

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


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

Document Review History

| <i>Review Date</i> | <i>Reviewed By</i> | <i>Signature</i> |
|--------------------|--------------------|------------------|
| <i>2020</i> | | |
| | | |

Document Change History

| <i>Change to Document</i> | <i>Reason for Change</i> |
|---------------------------|--------------------------|
| | |

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 2 of 29 | |


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

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 3 of 29 | |

Contents

| | Page No |
|---|---------|
| 1.0 Introduction | 2 |
| 2.0 Commonly used reference tables | 4 |
| <i>a. Table 1... Skin Asepsis prior to peripheral or central line insertion</i> | 4 |
| <i>b. Table 2...Guide to CVAD choice and the duration of usage</i> | 6 |
| <i>c. Table 3 ...Blood discard volumes and Flush volumes for CVAD</i> | 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 |


| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 4 of 29 | |

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**.

| Indication | Product | Composition |
|---|---|--|
| Skin cleansing prior to peripheral canula insertion | Sanicloth® | ↑ |
| Skin cleansing prior to CVC insertion | OR | 2% chlorhexidine gluconate in 70% isopropyl alcohol |
| Device cleaning (e.g. hubs) | Chlorhexidine 2% Alcohol (Ecolab) 200ml bottle | ↓ |

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

| Indication | Product | Composition |
|---|--------------------------------------|---|
| Skin cleansing prior to peripheral and central line insertion in infants < 2 months old (Corrected age) | Sterexidine 200® 150ml bottle | contains 0.5% Chlorhexidine Gluconate w/v in aqueous solution |


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

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 5 of 29 | |


| Type of Line | Type of access | Location | Length of usage |
|---|---|--|---|
| PERIPHERALLY INSERTED CENTRAL CATHETER PICC | <ul style="list-style-type: none"> Short-term venous access devices Inserted under local anaesthetic | <ul style="list-style-type: none"> Brachial, cephalic, median-cubital or scalp vein placement Single or multiple lumens | 0 days to 6 weeks Or as indicated |
| MIDLINE | <ul style="list-style-type: none"> Short-term venous access devices Inserted under local anaesthetic | <ul style="list-style-type: none"> Brachial, cephalic, median-cubital or scalp vein placement Single or multiple lumens | 0 days to 6 weeks or as indicated |
| <p><i>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.</i></p> | | | |
| Central Venous Catheter | <ul style="list-style-type: none"> Short term central device inserted under general anaesthetic | <ul style="list-style-type: none"> Single or multiple lumens Right or left internal jugular usually preferred Sutured in place | 7-10 days |
| TUNNELLED HICKMAN OR BROVIAC | <ul style="list-style-type: none"> Known to the children in OLCHC as "Freddy" | <ul style="list-style-type: none"> 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) | <ul style="list-style-type: none"> Totally implanted venous access device Inserted under general anaesthetic Accessed through the skin using a non-coring needle | <ul style="list-style-type: none"> Intradermal Dome-shaped Incision scar often seen across, above, or below the dome Palpable | indefinite |

| | | | |
|---------------------------------------|--|--|-------------------------------|
| Umbilical Venous Catheter | <ul style="list-style-type: none"> Used in neonatal units | <ul style="list-style-type: none"> 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 | 3-7 days |
| Non tunnelled Permcath/Vascath | <ul style="list-style-type: none"> Used predominately for Haemofiltration or plasmapheresis | <ul style="list-style-type: none"> 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 | Indefinite Max 3 weeks |

Table 2. Guide to CVAD Choice and the Duration of Usage

Table 3. Flush volumes for CVADS

| Line type | Age | Blood discard volume | Suggested Flush volume for pre and post line use | Heparin dose |
|--|-----------|----------------------|--|---|
| PICC/Midlines It is not possible to withdraw blood from a 1-2fr PICC | < 1 year | 1ml | 0.5ml | 10 units/ml |
| | 1-3 years | 2.5ml | 0.6 | 10 units/ml |
| | > 3 years | 3.5ml | 0.8 | 10 units/ml |
| Central Venous Catheters | < 1 year | 1 ml | 0.5-1ml | 10 units/ml |
| | 1-3 years | 2.5ml | 1-2.5mls | 10 units/ml |
| | > 3 years | 3-5ml | 3-5 mls | 10 units/ml |
| Hickman/Broviac | < 1 year | 1 ml | As per surgeons | 10 units/ml |
| | 1-3 years | 2 ml | As per surgeons | 10 units/ml |
| | > 3 years | 3-5 ml | As per surgeons | 10 units/ml |
| Implantofix In some cases it may be requested that blood is | < 1 year | N/A | 1ml -2.5 mls | 10 units/ml |
| | 1-3 years | N/A | 1ml- 2.5mls | 10 units/ml but Use 100 units/ml when on Discharge for patients |

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 7 of 29 | |

| | | | | |
|---------------------------------------|-----------------------------------|----------|------------|------------------------|
| withdrawn from an Implantofix. | > 3 years | N/A | 1ml-2.5mls | with CF 10 units/ml |
| | Umbilical Venous Catheters | < 1 year | 1ml | 0.5-1ml |
| | 1-3 years | N/A | N/A | 10 units/ml |
| | > 3 years | N/A | N/A | 10 units/ml |
| Permcath-Vascath | < 1 year | 1ml | 0.5-1ml | See guideline |
| | 1-3 years | N/A | N/A | See guideline |
| | > 3 years | N/A | N/A | See guideline |

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

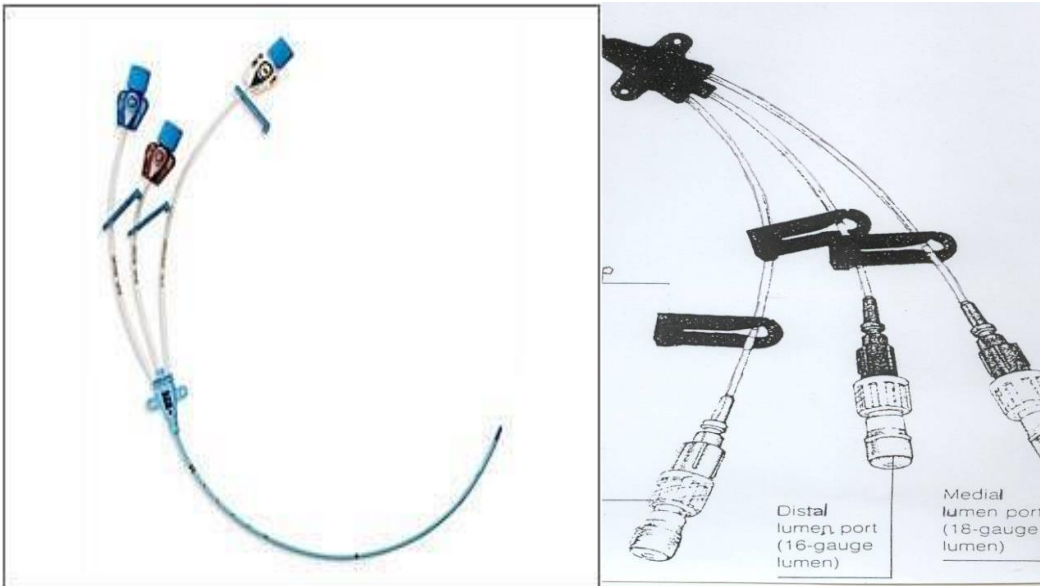
- 4 Fr - 5 cms
- 4 Fr -13 cms

Triple Lumen

- 4 Fr - 8 cms
- 4 Fr - 13 cms
- 5.5 Fr - 8 cms
- 7 Fr - 20cms

- Made of polyurethane

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 8 of 29 | |




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) swabs
- 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

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 9 of 29 | |

- 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

| ACTION | RATIONALE EVIDENCE AND REFERENCE |
|---|---|
| <p>A central venous (non-tunnelled) catheter is inserted usually in theatre or the Paediatric Intensive Care Unit (PICU) by the anaesthetist / Intensivist.</p> <p>Aseptic Non-touch Technique (ANTT) –Level 1 is required for this procedure, which requires a surgical scrub. Visor / Goggles recommended.</p> <p>Pre Procedure</p> <p>Safety Resuscitation equipment, including oxygen and suction should be available.</p> <p>Monitoring Heart rate and respirations on cardiac monitor Oxygen saturations with pulse tone on Non-invasive blood pressure or intra-arterial blood pressure</p> <p>Sedation / Analgesia Infants and children are fully sedated and ventilated children may require muscle relaxants as per anaesthetist / intensivist.</p> <p>Position The infant / child is position in a 30 degree Trendelenburg position, with a roll under their neck (Figure 2).</p> | <p>Universal precautions (Department of Health 2007, OLCHC, 2010a, 2011).</p> <p>(O’Grady <i>et al.</i> 2011, OLCHC 2013, Loveday 2014)</p> <p>Early detection of any patient instability.</p> <p>To facilitate venous access and ensure child is sedated and pain free.</p> <p>This allows maximum venous distension and prevents air embolism (Dougherty and Lister 2015)</p> |

Turn head slightly away from site (RIJ site preferred).

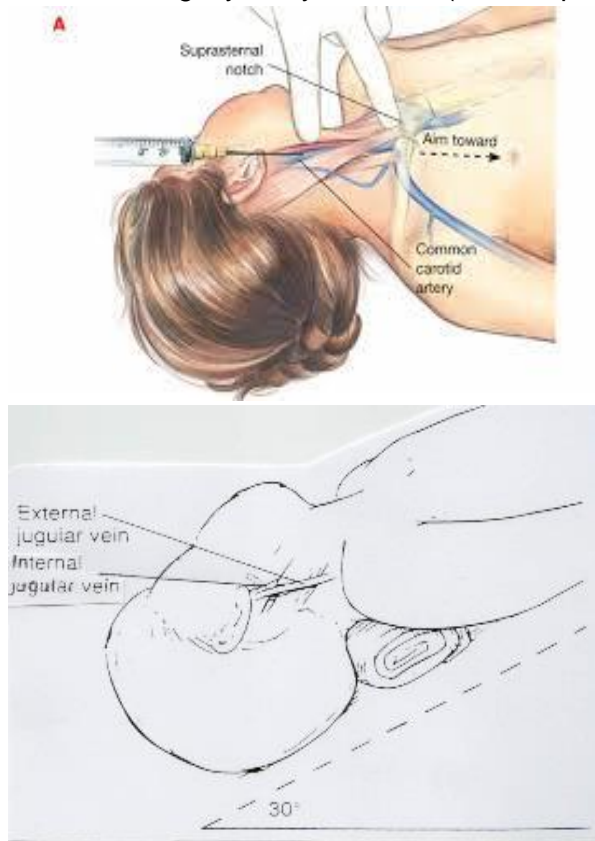


Figure 2: Child position for neck cannulation of CVC.

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

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 11 of 29 | |

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 > 2months.
- 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, OLCCH 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 OLCCH 2012).

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

Opsite 3000 dressing allows observation of the entry site (O'Grady *et al.* 2011, Loveday *et al.* 2014, Porritt 2016, Stephenson 2016).


Anaesthetist/Intensivist will confirm CVC placement and position. Distal tip of CVC should be in lower third of SVC or right atrium. Also to

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 12 of 29 | |

| | |
|---|---|
| <p>Dispose of clinical waste and sharps appropriately i.e. yellow bag / sharps bin.</p> <p>Clean dressing trolley.</p> <p>Leave the child in a comfortable position.</p> <p>Remove gloves and wash / decontaminate hands.</p> <p>Document date, time of insertion, type of catheter and condition in nursing notes.</p> | <p>exclude malposition of catheter to small vessels / knotting and rule out pneumothorax and other complications.</p> <p>To ensure safe disposal of waste, prevent cross infection (Department of Health and Children 2002, OLCHC 2008, Loveday <i>et al.</i> 2014, NICE 2014).</p> <p>To ensure comfort (Dougherty and Lister 2015).</p> <p>Standard precautions (OLCHC, 2011, Loveday <i>et al.</i> 2014).</p> <p>To maintain accountability by ensure accurate documentation of the procedure and continuity of patient care (NHO 2011, NMBI 2015a).</p> |
|---|---|

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

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 13 of 29 | |


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

| ACTION | RATIONAL EVIDENCE AND REFERENCE |
|--|--|
| <p>System Integrity Maintain a close system</p> <p>Ensure a bionnector is on each port and clamp lumen if not in use. Change weekly using Aseptic Non Touch Technique (ANTT) (Level 2).</p> <p>Administration sets / syringes with a Leur-lok™ connection should be used to secure to the bionnector.</p> <p>When moving / repositioning the infant / child be vigilant to prevent pulling on CVC.</p> <p>Administration of Medication / Fluids An (ANTT) Level 3, is used to access the CVC line which has a bionnector in situ.</p> <p>Clamp the CVC line before opening a port</p> <p>Disinfect bionnector with Clinell (2% Chlorhexidine) swap and allow to dry 2 minutes, prior to accessing CVC lumen.</p> <p>Aspirate line for blood return prior to administering medication / fluids.</p> | <p>(Feil 2012).</p> <p>Needle-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).</p> <p>They are more secure and minimises the risk of accidental disconnection and risk of air embolism (RCN 2010, Braun 2011, Dougherty and Lister 2015).</p> <p>To minimize the risk of air embolism (Feil 2012).</p> <p>To prevent cross infection (OLCHC 2010a, O'Grady <i>et al.</i> 2011, OLCHC 2011, 2013, Loveday <i>et al.</i> 2014).</p> <p>To minimize risk of air embolism (Feil 2012).</p> <p>(RCN 2010).</p> <p>To confirm CVC line patency (RCN 2010).</p> |

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 14 of 29 | |


| | |
|--|---|
| <p>Maintaining Patency of CVC</p> <p>Flush with Heparin Saline flush i.e. Heplock 10 i.units / ml, minimum 6 hourly, if no infusion is running through the CVC lumen.</p> <p>Volume should be equal to or double dead space of catheter and any add on device.</p> <p>Ensure adequate flush of 0.9% Normal Saline for Injection as clinically indicated following all medication / fluids administered via CVC.</p> <p>Use pulsated flushing technique (1 ml) at a time.</p> <p>Blocked CVC</p> <p>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.</p> <p>Leaking CVC</p> <p>Aspirate all lumens of CVC to check for patency. Inform anaesthetist who will check position of CVC on chest x-ray.</p> <p>Monitoring for Line Infection</p> <p>Document date insertion (inform anaesthetist if > 7 days).</p> <p>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</p> | <p>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).</p> <p>(RCN 2010).</p> <p>Precipitate can occur due to inadequate flushing of CVC between incompatible medications (Dougherty and Lister 2015).</p> <p>To create turbulence within the cvc lumen to remove any debris from wall, by maintaining a positive pressure (Pratt <i>et al.</i> 2007).</p> <p>To ensure timely medical treatment (Dougherty and Lister 2015, OLCHC 2010b, OLCHC 2012b).</p> <p>To ensure timely medical treatment (OLCHC 2012b).</p> <p>(NMBI 2015a).</p> <p>(HCAI/ RCPI/ HSE 2014, NMBI 2015a).</p> |
|--|---|

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 15 of 29 | |


| | |
|---|---|
| <p>Portfolio (ICIP).</p> <p>Inform Medical team if suspect sepsis Central and peripheral blood cultures may be requested for culture and sensitivity.</p> <p>CVC dressing should allow clear visualisation of the insertion site and be secure with no lifting Change dressing a minimum of every 7 days.</p> <p>Redress insertion site as soon as possible if soiled, oozing, lifting or contaminated PRN</p> <p>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. <i>NB:</i> <i>Commence infusion 6 hours post-operatively if no bleeding</i> <i>Stop infusion 4 hours prior to removal of intracardiac lines/ pacing wires.</i></p> | <p>This dressing allows observation of exit site when applied correctly. It is also moisture permeable, preventing collection of moisture under the dressing (O'Grady <i>et al.</i> 2011, Loveday <i>et al.</i> 2014, NICE 2014).</p> <p>To prevent infection.</p> <p>To prevent CVC thrombosis (ACCP 2012, OLCHC 2012b).</p> |
|---|---|

5. a) Changing a CVC Dressing

| ACTION | RATIONAL EVIDENCE AND REFERENCE |
|--|--------------------------------------|
| <p>Inspect insertion site at beginning of each shift.</p> <p>Changed CVC minimum of every 7 days or more frequently if lifting, oozing, bleeding or contaminated.</p> <p>Ensure extra care and vigilance with femoral insertion sites.</p> | <p>(O'Grady <i>et al.</i> 2011).</p> |

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 16 of 29 | |

| | |
|--|---|
| <p>Changed using Aseptic Non-Touch Technique (ANTT) – Level 2.</p> <p>Explain procedure to child as appropriate.</p> <p>Place infant / child in supine position.</p> <p>Decontaminate hands</p> <p>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.</p> <p>Wash hands Aseptic Non-Touch Technique (ANNT) Level 2</p> <p>Lay out dressing field and prepare equipment for the procedure.</p> <p>Attach small yellow bag to side of the trolley below the sterile field level.</p> <p>Remove Opsite IV 3000 dressing.</p> <p>Decontaminate hands</p> <p>Place sterile prep towel under the CVC line</p> <p>Inspect insertion site. Check site for discomfort, leakage Ensure line is sutured securely and there is no traction on the line</p> | <p>To prevent cross infection (OLCHC 2010a, 2011a, O'Grady <i>et al.</i> 2011, OLCHC 2013).</p> <p>To relieve fear, anxiety and foster trust understanding and cooperation for the procedure (Hockenberry and Wilson 2015).</p> <p>Standard precautions (OLCHC 2011a, Loveday <i>et al.</i> 2014).</p> <p>To create a clean working surface (OLCHC 2017).</p> <p>To prevent cross infection. Standard precautions (OLCHC 2010a, 2013, Loveday <i>et al.</i> 2014).</p> <p>To be prepared for the procedure and prevent unnecessary breaks.</p> <p>To prevent contamination of contents (Dougherty and Lister 2015).</p> <p>Standard precautions (OLCHC 2011a, Loveday <i>et al.</i> 2014).</p> <p>To ensure a sterile dressing field.</p> |
|--|---|

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 17 of 29 | |

| | |
|--|--|
| <p>Clean site with antiseptic solution:</p> <ul style="list-style-type: none"> • Chlorhexidine gluconate 0.2% / 70% isopropyl alcohol solution > 2 months. • Chlorhexidine 0.5% in Aqueous Solution i.e. Sterexidine 200 ® < 2 months <p>Apply solution with friction for 30 seconds using 'back and forth' strokes.</p> <p>Solution should be allowed to air dry for 2 minutes.</p> <p><i>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.</i></p> <p><i>NB: In a patient with a history of Chlorhexidine allergy, Povidone Iodine 10% i.e. Vodene ® or Betadine ® is the solution of choice.</i></p> <p>Swab site if clinically indicated. Clean site first and then take swab. Send for Culture and Sensitivity.</p> <p>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.</p> | <p>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).</p> <p>To ensure antisepsis is achieved (Centre for Disease Control and Prevention 2002).</p> <p>Gentle friction can damage the immature stratum corneum of the immature infant (OLCHC 2012a).</p> <p>(Sari 2009, OLCHC 2012a, Loveday et al. 2014).</p> <p>To check for pathogens and ensure timely treatment if required (Dougherty and Lister 2015).</p> <p>To ensure visibility of insertion site and minimise risk of dressing lifting (Dougherty and Lister 2015).</p> |
|--|--|


| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 18 of 29 | |



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.

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).

5 b) 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).

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 19 of 29 | |

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 (Sari 2009, Loveday *et al.* 2014, OLCHC 2015)

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


| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 20 of 29 | |

- 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 | RATIONAL, EVIDENCE AND REFERENCE |
|--|--|
| <p>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.</p> <p>Ensure 2 nurses present for the procedure.</p> <p>Preparation Check infants/childs' 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.</p> <p>Ensure infant / child is not dehydrated.</p> <p>Ensure that central venous access is no longer required and alternative intravenous peripheral access have been established for continuing IV</p> | <p>CVC removal is a complex procedure with the potential to result in life threatening complications (RCN 2010, Dougherty and Lister 2015, NMBI 2015b).</p> <p>To support the infant / child and assist the first nurse removing the CVC (Ingram <i>et al</i> 2006. NMBI 2015b).</p> <p>Prolonged clotting time will increase the risk of bleeding and haematoma formation post catheter removal (Drewett 2000).</p> <p>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 <i>et al.</i>1998).</p> <p>(Dougherty 2015).</p> |

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 21 of 29 | |


| | |
|---|--|
| <p>therapy / medications.</p> <p>Flush CVC with 0.9% Normal Saline.</p> <p>Close slider clamp on each lumen of CVC line. Turn off any 3 way taps.</p> <p>Ensure warmth, privacy and dignity for the child during the procedure.</p> <p>Explanation to child / parents as clinically indicated</p> <p>Ensure adequate analgesia has been administered</p> <p>Lie the infant / child in supine / Trendelenburg (10-30 degree head down tilt) position and remove any pillows.</p> <p>NB: <u>DO NOT</u> remove CVC with infant / child sitting / upright.</p> <p>Procedure Decontaminate hands. Procedure is performed at Aseptic Non-Touch Technique (ANTT) level 2.</p> <p>Clean dressing trolley with 70% isopropyl alcohol swab i.e alcowipe and allow to air dry.</p> | <p>To ensure all medications have been delivered (Dougherty 2015).</p> <p>To prevent inadvertent delivery of medication, fluid or air to the infant / child (Ingram <i>et al.</i> 2006).</p> <p>To maintain the child's privacy and dignity (Ball Bindler and Cowen 2013, Hockenberry and Wilson 2015)</p> <p>To relieve fear, anxiety and foster trust understanding and cooperation for the procedure (Hockenberry and Wilson 2015).</p> <p>To ensure comfort and prevent pain (Lloyd-Jones 2004).</p> <p>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 <i>et al</i> 2006, Feil 2012, Brockmeyer <i>et al.</i> 2013, Joanna Briggs Institute 2013).</p> <p>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).</p> <p>Prevent cross infection and reduce transmission of microorganisms (OLCHC 2011, Loveday <i>et al.</i> 2014, NICE 2014).</p> <p>To create clean working surface.</p> |
|---|--|

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 22 of 29 | |


| | |
|--|--|
| <p>Assemble all equipment on bottom shelf of the trolley.</p> <p>Decontaminate hands Aseptic Non-Touch Technique (ANNT) Level 2</p> <p>Lay out dressing field and prepare equipment for the procedure.</p> <p>Attach small yellow bag to side of trolley below the sterile field level.</p> <p>Apply non-sterile gloves</p> <p>Expose CVC site and remove dressing with adhesive remover.</p> <p>Place sterile field under central venous catheter (CVC).</p> <p>Decontaminate hands and apply sterile gloves Clean site with antiseptic solution</p> <p>Solution should be allowed to air dry for 2 minutes.</p> <p>Remove CVC sutures while holding CVC to prevent accidental migration out. Ensure all suture material has been removed from skin.</p> <p>Cover CVC insertion site with gauze for CVC removal.</p> <p>Ask child to take a deep breath and hold it, if cooperative for the period necessary to remove CVC.</p> | <p>To prevent cross infection (OLCHC 2011, Loveday <i>et al.</i> 2014).</p> <p>To be prepared for the procedure and prevent unnecessary breaks.</p> <p>To prevent contamination of contents (Dougherty and Lister 2015).</p> <p>Universal precautions (OLCHC, 2011).</p> <p>To gain access to the insertion site (Ingram <i>et al.</i> 2006).</p> <p>To create sterile field (Joanna Briggs Institute 2013).</p> <p>Universal precautions (OLCHC 2011a, Loveday <i>et al.</i> 2014)</p> <p>To prevent contamination of the CVC on removal and a false positive culture of CVC tip (Dougherty and Lister 2015).</p> <p>To facilitate catheter removal (Ingram <i>et al.</i> 2006).</p> <p>To seal the CVC site and minimise risk of air embolism (Feil 2012).</p> <p>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</p> |
|--|--|

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 23 of 29 | |


| | |
|--|--|
| <p>Once catheter removed tell the child to breathe again.</p> <p>In the ventilated patient or an infant / uncooperative child remove the catheter at the beginning of expiration.</p> <p>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.</p> <p>Continue applying direct manual pressure above the puncture site for a minimum 5 minutes until bleeding has stopped. Carefully check site.</p> <p>If bleeding continues continue manual pressure for a further 5 minutes and repeat site check. Following haemostasis maintain pressure for a minimum 5 minutes.</p> <p>Check central venous catheter for clots and completeness.</p> | <p>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).</p> <p>The intrathoracic pressures are greater than atmospheric on expiration, thereby minimising the risk of air entering the venous circulation (Drewett 2000).</p> <p>There is a risk of air embolism.</p> <p>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 <i>et al</i> 2006).</p> <p>Direct pressure is necessary to prevent both air entry and stop bleeding from a large vein (Chen 2014, Dougherty 2015).</p> <p>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).</p> <p>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).</p> |
|--|--|

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 24 of 29 | |

| | |
|---|---|
| <p>Should catheter fracture be suspected, position patient in Trendelenburg position and on left side. Notify medical team immediately.</p> <p>If catheter fragment is palpated, apply additional distal pressure to the catheter to prevent migration.</p> <p>Following haemostasis apply a transparent occlusive dressing i.e. Opsite™ and ensure it is maintained for a minimum 72 hours.</p> <p><i>N.B.</i></p> <ul style="list-style-type: none"> • Do not use gauze and tape • Do not apply a BULKY PRESSURE DRESSING <p>When CVC removal is due, to a suspected catheter related infection, sent a 5cm tip to microbiology laboratory for culture and antimicrobial sensitivity.</p> <p>Cut with sterile scissors and allow to fall into the sterile container.</p> <p>Remove non-sterile gloves and decontaminate hands.</p> <p>Post Procedure</p> <p>Reposition infant / child and ensure bedrest for minimum 30-60 minutes.</p> | <p>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.</p> <p>To prevent further migration (Morgan 2013).</p> <p>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 <i>et al.</i> 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 <i>et al.</i> 2013). Cessation of bleeding from a large vein requires the application of direct pressure only (Morgan 2013).</p> <p>To prevent contamination (RCN 2010, Morgan 2013, Dougherty 2015). Early detection of infection and timely treatment (Chen 2014, Dougherty and Lister 2015).</p> <p>To avoid contamination of specimen (SARI 2009, OLCHC 2011, Dougherty 2015).</p> <p>To maximise the infant / child's comfort and minimise air embolism, secondary haemorrhages and pneumothorax (Drewett 2000a, Ingram <i>et al.</i></p> |
|---|---|

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 25 of 29 | |

| | |
|--|--|
| <p>Dispose of clinical waste and sharps appropriately i.e. yellow bag / sharps bin. Clean dressing trolley.</p> <p>Make the infant / child comfortable.</p> <p>Decontaminate hands.</p> <p>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.</p> | <p>2006, Feil 2012, Morgan 2013).</p> <p>To ensure safe disposal of waste, prevent cross infection and environmental contamination (Department of Health and Children 2002, OLCHC 2008).</p> <p>To ensure comfort (Dougherty and Lister 2015).</p> <p>Standard precautions (OLCHC 2011a, Loveday <i>et al.</i> 2014).</p> <p>To maintain accountability by ensure accurate documentation of the procedure and continuity of patient care (NMBI 2015a).</p> |
| <p>Suspected Air Embolism</p> <ul style="list-style-type: none"> • Sudden deterioration • Agitation / confusion/ anxiety/ impending doom • Collapse / CVS instability / hypotension • Bradycardia / tachycardia/ cardiac arrhythmia • Collapse / cardiac Arrest • Desaturation / pallor/ cyanosis • Respiratory distress / gasp/ respiratory arrest • Lightheadedness • Petechiae • Weakness / seizure • Mill wheel murmur (classic transient sign due to right atrial and right ventricular obstruction) <p>Nursing Action</p> <ul style="list-style-type: none"> • Call senior nurse / medical team • Turn infant / child in LEFT side down, trendelenburg position (head down) • In older child ask to perform valsava | <p>(Drewett 2000a, Dumont 2001, Peter and Saxman 2003, Ingram <i>et al.</i> 2006).</p> <p>To ensure urgent and timely nursing and medical assistance and treatment.</p> <p>This position may encourage air to rise in the right atrium away from right ventricular outflow track and pulmonic valve, allow blood through and</p> |

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 26 of 29 | |

| | |
|---|---|
| <p>maneuver if indicated</p> <ul style="list-style-type: none"> • 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. | <p>prevent embolism to the lungs (Drewett 2000b, Ingram <i>et al.</i> 2006, Feil 2012). 100% oxygen will help in removing nitrogen from the air embolism (Ingram <i>et al.</i> 2006).</p> |
|---|---|

7.0 References

American College of Chest Physicians (ACCP) (2012) Antithrombotic therapy in neonates and children: antithrombotic therapy and *prevention* of thrombosis, 9th Edition. *Chest*, **141**: e737s-e801s.

Ball, J.W. Bindler, R.C. and Cowen, K. (2013) *Child Health Nursing: Partnering with Children and Families*, 3rd Edition. Pearson: London.

BBraun (2011) *Air Embolism: Risk Prevention in Infusion Therapy*. BBraun: Melsungen, Germany. Available online: [http://www.safeinfusiontherapy.com/documents/french/air_embolism\(1\).pdf](http://www.safeinfusiontherapy.com/documents/french/air_embolism(1).pdf) (Accessed February 15th 2017).

Boer, W.H. and Hene, R.J. (1999) Lethal air embolism following removal of a double lumen jugular vein catheter. *Nephrology Dialysis Transplantation*. **14**(8): 1850-1852.


Brockmeyer, J. Simon, T. Seery, J. Johnson, E. and Armstrong, P. (2009) Cerebral air embolism following removal of central venous catheter. *Military Medicine*, **174**(8): 878-881.

Carrett, L. Reverdy, M.E. Lafforgue, C. Falson, F. Fleurette, J. and Freney, J. (1997) Kinetics of chlorhexidine on intact skin following a single application. *Pathology Biology* **54**(9): 737-740.

Chen, Z. (2014) *Evidence Summary: Central Venous Access Device (CAVD), Removal*. The Joanna Briggs Institute: Adelaide.

Department of Health (2007) *Saving Lives: Reducing Infection, Delivering Clean and Safe Care. High Impact Intervention No 1: Central venous Catheter Care Bundle*. Department of Health: London. Available online: http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_078120.pdf (Accessed February 15th 2017).

Department of Health (2010) *Clean Safe Care. High Impact Interventions: Central Venous Catheter Care*

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 27 of 29 | |

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

Department of Health and Children (2002) *Segregation Packaging and Storage Guidelines for Healthcare Risk Waste.* Department of Health and Children: Dublin.

Drewett, S.R. (2000a) Central venous catheter removal: procedures and rationale. *British Journal of Nursing* **9**(22): 2304-2315.

Drewett, S.R. (2000b) Complications of central venous catheters: nursing care. *British Journal of Nursing*, **9**(8): 466-478.

Dougherty, L. (2015) How to remove a non-tunnelled central venous catheter. *Nursing Standard*, **30**(16-18): 36-38.

Dougherty, L. and Lister, S (eds) (2015) *The Royal Marsden Hospital Manual of Clinical Nursing Procedures*, 9th Edition. Wiley-Blackwell: Chichester.

Dumont, C. (2001) Procedures nurse use to remove central venous catheters and complications they observe: A pilot study. *American Journal of Critical Care* **10**(3): 151-155.


Feil, M. (2012) Reducing risk of air embolism associated with central venous devices. *Pennsylvania Patient Safety*, **9**(2): 58-64. Available online: [http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2012/Jun;9\(2\)/Pages/58.aspx](http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2012/Jun;9(2)/Pages/58.aspx) (Accessed February 15th 2017).

Hadaway, L.C. (2010) *Anatomy and Physiology Related to Infusion Therapy*. In Infusion Nurse Society, Alexandra, M. Corrigan, A. Gorski, L. HANKINS, j. AND Perucca, R. *Infusion Nursing: An Evidence-based Approach*, 3rd Edition. Saunders Elsevier: St Louis, 139-177.

HCAI / Royal College of Physicians of Ireland/ HSE (2014) *Prevention of Intravascular Catheter-related Infections in Ireland: Update of 2009 National Guidelines*. Available online: <http://www.hpsc.ie/AZ/MicrobiologyAntimicrobialResistance/InfectionControlandHAI/Guidelines/File,4115,en.pdf> (Accessed February 15th 2017).

Hockenberry, M.J. and Wilson, D. (eds) (2015) *Wong's Essentials of Pediatric Nursing*, 10th Edition. Mosby: St Louis.

Ingram P. Sinclair L. and Edwards T. (2006) The safe removal of central venous catheters. *Nursing Standard* **20**(49): 42-46.

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 28 of 29 | |

INS (2011) Infusion nursing standards of practice, 2011. *Journal of Infusion Nursing* **34**(1): supplement.

Joanna Briggs Institute (2013) *Central Venous Access Device (CAVD): Removal*. The Joanna Briggs Institute; Adelaide.

Kim, D.K. Gottesman, M.H. Forero, A. Han, D. Myers, D.W. Forienza, R. and Golzarian, J. (1998) The CVC removal distress syndrome: an unappreciated complication of central venous line removal. *American Journal of Surgery*, 64(4): 344-347.

Lloyd-Jones, M. (2004) Minimizing pain at dressing changes. *Nursing Standard* **18**(24):65-70.

Long, K.D.L. (2015) *Central Venous Catheter (CVC): Dressing and Flushing*. The Joanna Briggs Institute; Adelaide.

Loveday, H.P. Wilson, J.A. Pratt, R.J. Golsorkhi, M. Ingle, A. Bak, J. Browne, J. Prieto, J. Wilcox, M. (2014) Epic3: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospital in England. *Journal of Hospital Medicine*, **8651**: s1 – s70.

Luettel, d. (2011) Avoiding air embolism when removing CVCs. *Nursing Times*, **107**(43): 23.

Maki, D.G. Kluger, D.M. Cmich, C.J. (2006) The risk of bloodstream infection in adults with different intravascular devices: a systematic review of 200 published prospective studies. *Mayo Clin Proc.*, **81**(9): 1159-1171.


Meggiolaro, M. Roman-Pognuz, E. Baritussio, A, and Scatto, A. (2013) Air embolism after central venous catheter removal; Fibrin sheath at the portal of persistent air entry. *Case Reports in Critical Care*, 2013, Article ID 403243, 1-3. Available online: www.hindawi.com/journals/cricc/2013/403243/ (Accessed April 27th 2016).

Morgan, B. (2013) *Procedure for Removal of Central Venous Catheters (Jugular, Subclavian and Femoral.)* London Health Sciences Centre. Available online: www.lhsc.on.ca/Health_Professionals/CCTC/procedures/cvremoval.htm (Accessed January 30th 2017).

National Institute for Health and Clinical Excellence (NICE) (2012) *Healthcare Associated Infection : Prevention and Control in Primary and Community Care*. NICE: London.

NMBI (2015a) *Recording Clinical Practice*, 2nd Edition. Nursing and Midwifery Board of Ireland: Dublin.

NMBI (2015b) *Scope of Nursing and Midwifery Practice Framework*, 2nd Edition. Nursing and Midwifery Board of Ireland: Dublin.

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 29 of 29 | |

NPSA (2011) *Risk of Air Embolism When Removing Central Lines / Signal*. National Patient Safety Agency. Available online:

<http://www.nrls.npsa.nhs.uk/resources/?entryid45=132830> (Accessed February 15th 2017).

Nolan, T. and Berwick, D.M. (2006) All or none measurement raises the bar on performance. *JAMA*, **295**(10): 1168-1170.

O'Grady, N.P. Alexander, M. Burns, L.A. Dellinger, E.P. Garland, J. Heard, S.O. Lipsett, P.A. Masur, H. Mermel, L.A. Person, M.L. Raad, I.I. Randolph, A. Rupp, M.E. Saint, S. and Healthcare Infection Control Practices and Advisory Committee (HICPAC) (2011) *Guidelines for Prevention of Intravascular Catheter-related Infection*. (CDC) / HICPAC. Available online: <https://www.cdc.gov/hicpac/pdf/guidelines/bsi-guidelines-2011.pdf> (Accessed February 15th 2017).

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 (2013) *Aseptic Non-touch Technique, OLCHC Reference Guide*. 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.

Peter, D.A. and Saxman, C. (2003) Preventing air embolism when removing cvcs: An evidence-based approach to changing practice. *Medsurg Nursing* **12**(4): 223-228.

Phifer, T.J. Bridges, M. Conrad, S.A. (1991) The residual central venous catheter track- an occult source of lethal air embolism: case report. *Journal of Trauma* **31**(11): 1558-1560.

Porritt, K. (2016) *Central Venous Access Device (CAVD): Dressing Change*. The Joanna Briggs Institute: Adelaide.

| | | |
|--|-------------------|---|
| Our Lady's Children's Hospital, Crumlin | |  |
| Document Name: Guideline for Clinical staff on the care of CVC | | |
| Reference Number: CVCCGCS-12-2016-FON-V2 | Version Number: 2 | |
| Date of Issue: February 2017 | Page 30 of 29 | |

Pronovost, P. Needham, D. Berenholtz, S. Sinopoli, D. Chu, H. Cosgrove, S. Sexton, B. Hyzy, R. Welsh, R. Roth, G. Bander, J. Kepros, J. and Goeschel, C. (2006) An intervention to decrease catheter-related bloodstream infections in the ICU. *New England Journal of Medicine*, **355**(26): 2725-2732.

Resar, R. Griffin, F.A. Haraden, C. and Nolan, T.W. (2012) *Using Care Bundles to Improve Healthcare Quality*. IHI Innovative Series White paper. Institute for Healthcare Improvement (IHI); Cambridge, MA. Available online: www.IHI.org (Accessed April 22nd 2016).

Royal College of Nurses (2010) *Standards for Infusion Therapy*, 3rd Edition. RCN: London. Available online: <http://www.bbraun.it/documents/RCN-Guidelines-for-IV-therapy.pdf> (Accessed February 15th 2017).

SARI Infection Control Sub Committee (2009) *A Strategy for the Control of Antimicrobial Resistance in Ireland (SARI): Guidelines for Hand Hygiene in Irish healthcare Settings*. Health Service Executive (HSE) / Health Protection Surveillance Centre (HPSC).

Stephenson, M. (2016) *Evidence Summary: Central Venous Catheter (CVC), Dressing of Insertion Site*. The Joanna Briggs Institute: Adelaide.

Van Matre, J.G. (2006) All or none measurement of healthcare quality. *JAMA*, **296**(4): 392.

8.0 Appendices

APPENDIX I

CVC Care Bundle Compliance Tool

Example

| Care elements Observation | Care element 1 | Care element 2 | Care element 3 | Care element 4 | All elements performed |
|---|-------------------|-------------------|-------------------|-------------------|---------------------------|
| 1 | ✓ | | ✓ | ✓ | |
| 2 | ✓ | ✓ | | ✓ | |
| 3 | ✓ | ✓ | ✓ | ✓ | ✓ |
| 4 | ✓ | ✓ | ✓ | | |
| 5 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Total number of times an individual element was performed | 5 | 4 | 4 | 4 | 2 |
| % when element of care was given | 100% | 80% | 80% | 80% | 40% |

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.