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Introduction

This workbook is a learning tool for qualified nursing staff who are competent/hold a certificate in intravenous (IV) drug administration.

To determine your competence in CVC IV drug administration, you are required to undertake the following:

- Successful completion of this workbook (2 weeks prior to study day, this is a mandatory requirement)
- Attendance at Trust CVC study day
- Completion of competency assessment document

Maintenance of knowledge and skills should be an ongoing process, and as such it is recommended competency is updated every three years.

WHHT documents to be read in conjunction with this workbook.

- Aseptic/Aseptic Non touch technique (ANTT) policy
- Hand hygiene policy
- Prevention of infections associated with venous access devices
  - Central venous catheter insertion and management in adults & paediatrics
  - Injectable medicines policy
  - Blood culture collection policy
  - Methicillin resistant Staphylococcus Aureus (MRSA) policy
  - Parenteral feeding in hospital

☐ Tick box to confirm you have read the above policies

08/01/2017
AIM

The aim of the workbook is to provide information and guidance to assist in promoting standardised up to date evidence based care in the management of Central Venous catheters
Learning Outcomes

• Having completed this work book you will have a fundamental understanding of central venous catheter (CVC) / Central venous access device (CVAD), including:

  • Applied anatomy
  • Indication for use
  • Device selection and insertion
  • Care and Maintenance
  • Complications and management
Definition

A central venous catheter is one in which the tip or end of the catheter lies in a large vein of the central circulation such as the lower third of the superior vena cava (SVC), atrio caval junction (ACJ) and upper right atrium. The tip of a femoral catheter lies in the inferior vena cava (Hamilton and Bodenham 2009)

Blood flow around the catheter is maximised and physical and chemical damage to the internal walls of the vein is minimised.
Related Anatomy

Veins

The function of most veins is to return deoxygenated blood from the organs to the heart.

They are classified in a number of ways, including

- Superficial veins are closer to the surface of the body, and have no corresponding arteries.
- Deep veins are deeper in the body and have corresponding arteries.

Most veins are equipped with valves to prevent backflow of blood. The superior vena cava, does not contain valves

Although translucent the colour of a vein can be affected by the characteristics of a person’s skin, oxygen concentration in the blood, and size and depth of the vessel.

Vena cava.

The superior (SVC) and inferior vena cave (IVC) are the biggest veins in the body, and enter the right atrium of heart from above (SVC) and below (IVC)

(Flewell, R 2017)
Vein Structure

Veins consist of three main layers. Tunica adventitia or tunica externa is the outer layer of connective tissue. Tunica media the middle layer of smooth muscle. In comparison to an artery the muscle layer is much thinner therefore easier to collapse and distend under pressure. Tunica intima the inner layer lined with endothelial cells and folds to form the valves.
Indications For Use

- Prolonged intravenous (IV) therapy
  - Chemotherapy
  - Antimicrobials
  - Parenteral Nutrition (PN)
  - Blood and blood products
- Difficult IV access
- Frequent blood sampling
Types of CVAD

• Short term (non-tunnelled)

• Tunnelled (Hickman)

• PICC

• Port-a-Cath
## Types of CVAD

<table>
<thead>
<tr>
<th>Type of Catheter</th>
<th>Length of Therapy</th>
<th>Type of Treatment</th>
<th>Other considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Tunneled</td>
<td>Usually &lt; 3 weeks. These are left in according to the patients needs with regular review (VIP Score)</td>
<td>Short Term intensive IV therapy, inpatient use only, CVP monitoring, multiple infusions</td>
<td>Antimicrobial impregnated catheters for adults requiring &lt;3 weeks IV therapy and who are at increased risk of infection</td>
</tr>
<tr>
<td>PICC</td>
<td>Indefinitely. According to patient’s needs and device function.</td>
<td>Long term IV therapy, TPN.</td>
<td>Requires suitable vein near Antecubital fossa for insertion (unless ultrasound) Made of silicone or polyurethane and normally valved.</td>
</tr>
<tr>
<td>Tunneled, cuffed</td>
<td>Patient dependent but up to 2 –3 years</td>
<td>Long term, intermittent IV therapy. TPN.</td>
<td>Dual lumen for Haematology treatments if necessary</td>
</tr>
<tr>
<td>Tunnelled, uncuffed</td>
<td>Short term &lt; 2 weeks</td>
<td>Parenteral Nutrition</td>
<td>Requires suitable securement and exit site monitoring</td>
</tr>
<tr>
<td>Apherisis/ Dialysis</td>
<td>Indefinitely according to patients needs and function of line</td>
<td>Apheresis and dialysis only</td>
<td></td>
</tr>
<tr>
<td>Implanted Ports</td>
<td>Many years</td>
<td>Intermittent long term IV therapies.</td>
<td></td>
</tr>
</tbody>
</table>
Insertion

- Informed consent should be obtained
- Procedure must be performed by a trained, competent practitioner using an aseptic technique
- Performed only in a designated clean environment (ICU/ theatres)
- Use of ultrasound guidance recommended by NICE
- MRSA screen should be performed prior to insertion
- Optimal aseptic technique includes hand decontamination, sterile gloves, hat and mask
- Skin should be prepared using 2% chlorhexidine gluconate with 70% alcohol (3ml)
- The patient should be observed for signs of dyspnoea, agitation and restlessness
- Once inserted each lumen should be aspirated and flushed with normal saline
- The device should be secured with sutures or an adhesive device
- The site should be dressed with a transparent semi-permeable membrane dressing which has been impregnated with chlorhexidine
- Lines must be x-rayed post insertion to confirm the tip position before use
- Insertion line details should be recorded on a central line high impact intervention form (Care Plan)
Care & Management

• Hands should be clean and decontaminated with an alcohol based hand rub
• Site to be covered with a transparent, semi-permeable polyurathane dressing with chlorhexidine impregnated sponge
• If site is bleeding, or the patient is sweating profusely, use a sterile gauze dressing. Replace with the transparent dressing as soon as possible
• Dressings should be changed every 7 days, or when visibly soiled
• Dressings should be changed using an aseptic technique. Insertion site to be cleaned with 2% chlorhexidine gluconate in 70% alcohol (Chlorprep) and allowed to dry
• All ports should be capped off with a needle free access device. These should be changed as per manufacturers guidance
• Prior to accessing a port it should be cleaned for at least 15 seconds with 2% chlorhexidine gluconate in 70 % alcohol (sanicloth PDI wipes)
• At least 12 hourly observations for signs of infection
• No routine replacement of the line
• The need for the line should be assessed daily
• The line should be removed when no longer clinically indicated
Care & Management

Line patency

• For unvalved lines, the line should be clamped (unless administering or withdrawing fluid)

• Wash hands and wear gloves and apron before accessing the catheter

• The catheter should be secured to the skin away from the exit site

• The catheter should be checked regularly for mal-position and signs of fracture, leakage and redness/swelling at the site
Accessing the Line

• Use a sterile non-touch technique

• To use a port:
  • It should flush with ease
  • You should be able to withdraw blood
  • The patient should not experience any discomfort during flushing
  • Check for any other complication

Flushing:

• Use a (minimal) 10 ml syringe

• Flush with 0.9% sodium chloride

• Use a brisk ‘push – pause’ technique

• Clamp the line while the final ml of flush is being injected

• Do not routinely withdraw and discard blood from the catheter before flushing (unless vasoactive drugs are in the line)
Care & Management

Audit

• Central line high impact intervention form (Care Plan) should be completed every 12 hours – and when the line is accessed.
Complications

• Infection
• Line Occlusion
  Persistent withdrawal Occlusion
  Complete Occlusion
• Thrombosis
• Air Embolism
• Catheter Migration
• Catheter fracture
• Extravasation
Types of CVAD Infection

Exit site infection

- Erythema at exit site and/or tracking along skin tunnel
- Swelling
- Pain
- Discharge / exudate at exit site
- Pyrexia
- Positive external swab

Catheter lumen infection

- Pyrexia
- Generally unwell
- Rigor during or post line flush
- Sepsis / neutropenic sepsis
- Bacteraemia – POSITIVE BLOOD CULTURES.
Infection

Management

• Report to medical team (who discuss with microbiology)
• Take blood cultures if temperature is > 38 (all lumens plus peripheral)
• Swab exit site
• Remove line if clinically indicated
• If line is to be replaced use a new site
Persistent Withdrawal Occlusion (PWO)

**Causes**
- Malposition of catheter tip
- Catheter tip sucking up to vein wall with aspiration
- Blood clot, fibrin sheath obstructing end of lumen
- Incorrect technique when flushing catheter /disconnecting syringe
- Pinch off syndrome

**Signs**
- Inability to withdraw blood, but still able to Flush
Persistent Withdrawal Occlusion (PWO)

Management

• Get patient to change position/cough to alter intrathoracic pressure and aid line movement
• Ask patient to lift arm on side of catheter placement to exclude ‘pinch off’ syndrome - confirm on chest Xray
• Use of thrombolytic agents
Complete Occlusion

**Causes**

- Possible thrombus formation - Catheter can become blocked if not adequately flushed
- Solution precipitate - Catheter can become blocked if fluids are incompatible
- Catheter kinked!

**Signs**

- Inability to both draw blood and Flush
Complete Occlusion

Management

• Manipulation of clamp site to check line is not kinked or clamped
• Gently attempt to flush with saline using push/pull technique NEVER use force as this can result in catheter fracture and potential embolus
• Get patient to change position/cough to alter intrathoracic pressure and aid line movement
• Ask patient to lift arm on side of catheter placement to exclude ‘pinch off’ syndrome - confirm on chest Xray
• May require use of thrombolytic agent (as per hospital policy)
Fibrin Formation
Thrombosis

**Causes**
- Size of catheter – Catheter too large for the vein in which it is placed
- Fibrin mesh formation around the catheter can result in the formation of a blood clot
- Traumatic insertion or catheter malposition
- Pre-disposing factors (clotting disorders)
- Catheter tip malposition

**Signs**
- Swelling in hand, upper limbs or neck
- Skin discolouration, cyanosis
- Raised collateral circulation
- Pain
- Sensation changes in catheter arm / hand
- Looks like Phlebitis – usually with more swelling.
Thrombosis

Investigations & Treatment

• Inform Medical Team
• Doppler Ultra Sound
• Anticoagulation
• Line removal if venous return is compromised - otherwise leave in situ
Thrombosis

Investigations & Treatment

• Inform Medical Team (Discuss with haematology Reg)
• Doppler Ultra Sound
• Anticoagulation
• Line removal if venous return is compromised - otherwise leave in situ
Air Embolism

Causes
- Catheter port left unclamped
- Catheter lumens/extension sets not flushed prior to insertion
- Incorrect removal technique
- Catheter fracture
- Accidental damage (scissors)

Signs
- Respiratory Distress
- Reduced oxygen saturation
- Cyanosis
- Mental status changes (confusion/ loss of consciousness)
- Tachycardia
- Hypotension
Air Embolus Management

Medical emergency

• Call for immediate medical assistance
• Give Oxygen
• Monitor vital signs
• Clamp above damage
• Be prepared for CPR
Catheter Migration

Causes
• Insufficient securing of catheter
• Poor technique when removing dressing
• Accidental removal

Signs
• Increased external length of catheter
• Visible cuff (tunnelled lines)
• Broken securement sutures
• Inability to withdrawal blood
• Buzzing/Strange sensation around ear when CVC is flushed
Catheter Migration

Management

• NEVER try to reinsert a migrated catheter
• Secure line. Do not push back into vein. Do not use line
• Inform Drs/CNS Vascular Access
• Send patient for CXR to determine tip position
Accidental Removal

**Causes**

- Poor securement (including dacron cuff)
- Traction to line (trapped/pulled)
- Poor communication regarding continued use of line

**Management**

- Apply pressure dressing
- Observe for any signs of air embolus or excessive bleeding.
- Ensure full length of line removed (if this cannot be determined patient to have CXR to exclude catheter fracture)
Catheter Fracture

Can be internal or external

**Causes**

- Pulled or stretched catheter
- Excessive force when flushing/administering IV’s
- Incorrect syringe size (never less than 10ml)
- Accidental damage
External Catheter Fracture

Split or hole in external part of catheter

**Signs and Symptoms**
- Damage may be visible
- Signs of fluid leaking out
- Air bubbles in syringe if withdrawing

**Management**
- Clamp line between fracture site and insertion site
- Tape securely with sterile tape or occlusive dressing.
- Seek immediate medical help
Internal Catheter Fracture

**Signs & symptoms**
- Ragged tip on removal
- Extreme SOB or cyanosis
- Patient looks unwell, hypotension, tachycardia, obvious signs of shock

**Management**
- Give O2 (Emergency situation)
- Seek immediate medical help
- Keep patient calm and stay with patient until help arrive
- Be prepared for CPR
- **Internal fracture resulting in catheter embolism** will require surgery or snaring
Catheter Fracture
Extravasation

Inadvertent administration of a drug into the surrounding tissues, rather than into the vascular pathway as intended.

(Allwood, Stanley and Wright 2002)

**Signs**

- Burning, stinging, pain around the entry or exit site of a CVAD or along any part of the skin tunneled section.
- Induration, erythema, venous discolouration, swelling or leakage at the injection/cannula site.
- Discolouration alone may not indicate extravasation.
- Loss of blood return. (Although blood return is not always a reliable indicator)
- Absence of free flow of infusion, or increased resistance to the administration of the drug.
Extravasation

Management

• Stop drugs immediately, withdraw drug from the line.
• Seek medical advice
• Follow guidance in Trust Extravasation policy (cytotoxic or non-cytotoxic drugs)
CVC Removal

Indications

• No longer required
• Infection (following advice from microbiology)
• Line complications
• Patient choice

• Request for removal must be documented in the medical notes
• Informed consent should be obtained
• Procedure must be performed by a trained, competent practitioner using an aseptic technique (appropriate to the type of line)
References/ supportive Literature

- Epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England. *Journal of Hospital Infection* 86S1; S1–S70
- www.the-hospitalist.org/hospitalist/article124028/what-best-approach-treat-upper-extremity-DVT.
- West Hertfordshire Hospitals NHS Trust (2016) Policy for Central Venous Catheter Insertion and Management in Adults and Paediatrics.
Thank you.

• Now please scroll back if you are using the e-module and take a test prior to attending the study day.

Or

• If you are reading the workbook then log onto the e-learning website using the following link and attempt the test online.

http://www.westhertshospitals.nhs.uk/training/cvsstudyday.asp

Many Thanks and best of luck