery of medication, fluid or air to the infant / child (Ingram *et al.* 2006).
To maintain the children’s privacy and dignity (Ball Bindler and Cowen 2013, Hockenberry and Wilson 2015)
To relieve fear, anxiety and foster trust understanding and cooperation for the procedure (Hockenberry and Wilson 2015).
To ensure comfort and prevent pain (Lloyd-Jones 2004).
Correct positioning prior to and during removal is crucial to preventing air embolism. Head down position elevates the venous pressure above atmospheric pressure and therefore minimises the risk (Drewett 2000a, Peter and Saxman 2003, Ingram *et al.* 2006, Feil 2012, Brockmeyer *et al.* 2013, Joanna Briggs Institute 2013).
This will reduce CVP and predispose them to air embolism, as a result of passive entry. National Patient Safety Agency have reported incidents of air embolism from incorrect positioning, which resulted in patient collapse / cardiac arrest (Peter and Saxman 2003, Luettel 2011, NPSA 2011, Dougherty 2015).
To create clean working surface.
<table>
<thead>
<tr>
<th>Action</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assemble all equipment on bottom shelf of the trolley.</td>
<td>To prevent cross infection (OLCHC 2011, Loveday et al. 2014).</td>
</tr>
<tr>
<td>Decontaminate hands Aseptic Non-Touch Technique (ANNT) Level 2</td>
<td>To be prepared for the procedure and prevent unnecessary breaks.</td>
</tr>
<tr>
<td>Lay out dressing field and prepare equipment for the procedure.</td>
<td>To prevent contamination of contents (Dougherty and Lister 2015).</td>
</tr>
<tr>
<td>Attach small yellow bag to side of trolley below the sterile field level.</td>
<td>Universal precautions (OLCHC, 2011).</td>
</tr>
<tr>
<td>Apply non-sterile gloves</td>
<td>To gain access to the insertion site (Ingram et al. 2006).</td>
</tr>
<tr>
<td>Expose CVC site and remove dressing with adhesive remover.</td>
<td>To create sterile field (Joanna Briggs Institute 2013).</td>
</tr>
<tr>
<td>Place sterile field under central venous catheter (CVC).</td>
<td>Universal precautions (OLCHC 2011a, Loveday et al. 2014)</td>
</tr>
<tr>
<td>Decontaminate hands and apply sterile gloves</td>
<td>To prevent contamination of the CVC on removal and a false positive culture of CVC tip (Dougherty and Lister 2015).</td>
</tr>
<tr>
<td>Clean site with antiseptic solution</td>
<td>To facilitate catheter removal (Ingram et al. 2006).</td>
</tr>
<tr>
<td>Solution should be allowed to air dry for 2 minutes.</td>
<td>To seal the CVC site and minimise risk of air embolism (Feil 2012).</td>
</tr>
<tr>
<td>Remove CVC sutures while holding CVC to prevent accidental migration out.</td>
<td>During spontaneous breathing a negative intrathoracic pressure generates the pressure gradient for inspiration. This negative pressure can also encourage air to enter the insertion site resulting in an air embolism. Breath holding...</td>
</tr>
<tr>
<td>Ensure all suture material has been removed from skin.</td>
<td></td>
</tr>
<tr>
<td>Cover CVC insertion site with gauze for CVC removal.</td>
<td></td>
</tr>
<tr>
<td>Ask child to take a deep breath and hold it, if cooperative for the period necessary to remove CVC.</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Our Lady’s Children’s Hospital, Crumlin*
Once catheter removed tell the child to breathe again.

In the ventilated patient or an infant / uncooperative child remove the catheter at the beginning of expiration.

Apply pressure to site with sterile gauze swabs whilst gently withdrawing the catheter in one swift steady movement.
NB: Do not massage the exit site.

Continue applying direct manual pressure above the puncture site for a minimum 5 minutes until bleeding has stopped.
Carefully check site.

If bleeding continues continue manual pressure for a further 5 minutes and repeat site check.
Following haemostsis maintain pressure for a minimum 5 minutes.

Check central venous catheter for clots and completeness.

Engorges the neck veins and creates a positive pressure in the intrathoracic space which minimises this risk of air entering the venous circulation (Ingram 2006, Morgan 2013).

The intrathoracic pressures are greater than atmospheric on expiration, thereby minimising the risk of air entering the venous circulation (Drewett 2000).

There is a risk of air embolism.

Gauze will also absorb any blood loss and encourage resealing of the vein wall (Dougherty and Lister 2015).
Massage can dislodge a thrombus or cause vagal stimulation (Ingram et al 2006).
Direct pressure is necessary to prevent both air entry and stop bleeding from a large vein (Chen 2014, Dougherty 2015).

Haematoma formation at a jugular venous site can impede cerebral blood flow.
A femoral venous site haematoma can impair blood flow to the lower limb (Drewett 2006, Morgan 2013).

To ensure that catheter is intact and entire catheter has been removed. Clots may form on catheter tip.
They can dislodge on removal and clots / fragments can embolise to the lung (Morgan 2000, Chen 2014, Dougherty and Lister 2015).
Should catheter fracture be suspected, position patient in Trendelenburg position and on left side. Notify medical team immediately.

If catheter fragment is palpated, apply additional distal pressure to the catheter to prevent migration.

Following haemostasis apply a transparent occlusive dressing i.e. Opsite™ and ensure it is maintained for a minimum 72 hours. 

N.B.
- Do not use gauze and tape
- Do not apply a BULKY PRESSURE DRESSING

When CVC removal is due, to a suspected catheter related infection, send a 5cm tip to microbiology laboratory for culture and antimicrobial sensitivity.

Cut with sterile scissors and allow to fall into the sterile container.

Remove non-sterile gloves and decontaminate hands.

Post Procedure
Reposition infant / child and ensure bedrest for minimum 30-60 minutes.

This position may trap the embolus in the right ventricle and prevent migration to the lung (Morgan 2013). To ensure timely medical review and treatment.

To prevent further migration (Morgan 2013).

To prevent entry of pathogens, to allow observation of site and prevent air entry into the site resulting in an air embolism. Residual catheter tract remains an air entry port following removal until completely sealed. The longer the CVC was in situ the longer the CVC tract takes to heal (Phifer et al. 1991, Boer and Hene 1999, Drewett 2000, Ingram 2006, RCN 2010, Dougherty and Lister 2015, Dougherty 2015). An air-occlusive dressing is required to prevent air embolism, which can occur many hours after original removal of CVC (Meggiolaro et al. 2013). Cessation of bleeding from a large vein requires the application of direct pressure only (Morgan 2013).

To prevent contamination (RCN 2010, Morgan 2013, Dougherty 2015).

Early detection of infection and timely treatment (Chen 2014, Dougherty and Lister 2015).

To avoid contamination of specimen (SARI 2009, OLCHC 2011, Dougherty 2015).

To maximise the infant / child’s comfort and minimise air embolism, secondary haemorrhages and pneumothorax (Drewett 2000a, Ingram et al.)
Dispose of clinical waste and sharps appropriately i.e. yellow bag / sharps bin.
Clean dressing trolley.

Make the infant / child comfortable.

Decontaminate hands.

Document date, time of removal, type of catheter and condition in nursing notes. Include condition of patients skin i.e. redness, swelling, bleeding or discharge.

<table>
<thead>
<tr>
<th>Suspected Air Embolism</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sudden deterioration</td>
</tr>
<tr>
<td>• Agitation / confusion/ anxiety/ impending doom</td>
</tr>
<tr>
<td>• Collapse / CVS instability / hypotension</td>
</tr>
<tr>
<td>• Bradycardia / tachycardia/ cardiac arrhythmia</td>
</tr>
<tr>
<td>• Collapse / cardiac Arrest</td>
</tr>
<tr>
<td>• Desaturation / pallor/ cyanosis</td>
</tr>
<tr>
<td>• Respiratory distress / gasp/ respiratory arrest</td>
</tr>
<tr>
<td>• Lightheadedness</td>
</tr>
<tr>
<td>• Petechiae</td>
</tr>
<tr>
<td>• Weakness / seizure</td>
</tr>
<tr>
<td>• Mill wheel murmur (classic transient sign due to right atrial and right ventricular obstruction)</td>
</tr>
</tbody>
</table>

Nursing Action

• Call senior nurse / medical team
• Turn infant / child in LEFT side down, trendelenburg position (head down)
• In older child ask to perform valsava


To ensure safe disposal of waste, prevent cross infection and environmental contamination (Department of Health and Children 2002, OLCHC 2008).

To ensure comfort (Dougherty and Lister 2015).


To maintain accountability by ensure accurate documentation of the procedure and continuity of patient care (NMBI 2015a).


To ensure urgent and timely nursing and medical assistance and treatment.

This position may encourage air to rise in the right atrium away from right ventricular outflow track and pulmonic valve, allow blood through and
maneuver if indicated
- Administer 100% oxygen / high flow 15 litres
- Check all connections / ports to ensure air tight
- Perform BLS as clinically indicated
- Assess vital signs, heart rhythm and oxygen saturation
- Attempt aspiration of air from right atrial or pulmonary artery line if in situ.

prevent embolism to the lungs (Drewett 2000b, Ingram et al. 2006, Feil 2012).
100% oxygen will help in removing nitrogen from the air embolism (Ingram et al. 2006).

7.0 References


Bundle and Peripheral IV Cannula Care Bundle. Department of Health, London.


OLCHC (2008) Infection Control / Waste Policy, Our Lady’s Children’s Hospital, Crumlin: Dublin.

OLCHC (2010a) *Guideline for Hand Hygiene*, Our Lady’s Children’s Hospital Crumlin: Dublin.

OLCHC (2010b) *Hospital Formulary*, Our Lady’s Children’s Hospital, Crumlin, Dublin.

OLCHC (2011) *Standard Universal Precautions*, Our Lady’s Children’s Hospital, Crumlin: Dublin.

OLCHC (2012a) *Skin Asepsis Prior to Peripheral and Central Line Insertion*. Our Lady’s Children’s Hospital, Crumlin: Dublin.

OLCHC (2012b) *Anti Thrombotic Central Line Guidelines*. Our Lady’s Children’s Hospital, Crumlin: Dublin.


OLCHC (2015) Guidelines on Care Bundles in Our Lady’s Children’s Hospital Crumlin (OLCHC). Our Lady’s Children’s Hospital, Crumlin: Dublin.


8.0 Appendices

APPENDIX I

CVC Care Bundle Compliance Tool

<table>
<thead>
<tr>
<th></th>
<th>Care element 1</th>
<th>Care element 2</th>
<th>Care element 3</th>
<th>Care element 4</th>
<th>All elements performed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Total number of times an individual element was performed</strong></td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>% when element of care was given</strong></td>
<td>100%</td>
<td>80%</td>
<td>80%</td>
<td>80%</td>
<td><strong>40%</strong></td>
</tr>
</tbody>
</table>

This example shows that while most care elements were performed on only two occasions were ALL elements performed correctly. Overall compliance with all elements was only 40% and as a result the risk of infection was significantly increased.

*(Department of Health 2007)*

©2017 OLCHC.

Disclaimer 2017, Our Lady’s Children’s Hospital Crumlin, Dublin 12. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means without the prior written permission of the copyright holder. Every effort has been made to ensure that the information provided is accurate and in accord with standards accepted at the time of printing.