Device Related Infection Prevention Practice - DRIPP

Improvement Collaborative

Spreading best practice, reducing infections, improving outcomes for patients with urinary catheters and intravascular devices

Procedures for the management of post insertion complications associated with vascular access devices - central vascular access devices (CVAD), peripheral intravenous cannula (PIVC) and midline catheters

NHS England

ips Infection Prevention Society

NIVAS National Infusion and Vascular Access Society

Association for Safe Aseptic Practice ANTT Aseptic Non Touch Technique

BD

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Introduction and Key Points

The single most effective method to reduce the risk, or spread of, infection is through good hand hygiene[1]

Refer to section below for full details on the prevention, identification, cause and management of CVAD associated complications.

- Aseptic Non-touch technique (ANTT) or other standardised aseptic technique must be used whenever the catheter is accessed, or the dressing changed.[2]
- Use decision tree below to determine Standard-ANTT or Surgical-ANTT for CVAD dressing change.[3]

ANTT Risk Assessment

To determine Standard-ANTT or Surgical-ANTT for any given procedure consider the risks posed by:

- The procedure environment
- Number & size of Key-Parts & Key-Sites
- Operator competency
- Procedure duration
- Level of invasiveness

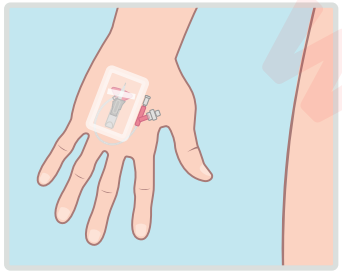
Then ask... **"Is it technically simple to perform the procedure without touching Key-Parts?"**

- Yes → Standard-ANTT
- No → Surgical-ANTT

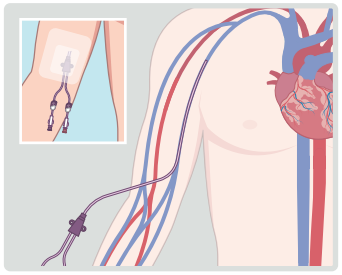
- All staff accessing or managing any VAD must have received training in Vascular Access Device (VAD) care and management and been assessed as competent to do so in line with their Trust and Health Board's requirements.[2]
- Following initial training and competency assessment, all healthcare professionals accessing VAD's are personally accountable for their actions and as such, must take part in appropriate learning and practice activities that maintain and develop their knowledge, skills, competence and performance[4].
- The VAD site (e.g., Visual Infusion Phlebitis score, catheter / skin junction, CVAD skin tunnel, TIVAD, skin integrity etc) must be visually inspected and documented at least every shift[1,2,5]
- Educate patients with a CVAD / midline in situ in the community and caregivers to observe their VAD exit site daily and report any obvious signs of complications to their vascular access team[2].
- Ensure dressings clean, dry and intact, assess skin integrity [2]

60% - 90% of hospitalised patients require an IV catheter during their hospital stay, with an overall failure rate between 35% - 50% largely due to complications[6]

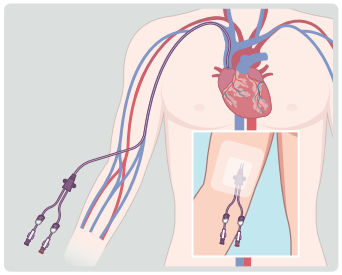
Vascular Access Device (VAD) definitions[7]



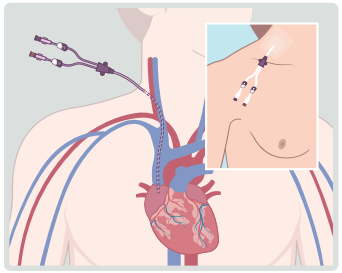
Peripheral intravenous cannula (PIVC):
A catheter which terminates in the peripheral veins. PIVCs are often inserted in the veins of upper extremities or alternative locations (with / without ultrasound guidance).



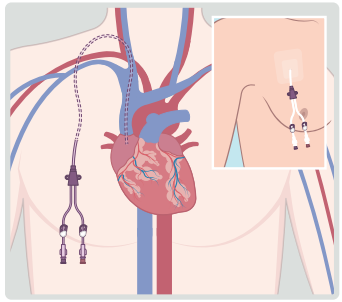
Midline catheter (ML):
A catheter intended for short to intermediate term use, inserted into a peripheral vein in the upper arm via the basilic, cephalic, or brachial vein. The catheter tip terminates in a large peripheral vein distal to the axilla, outside the thoracic cavity.



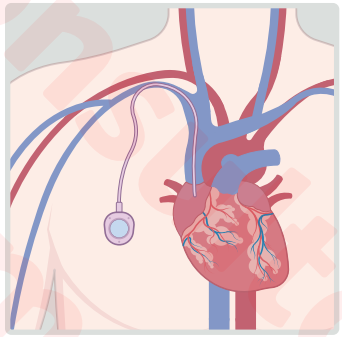
Peripherally inserted catheter (PICC):
A peripherally inserted central catheter is a device (central venous catheter) that is placed in the peripheral veins and whose tip terminates in the veins of the central circulation (e.g. cavoatrial junction).



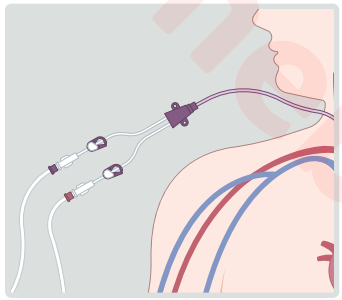
Non-tunnelled Central Venous Catheter (nt-CVC):
A nt-CVC is a device (central venous catheter) that is directly inserted in the central veins whose tip terminates in the veins of the central circulation (e.g. cavoatrial junction).



Tunnelled Central Venous Catheter (t-CVC):
A t-CVC is a device (central venous catheter) that is placed such that the skin entry site and the vein entry site are separated by a subcutaneous space (e.g., tunnel). The tip of the catheter terminates in the central veins of the circulation (e.g. cavoatrial junction). The catheter may or may not have a tissue ingrowth cuff.



Totally implanted venous access device:
A TIVAD (or Ti-CVC) is a device (central venous catheter) that has a septum / chamber / reservoir [that requires percutaneous/needle access] and is implanted in a subcutaneous tissue/pocket attached to a catheter whose tip terminates in the central veins of the circulation (e.g. cavoatrial junction), also referred to as a port or implanted port.



Haemodialysis catheter (HDC):
A HDC is a device (central venous catheter) designed to allow high flow rates to permit haemodialysis or apheresis. The catheter tip may be staggered or have a splitter tip to prevent blood mixing at the inflow and outflow portions. The catheter may be non-tunnelled or tunnelled, with or without a tissue ingrowth cuff.

Infective Phlebitis

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Infective phlebitis **Description:** Inflammation of the intimal lining of the vein associated with a bacterial infection. *Also see Exit Site Infection*	PIVC, Midline, CVAD, PICC	• Tracking • Pain or tenderness • Erythema • Warmth • Swelling • Purulent discharge • Fever	• Poor adherence to hand hygiene and patient skin asepsis • Repalpating site after skin decontamination • Poor adherence to ANTT (or other standardised technique) during insertion, administration or site maintenance • Lack of appropriate securement and/or dressing of site • Inadequate decontamination of hubs and connectors • Haematogenous seeding from another site of infection	• Hand hygiene[1,2,12] • Decontaminate skin for 30 seconds with 2% Chlorhexidine Gluconate (CHG) in 70% alcohol (single use, sterile) and allow to air dry. • Adherence to ANTT (or other standardised technique) and not repalpating after skin decontamination • Good securement to prevent pistoning of the device allowing microbial ingress. • Scrubbing the hub for 15 seconds and allowing to air dry[1,2,10]	• Regular assessment of the site, do not bandage a PIVC as this prevents observation, use a standardised VIP score. • Provide education to the patient and caregivers. • Document actions and patients' response • Educate patient to observe and report any adverse reactions for 48 hours post removal of device[2].

Mechanical Phlebitis

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Mechanical Phlebitis **Description:** A reaction associated with the placement of a VAD causing inflammation of the endothelial lining of the vein.	PIVC, Midline, PICC, non-tunnelled CVAD	• Tracking • Pain or tenderness • Erythema • Warmth • Swelling	• Trauma during insertion • Poor securement causing movement of the device. • Inappropriate site of placement (e.g., over bony prominences or in areas of flexion) • Catheter diameter too big for the size of the vein (see Thrombosis also)	• Correct stabilisation of the device • Appropriate site for placement of device using smallest gauge catheter for intended therapy. • Training and experienced healthcare professionals to insert VADs. • Measure catheter to vein ratio to less than 45%, where ultrasound is utilised[2,11]. • Use ultrasound for insertion of Midlines, PICCs, tunnelled and non-tunnelled CVCs and for difficult to access patients requiring PIVCs. • Use Seldinger or modified Seldinger method for insertion. Advanced Seldinger technique can also be used for midline insertion.	• If immediately post insertion, treat by stabilising the VAD, applying heat, elevating the limb and monitoring for 24 hours post insertion: if signs and symptoms persist, remove device. • At each shift change assess the site, do not bandage a PIVC as this prevents observation. • Use a standardised phlebitis score. • Provide education to the patient and caregivers to report any pain or redness at the site. • Application of a warm compress • Oral analgesia as required. • Consider alternative securement. • Remove device if clinically indicated. • Document actions and patients' response • Educate patient to observe and report any adverse reactions for 48 hours post removal

Chemical / Infusional Phlebitis

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Chemical / Infusional Phlebitis **Description:** A reaction of the endothelial lining of the vein to the chemical composition of the infusate. *Also see Infiltration Extravasation*	PIVC Midline	• Tracking • Pain or tenderness • Erythema • Warmth • Swelling • Palpable cord	• Infusate solutions outside normal range (pH >5 or <9, Osmolarity greater than 600 mOsm/L • Inadequate haemodilution due to VAD placed in too small a vein, with lower flow rate. • Not allowing skin decontamination fluid to dry, this may then be tracked into the vein.	• Ensure therapy is suitable for peripheral administration. • Smallest gauge catheter selected for intended therapy to facilitate adequate haemodilution. • Allow skin preparation to dry.	• Regular assessment of the site, do not bandage as prevents observation, using a standardised VIP score. • Provide education to the patient and caregivers to report any pain, stinging, burning, redness or swelling at the site. • Use of a standardised phlebitis score. • Provide education to the patient and caregivers. • Remove device as per VIP score and when clinically indicated. • Document actions and patients' response • Educate patient to observe and report any adverse reactions for 48 hours post device removal.

Catheter Lumen Infection

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Catheter Lumen Infection	All VADs	• Presents similar to a general infection with fevers, rigors and signs of sepsis. • There is often no outward sign of infection at the exit site. • The patient may have fevers and rigor within an hour after the catheter is flushed.	There are four recognised routes for contamination of catheters[2]. 1. Migration of organisms at the insertion site into the cutaneous catheter tract and along the surface of the catheter with colonisation of the catheter tip. 2. Direct contamination of the catheter or catheter hub by contact with hands or contaminated fluids or devices. 3. Catheters may become haematogenously seeded from another focus of infection. 4. Rarely, infusate contamination might lead to catheter related infection.	• Hand hygiene[1,2,12] • Use of maximal barrier precautions, including sterile gloves on insertion[1,2,13] • ANTT (or other standardised aseptic technique) during dressing changes and manipulation / administration through the VAD[3]. • Thorough examination of exit site on each access for any signs of exit site infection[2] • Scrubbing the hub 15 seconds, allow to air dry[1,2,8] • Consider use of passive disinfection caps[2] • Avoid routine exchange for CVADs[2pS159]. • Consider CVAD exchange in the setting of an actual or suspected infection when there is limited vascular access[2pS159].	• If the patient is having systemic anti-cancer therapy, then neutropenic sepsis needs to be excluded as a matter of urgency (See local neutropenic sepsis policy). • Take blood cultures from each lumen of the VAD and also peripherally: **clearly label all as to their origin**. • Exclude other sources of infection: e.g., local septic screen. • Treat with parenteral antibiotics: catheter salvage as per local policy with catheter locking antimicrobial/ antiseptic solution[2]. • Dependant on the clinical condition of the patient, the VAD may need to be removed: discuss with patient's attending consultant or microbiology if required to decide on best timing for replacement[2]. • If catheter related bacteraemia is suspected (pyrexia >38^{0C}, rigors) then manage as per hospital policy for catheter related bacteraemia[2]. • Consider using the DRIPP surveillance tool available at: https://dripp.org.uk/Resources/

Local Infection

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Local Infection e.g. at catheter skin junction, VAD exit site, along skin tunnel, or within the TIVAD pocket.	All VAD's Can also present as infective phlebitis in a midline / PIVC or non-tunnelled PICC	Symptoms include: • erythema, oedema, at exit site, at port access site, and /or tracking along skin tunnel. • Tenderness, swelling, pain. • Discharge, pus, exudate at exit site or within port pocket, • Pyrexia above 38.0˚C • Reflects symptoms associated with infective phlebitis.	• Migration of organisms at the insertion site into the cutaneous catheter tract and along the surface of the catheter with colonisation of the catheter tip. • Inadequate exit site dressing and technique. • Poor ANTT during the manipulation of the device.	• Hand hygiene[1,2,12] • Use maximal barrier precautions and Surgical-ANTT technique (or other standardised aseptic technique) on insertion and use of Standard-ANTT (or other standardised aseptic technique) during manipulation of the catheter[1,2,3,13] • Thorough examination, including palpation of exit site on each visit for any signs of exit site infection. • Decontaminate skin for 30 seconds with 2% CHG in 70% alcohol (single use, sterile) and allow to air dry, at the VAD site prior to placement and as part of routine site care [1,2,14]. • Use chlorhexidine-impregnated dressings for all short term, non-tunnelled CVADs and arterial lines for patients 18 years and older[2].	• Swab exit site for culture and sensitivity and take full set of bloods including blood cultures if systemic symptoms e.g., fever or in case of suspected sepsis. • Culture the reservoir contents of a TIVAD and the catheter tip when it is removed for suspected CABSI. It is advised that the TIVAD is not accessed if a pocket infection is suspected. • After swabs have been taken commence appropriate systemic antibiotics as per local antibiotic policy (oral or intravenous dependant on the patient's clinical situation). • Do not remove a functioning CVAD solely on suspicion of infection, when there is no other confirmatory evidence of catheter-related infection other than an elevation in core body temperature. Remove the CVAD if there is clinical deterioration or persisting or relapsing bacteraemia[2] • Observe exit site at each shift change and document findings. Increase frequency of exit site dressings as clinically indicated and document actions. • If catheter related bacteraemia is suspected (pyrexia >38OC, rigors) then manage as per hospital policy for catheter related bacteraemia

Catheter associated Upper Extremity Venous Thrombosis (UEVT)

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Catheter associated Upper Extremity Venous Thrombosis (UEVT)	All CVADs and Midlines	• Swelling or pain in the hand, upper limb, on the side of catheter insertion, • Pain or raised collateral circulation on the chest or neck. • Pain may be felt in the axilla and/ or shoulder and swelling may extend to the lower arm. • Skin discolouration or raised collateral circulation on chest. • Sensation changes in arm / hand on side of catheter • Increased circumference of arm • Leakage at the skin/ device junction	• Size of catheter: Catheter diameter too large for the size of the vein in which it is placed[9]. • Fibrin sheath formation around the catheter can result in the formation of a blood clot. • Incorrect position of the catheter tip • PICC placement in an arm where thrombophlebitis is already present	• Full venous assessment before insertion to check vein patency and measure catheter to vein ratio of less than 45%[2pS162, 15]. • Use of smallest possible catheter diameter, avoid multi lumencatheters if possible,depending on patienttherapy needs[1,2]. • Correct tip position at Cavo-atrial Junction[2] • Placement of a device appropriate to the patient's therapy needs and co-morbidities[2] • Prophylactic anticoagulation for UEVT prevention is not recommended[2].	• Refer for colour-flow Doppler ultrasound[2pS163]. • Do not remove a CVAD in the presence of UEVT when the catheter is correctly positioned, functional, and clinically required[2pS163]. • Treat UEVT with anticoagulant medication for at least 3 months or as per hospital policy[2pS163] • Effectiveness of thrombolytic therapy is often dependent on the size of the clot and area of impaired circulation. • Recognize that bacteria may adhere to thrombi in and around the CVAD and increase the risk of potential infection.

Catheter Migration / Malposition

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Catheter migration /malposition	All CVADs	• Dacron cuff visible outside skin tunnel and/or increased external catheter length. • 'Ear gurgling' when catheter is flushed. • Arrhythmias, headache / chest / back / shoulder pain with infusion • Signs of extravasation • Ipsilateral extremity oedema	• Secondary intravascular malposition of CVADs, also known as tip migration, can occur at any time during the dwell and is related to sporadic changes in intrathoracic pressure (e.g., coughing, vomiting); original tip located high in the SVC; DVT; congestive heart failure; neck or arm movement; and positive pressure ventilation. • Forceful flushing • Inadequate securement of the device • Disconnection of securement device. • Incorrect removal of dressings.	• Adequate securement of catheter • Patient and staff education on best practice guidelines	• Never re-advance a catheter that has migrated externally. • CXR or ECG tip confirmation on CVAD placement to confirm correct tip position. Repeat CXR should migration be suspected or occur after placement. • If the CVAD tip is not in the correct position (e.g., the tip is not in the lower third of the superior vena cava (SVC) at the cavo-atrial junction (CAJ) or in the upper right atrium (RA) it should be replaced.

Persistent Withdrawal Occlusion (PWO)

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Persistent withdrawal occlusion (PWO)	All CVADs and Midlines	The inability to aspirate blood, but still able to instil fluid	• Malposition of catheter tip due to incorrect placement or migration after placement • Catheter tip abutting the vein wall restricting aspiration. • Fibrin sheath around catheter tip. • Pinch off syndrome (if subclavian placement)	• Placement of catheter tip at cavo-atrial junction. • Correct securement to prevent migration. • Routine flushing of catheter as per manufacturers IFU with correct flushing technique (push/ pause and positive pressure) when disconnecting syringe after flushing the catheter, or removing a port needle. • Ensure VAD is always flushed with 0.9% sodium chloride after any attempt to aspirate blood • PWO Can lead to complete occlusion so treat early.	• Get patient to change position/cough to alter intrathoracic pressure and alter tip position. • If subclavian insertion, ask patient to lift arm on side of catheter placement to exclude 'pinch off' syndrome. • Confirm correct tip position on chest X-ray / Fluoroscopy before use of VAD • Challenge affected lumen with 250mls normal saline over 15 minutes via a pump to test for patency. (Caution in fluid/sodium restricted patients) • Do not use VAD for drug administration if patency cannot be confirmed • Use of thrombolytic agents to disperse fibrin sheath as per hospital policy or consider infusion if this fails[2] • Removal / replacement of the catheter may be required[2]. • Request support from vascular access service, if available • Consider discussion with IR for a lineogram.

Complete Catheter Occlusion

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Complete catheter Occlusion	All CVADs	The inability to both aspirate blood and infuse fluid.	• Possible thrombus formation within catheter lumen, the catheter can become blocked if not correctly or adequately flushed, especially after blood sampling. • Solution precipitate, the catheter can become blocked if fluids are incompatible. • The catheter is kinked. • Catheter migration: The catheter tip is in the incorrect position.	• Use proper flushing and locking procedures[2] (i.e. Push / pause positive pressure technique when disconnecting syringes) • Assess VAD patency by aspirating for blood return and flush each lumen prior to administering any solution[2]. • Effective flushing of VAD between and after drug administration, or blood sampling to prevent build-up of precipitate in catheter lumen.	• Manipulation of clamp and site to check line is not kinked or clamped. • Consider replacing needle free device and dressing in case of kinking of the catheter using ANTT or other standardised technique. • Gently attempt to flush with saline using push/pull technique, always with a 10ml syringe, NEVER use force to flush a catheter as this can result in catheter fracture and potential embolus. • Confirm correct tip position on chest X-ray. • Use of thrombolytic agent (as per hospital policy) using either 3-way tap technique or bolus to instil thrombolytic agent or to dissolve precipitate[16]. • Consider discussion with Interventional Radiology for a lineogram. • Removal / replacement of the catheter may be required. • Recognize that bacteria may adhere to thrombi in and around the CVAD, increasing the risk of potential infection.

Compartment Syndrome

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Compartment Syndrome	PIVC, PICC, Midline	• More prevalent in PICC's placed in the antecubital fossa. • Hand/arm: Numb, tingling & cyanosed. • Occurs within 24 hours of PICC insertion.	• Fluid accumulating in the tissue can lead to nerve compression injuries. Fluid can originate from infiltrated IV solutions, hematoma, and oedema associated with the inflammatory process of phlebitis and thrombophlebitis[2]. • Structures at risk: median and ulnar nerves; radial and ulnar arteries.	• Use ultrasound for placement to prevent inadvertent puncture of artery.	• Treatment is ESSENTIAL and URGENT for surgical relief of pressure. • Use appropriate means to control bleeding at attempted and successful sites to reduce the risk of hematoma that can lead to nerve injury due to compression[2]. • Urgent decompression is required to prevent severe ischaemia. • Early referral for assessment as per hospital policy (i.e. orthopaedics/ plastics team) and continuous compartment pressure monitoring are required.

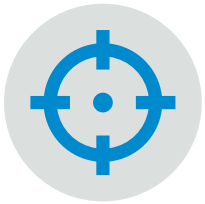
Infiltration and Extravasation

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Infiltration and Extravasation **Definition:** **Infiltration:** inadvertent administration of non-vesicant medication or solution into the surrounding subcutaneous or subdermal tissue instead of the intended vascular pathway[4]. **Extravasation:** inadvertent administration of vesicant medication or solution into the surrounding subcutaneous or subdermal tissue instead of the intended vascular pathway[4].	All VAD's	Infiltration / Extravasation should be suspected if any of these symptoms are present: • Evidence of induration, erythema, swelling, altered sensation, tightness of the skin or leakage around a PIVC site, at exit site or along skin tunnel of CVAD at exit site or around TIVAD insertion pocket[2] • The patient complains of burning, stinging, pain or any acute change around the VAD site, entry or exit site of a CVAD, along any part of the skin tunnelled section or around the site of an implanted TIVAD[2] • Patients may be at higher risk due to sedation, altered sensation, mental status or cognition require frequent monitoring of the site[2]	• Catheter fracture in the skin tunnel • Dislodgement of PIVC or TIVAD needle • Inadequate securement or bandaging of site. • Venous thrombosis or stenosis proximal to insertion site • Fibrin sheath formation along the catheter to the exit site	• Provide education to patients, caregivers and healthcare professions. • Always use a 10ml syringe or larger - do not apply force flush if resistance felt • Assess ability to aspirate blood return and no resistance to flushing prior to use. • Correct positioning of TIVAD needle • Adequate anchorage of TIVAD needle • Confirmation of catheter patency (using 0.9% sodium chloride or other compatible fluid), before use	• Provide education to the patient and caregivers to report any pain at the site. • Early recognition and prompt management is vital. • Immediately stop the infusion and initiate appropriate interventions according to your Trust extravasation policy[2]. • **General Principles:** [2pS143] - Aspirate if possible (do not aspirate contrast media) - Do not flush VAD. - Assess site, outline the area suspected. - Avoid pressure to the site. - Elevate limb (if appropriate) . - Photograph the area. - Estimate the volume of solution infiltrated / extravasated. - Remove VAD once the appropriate intervention has been initiated and keep for investigation (if appropriate) - Do not use affected extremity for subsequent VAD insertion wherever possible. • Extravasation of a vesicant drug must be treated as a medical emergency.

NIVAS Infiltration and Extravasation Strategy

Prevention

Safe IV therapy administration and vascular access practice is essential to preventing infiltration and extravasation occurring in the first instance. All healthcare professionals involved in the delivery of intravenous therapies and the use of vascular access devices should be aware of the preventative measures associated with infiltration and extravasation, vessel health and preservation and the principles of vascular access.



Recognition

Recognising the early stages of extravasation is vital, early diagnosis can reduce the amount of damage done to the patient's tissue.

Treatment

Early intervention and treatment to reduce or stop tissue damage. Hot or cold compress, injectable antidotes, tissue wash out and referral to plastics should be considered as part of the treatment pathway for extravasation.

Follow-up

Ensure the patient is followed up the appropriate department, either IVAS, Plastics or tissue viability and supported. Clinical photography should be used to continuously document the extravasation injury. The patient may need psychological support depending on the extent of the injury. Social support may also be necessary on discharge.

Reporting

Standardised local incident reporting of the infiltration and extravasation should be undertaken.

Catheter fracture / Air embolus / Catheter embolus

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Catheter fracture / Air embolus / Catheter embolus	All VAD's	• Damage to the catheter may be visible, such as fluid leaking out or air bubbles in syringe if withdrawing fluid[2]. • If embolised, patient may looks unwell with obvious signs of shock[2] • Extreme shortness of breath or cyanosis, hypotension, tachycardia[2] • Be aware of catheter pinch-off and potential for fracture if catheter has been inserted via subclavian vein[2].	• Re-sheathing of PIVC stylet during insertion[2] • Damage to CVAD caused by forceful flushing. • Incorrect CVAD removal technique • Use of scissors or blades. • Non-priming of extension sets. • Using a non-power rated catheter for CT/MRI injection[2].	• Never re-sheath a stylete[2] • Avoid frequent bending or friction against the catheter (e.g., rotate location pf integrated clamp/s)[2]. • Don't pull or stretch CVAD during removal, if resistance felt on removing catheter STOP, rest, relax, heat, 0.9% sodium chloride flush and then restart slowly. • Tunnelled CVCs to be removed by experienced practitioner (cut down) • No syringes smaller than • 10ml for assessing patency. • Do not forcibly push against resistance[2]. • Limit contrast power injections to VAD and add-on devices with labelled indication for power injection[2] • No scissors!	• External fracture of a CVAD: Immediately kink / clamp line and tape securely using sterile tape or dressing[2] • Stop infusions and label 'Do Not Use' while awaiting referral for intervention[2]. • Recognise signs and symptoms of "pinch off" syndrome in patients with subclavian veins.[2pS157] • If Embolism suspected, treat as medical emergency, place patient on left side in Trendelenburg position (unless contraindicated (i.e., cranial pressure, eye surgery, cardiac and respiratory disease) and apply pressure to limb or consider applying a tourniquet above the site[2]. • Internal fracture will require referral to surgery or interventional radiology[2]. • Keep patient calm and stay with patient until help arrives. • Document as per Trust policy for patient safety incident.

Medical Adhesive Related Skin Injury: (MARSI)

Complication	Device	Signs and Symptoms	Cause	Prevention	Action
Medical Adhesive Related Skin Injury: (MARSI)	All Devices	• Blistering • Skin Excoriation • Itching • Redness • Blanching • Stripping • Skin tears – partial or full thickness	• Skin irritation due to inadequate time interval between skin cleansing with chlorhexidine & alcohol solution and application of the Transparent Semipermeable Membrane dressing[17]. • If the alcohol solution is not allowed to completely dry it increases the risk of causing a chemical skin burn underneath the TSM dressing[2] • Sensitivity to skin preparation, TSM dressing, adhesive glue on anchorage device etc[2,17]	• Identify patients at risk and take precautions with site care 9eg malnutrition, dehydration, elderly/neonates, dermatologic conditions, low/ high humidity, radiation therapy, medications i.e., chemotherapy, anti-inflammatories, including long term corticosteroid use, anticoagulants)[17] • Correct dressing technique: allowing a minimum 30 seconds for the Chlorhexidine Gluconate 2% in 70% alcohol to air dry[1]. • Risk assessment of each individual case to determine allergy status[2]	• Educate staff/caregivers on appropriate application of skin decontamination, atraumatic application/removal of dressings and to assess VAD sites for signs and symptoms of skin injury [2pS168,17] • Rule out infiltration/extravasation, thrombophlebitis and other skin conditions (e.g. eczema, impetigo)[17] • Apply protective barrier film at all dressing change, particularly for high risk patients[2]. • Alternative non-alcoholic cleansing agent (saline to clean followed by application of Povidone iodine spray)[2] • If skin flap present, approximate viable skin flap edges prior to dressing application[17] • Consider use of sterile, medical adhesive removal product to minimise discomfort and skin damage associated with removal of dressing [2,10,17] • Alternative dressings as per hospital policy. • Discuss with tissue viability. • If an occlusive dressing is used the dressing must be changed every 24 hours[1, 5] • Consider anti-inflammatory, anti-pruritic, antihistamine and/or analgesia; cool compress (applied on top of dressing) [1,17]

References:

1. Loveday, H.P., Wilson, J.A., Pratt, R.J., (2014). EPIC3: National Evidence- Based Guidelines for Preventing Healthcare-associated Infections in NHS Hospitals. Journal of Hospital Infection. S86, ppS1 – S70
2. Gorski, L.A., Hadaway, L., Hagle, et al. (2021) Infusion Therapy standards of Practice. Journal of Infusion Nursing, 44 M., (supl1)
3. ANTT Clinical Practice Framework v4.1 www.antt.org
4. Nursing & Midwifery Council. (2018). The code: Professional standards of practice and behaviour for nurses, midwives and nursing associates. Retrieved from http://www.nmc.org.uk/globalassets/sitedocuments/nmc-publications/revised-new-nmc-code.pdf
5. Royal College of Nursing (RCN) (2016) Standards of Infusion Therapy 4TH Edition, RCN, London
6. Helm, R.E. et al (2015) Accepted but Unacceptable: Peripheral IV Catheter Failure. Journal of Infusion nursing. 38(3) p189-203
7. Schults et al (2020) International recommendations for a vascular access minimum data set: A Delphi consensus-building study. BMJ Quality & Safety. 2020;0:1–9. doi:10.1136/bmjqs-2020-011274
8. Surveillance of Blood Stream Infections in Patients Attending ICUs in England Protocol version 3.4 Infection in Critical Care Quality Improvement Programme, Public Health England, August 2018 https://www.ficm.ac.uk/sites/ficm/files/documents/2021-10/protocol_v3.4_07082018.pdf
9. Hallam C (2019) in: Vessel Health and Preservation: The Right Approach for Vascular Access. Chapter 18, p235-242. Springer open access publication
10. Sharp R, et al. BMJ Open 2021;11:e045895. doi:10.1136/bmjopen-2020-045895
11. SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update SHEA/IDSA/APIC Practice Recommendation: Strategies to prevent healthcare-associated infections through hand hygiene: 2022 Update (cambridge.org)
12. Moreau, N. (Ed) (2019) Vessel Health and Preservation: The Right Approach for Vascular Access. Vessel Health and Preservation: The Right Approach for Vascular Access | SpringerLink
13. Barton, A. et al (2022) How to improve aseptic technique to reduce bloodstream infection during vascular access procedures. British Journal of Nursing 31(17)
14. Balsorano, P. et al (2019) Peripherally inserted central catheter-related thrombosis rate in modern vascular access era- when insertion technique matters: A systematic review and meta-analysis
15. https://bnf.nice.org.uk/drugs/urokinase/
16. Broadhurst, D (2017) The World Congress of Vascular Access (WoCoVA) Skin Impairment Management Advisory Panel. Management of central venous access device-associated skin impairment: an evidence based algorithm. Journal Wound Ostomy Continence Nursing 44 (3)211-220. Doi.10.1097/WON.0000000000000322
17. Barton A. Medical adhesive-related skin injuries associated with vascular access: minimising risk with Appeel Sterile. Br J Nurs. 2020;29(8):S20– S27. https://doi.org/10.12968/bjon.2020.29.8.S20

Further Reading:

- Shaw SJ. Using the vessel health and preservation framework to enhance vein assessment and vascular access device selection. NursStand. 2017;31(46):50-63. doi:10.7748/ns.2017.e10741
- Fallouh N, McGuirk HM, Flanders SA, Chopra V. Peripherally inserted central catheter-associated deep vein thrombosis: a narrative review. Am J Med. 2015;128(7):722-738. doi:10.1016/j.amjmed.2015.01.027
- Crawford JD, Liem TK, Moneta GL. Management of catheter-associated upper extremity deep venous thrombosis. J Vasc Surg Venous Lymphat Disord. 2016;4(3):375-379. doi:10.1016/j.jvsv.2015.06.003
- Kearon C, Akl EA, Ornelas J, et al. Antithrombotic therapy for VTE disease: CHEST guideline and expert panel report. Chest. 2016;149(2):315-352.doi:10.1016/j.chest.2015.11.026
- Ullman AJ, Condon P, Edwards R, et al. Prevention of occlusion of central lines for children with cancer: an implementation study [published online ahead of print Aug 17, 2020]. J Paediatr Child Health.2020;10.1111/jpc.15067. doi:10.1111/jpc.15067
- Giordano P, Saracco P, Grassi M, et al. Recommendations for the use of long-term central venous catheter (CVC) in children with hemato-oncological disorders: management of CVC-related occlusion and CVC-related thrombosis. Ann Hematal. 2015;94(11):1765-1776. doi:10.1007/s00277-015-2481-1
- Westergaard B, Classen V, Walther-Larsen S. Peripherally inserted central catheters in infants and children – indications, techniques, complications and clinical recommendations. Acta Anaesthesiol Scand.2013;57(3):278-287. doi:10.1111/aas.12024
- Rowan CM, Miller KE, Beardsley AL, et al. Alteplase use for malfunctioning central venous catheters correlates with catheter-associated bloodstream infections. Pediatr Crit Care Med. 2013;14(3):306-309. doi:10.1097/PCC.0b013e318271f48a
- Thakarar K, Collins M, Kwong L, Sulis C, Korn C, Bhadelia N. The role of tissue plasminogen activator use and systemic hypercoagulability in central line-associated blood stream infections. Am J Infect Control. 2014;42(4):417-420. doi:10.1016/j.ajic.2013.11.016
- (Loveday et al. 2014, Dougherty and Lister 2015)
- Marschall J, Mermel LA, Fakih M, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals: 2014 update. Infect Control Hosp Epidemiol. 2014;35(7):753-771. doi:10.1086/676533
- Mermel LA, Allon M, Bouza E, et al. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 update by the Infectious Diseases Society of America. Clin Infect Dis. 2009;49:1-45. doi:10.1086/599376
- Timsit JF, Rupp M, Bouza E, et al. A state of the art review on optimal practices to prevent, recognize, and manage complications associated with intravascular devices in the critically ill. Intensive Care Med.2018;44(6):742-759. doi:10.1007/s00134-018-5212
- O'Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections. Clin Infect Dis. 2011;52(9):e162-e193. doi:10.1093/cid/cir257
- Rickard CM, Webster J, Wallis MC, et al. Routine versus clinically indicated replacement of peripheral intravenous catheters: a randomised controlled equivalence trial. Lancet. 2012;380(9847):1066-1074. doi:10.1016/S0140-6736(12)61082-4
- Takashima M, Schults J, Mihala G, Corley A, Ullman A. Complication and failures of central vascular access device in adult critical care settings. Crit Care Med. 2018;46(12):1998-2009. doi:10.1097/CCM.0000000000003370

- Fernandez-Pineda I, Ortega-Laureano L, Wu H, et al. Guidewire catheter exchange in pediatric oncology: indications, postoperative complications, and outcomes. Pediatr Blood Cancer. 2016;63(6):1081-1085. doi:10.1002/pbc.25947
- Kennard A, Walters G, Jiang S, Talaulikar G. Interventions for treating central venous haemodialysis catheter malfunction. Cochrane Database Syst Rev. 2017;10(10):CD011953. doi:10.1002/14651858.CD011953.pub2
- Park HS, Choi J, Kim HW, et al. Exchange over the guidewire from non-tunneled to tunneled hemodialysis catheters can be performed without patency loss. J Vasc Access. 2018;19(3):252-257. doi:10.1177/1129729817747541
- McCoy M, Bedwell S, Noori S. Exchange of peripherally inserted central catheters is associated with an increased risk for bloodstream infection. Am J Perinatol. 2011;28(6):419-424. doi:10.1055/s-0030-1268709
- Wang L, Wei F, Chen H, Sun G, Yu H, Jiang A. A modified de novo insertion technique for catheter replacement in elderly hemodialysis patients: a single clinic retrospective analysis. J Vasc Access. 2016;17(6):506-511. doi:10.5301/jva.5000600
- McNiven C, Switzer N, Wood M, et al. Central venous catheter repair is not associated with an increased risk of central line infection or colonization in intestinal failure pediatric patients. J Pediatr Surg. 2016;51(3):395-397. doi:10.1016/j.jpedsurg.2015.08.003
- Pabon-Ramos W, Soyinka O, Smith TP, Ronald J, Suhocki PV, Kim CY. Management of port occlusions in adults: different-site replacement versus same-site salvage. J Vasc Interv Radiol. 2019;30(7):1069-1074. doi:10.1016/j.jpedsurg.2015.08.003
- Rus RR, Battelino N, Ponikvar R, Premru V, Novljan G. Does guidewire exchange influence infection rate related to catheters used for vascular access in children on chronic hemodialysis? Ther Apher Dial. 2017;21(1):57-61. doi:10.1111/1744-9987.12481
- Saleh HA, Abouellail H. Prospective, randomized study of tunneled cuffed hemodialysis catheter removal and delayed insertion, versus guidewire exchange to treat catheter related blood stream infection. interim results of first 100 cases. Life Sci J. 2017;14(3):45-49. doi:10.7537/marslsj140317.07
- Chopra V, Kaatz S, Grant P, et al. Risk of venous thromboembolism following peripherally inserted central catheter exchange: an analysis of 23,000 hospitalized patients. Am J Med. 2018;131(6):651-660. doi:10.1016/j.amjmed.2018.01.017
- Suleman A, Agnot-Johnston T, McDiarmid S. Clinical outcomes related to over-the-wire catheter exchange for peripherally inserted central catheter re-insert
- Marschall J, Mermel LA, Fakih M, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals: 2014 update. Infect Control Hosp Epidemiol. 2014;35(7):753-771. doi:10.1086/676533
- Mermel LA, Allon M, Bouza E, et al. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 update by the Infectious Diseases Society of America. Clin Infect Dis. 2009;49:1-45. doi:10.1086/599376
- Chopra V, Flanders SA, Saint S, et al. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): results from a multispecialty panel using the RAND/UCLA appropriateness method. Ann Intern Med. 2015;163(6 Suppl):S1-S40. doi:10.7326/M15-0744
- Vassallo M, Dunais B, Roger PM. Antimicrobial lock therapy in centralline associated bloodstream infections: a systematic review. Infection. 2015;43(4):389-398. doi:10.1007/s15010-015-0738-1
- Huang EY, Chen C, Abdullah F, et al. Strategies for the prevention of central venous catheter infections: an American Pediatric Surgical Association Outcomes and Clinical Trials Committee systematic review. J Pediatr Surg. 2011;46(10):2000-2011. doi:10.1016/j.jpedsurg.2011.06.017