A4.7 Management of a totally occluded central catheter and persistent withdrawal occlusion (PWO)

Types of Catheter – Related Thrombotic

A catheter-related thrombus may be intraluminal (inside the catheter) or extraluminal (outside the catheter).

**Intraluminal thrombi** – may occur within the catheter lumen itself. Fibrin or blood products can build up inside the catheter lumen, creating a partial occlusion or fibrin sheath, evident by sluggish flow or blood return through the catheter, or a total occlusion, evident by the inability to infuse or withdraw from the catheter.

While intraluminal clots can occur with any Vascular Access Device, some factors contribute to an increased incidence including:

- Increased venous pressure from coughing
- Pump malfunction
- Inadvertent line disconnection
- The use of low ‘keep vein open’ infusion rates with ambulatory pumps

**Extraluminal thrombi** - may occur in the form of a fibrin tail or fibrin sheath as well as mural thrombi, which may progress to venous thrombosis, completely occluding the blood vessel.

- **Fibrin Sheath and Fibrin Tail** - the aggregation of fibrin occurs in the presence of a Venous Access Device due to damage of the endothelium lining of the vein. The fibrin starts to form a layer around the outside of the catheter within minutes of insertion, often starting at the line entry site or at the point where infusate first comes into contact with the vein. In some cases the fibrin sheath can grow over the catheter tip or may accumulate at the distal tip of the catheter, known as a ‘fibrin tail’. This creates a ‘ball valve effect’. Thus when the catheter is flushed, the fibrin is pushed away, but when withdrawal is attempted the fibrin tail is pulled over the tip of the catheter and will not allow blood to be aspirated back. This is commonly termed as ‘**Persistent Withdrawal Occlusion**’

It is important to note that a Fibrin Tail/Sheath can grow outside the whole length of the catheter covering the tip completely. The fluid, which is being infused through the catheter, is therefore unable to escape as normal into the main blood supply at the SVC and consequently finds an exit at the site of catheter entry leading to the risk of extravasation or infiltration.

- **Mural Thrombi** – This is the build up of fibrin along the wall of the blood vessel, which may also adhere to the catheter itself. This is known as a ‘**Mural Thrombus**’, which in turn can progress to a venous thrombus.
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- Catheter Related Thrombus – The build up of fibrin along the catheter can become large enough to attach to the Mural Thrombus and lead to total occlusion of the vein. This is serious and potentially life threatening. Possible complications include permanent obstruction, chronically reduced venous blood flow and pulmonary embolism.

Occluded Lines

A totally occluded catheter is when there is an inability to infuse solutions into or withdraw from the vascular access device.

Causes

The most common causes are:

a) Fibrin sheath formation – a layer of fibrin or clot, which encases a catheter at its tip. This is most often caused through line insertion, as the line itself injures the endothelium of the vein, stimulating the coagulation process, thus leading to fibrin and clot formation.

b) Blood occlusion – caused by blood returning back into the line. This may be caused by improper flushing technique, particularly after blood sampling.

c) Drug therapy – e.g. chemotherapy agents, antibiotics and lipid residues such as TPN.

d) Catheter tip or valve pressed against the vein wall or valve causing damage.

e) Too large a catheter – in too small a vein

f) Traumatic Cannulation

Health Status – This may also increase the likelihood of a Central Venous Thrombus. Factors include:

- Malignancy
- Dehydration
- Venous compression due to tumour or metastases
- Sepsis
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- Previous history of Venous Access Device placement
- Previous history of thrombus

Preventative strategies

- **Adhering to recommended flushing protocols** – Generally catheter occlusion can often be prevented if the correct flushing procedure is adopted. This means using a turbulent push/pause technique and completing the flush with positive pressure as the syringe is removed from the smart site bung. (Please refer to PICC line and Skin tunnelled Groshong line policies.)

- **Prophylactic therapy with an anticoagulant** – Some patients may be more at risk of developing a catheter-related thrombus. These patients may require prophylactic treatment with a very low dose of warfarin.

Diagnosis

It is important to follow the B.H.O.C.’s guidelines on the management of patients with possible Venous Access Device Thrombotic Occlusions. (See Nursing Algorithm).

Clinical signs and symptoms can often be absent in cases of catheter-related thrombus formation. In fact, by the time clinical signs and symptoms are evident the thrombus is usually extensive.

However, the following warning signs may be good indicators of catheter thrombosis:

- Frequent infusion pump alarms
- Change in the ability to infuse or withdraw from the catheter
- Visible clots in the external portion of the catheter
- Pain and/or swelling and/or limb discolouration around the chest/neck/shoulder area
- Headache
- Dyspnoea
- Pyrexia/febrility

It is helpful to assess the cause of the occlusion by taking a history of events leading up to the event. Accurate documentation of line care by nursing staff is essential in order to obtain a clear record of care and history of events.

For instance, identify what the catheter was last accessed for e.g. taking blood, the administration of a drug and if so what drug? Was the catheter immediately flushed after use?

ACTION TO BE TAKEN WHEN UNBLOCKING A TOTALLY OCCLUDED CATHETER USING UROKINASE AND A THREE WAY TAP
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Please note that UROKINASE will only work on blood related occlusions. It is of no use if the line occlusion is due to drug precipitate. The choice of the agent for clearing an occlusion due to drug precipitate will depend on the pH of the offending drug. Please contact Pharmacy for advice.

Urokinase is currently an unlicensed preparation and as such the prescriber must be made aware that he/she is responsible for its use. Urokinase has been approved by the consultants at B.H.O.C. for use with occluded catheters.

Before the administration of any I.V. drug, the nurse should be willing to undertake this procedure, have attended the current U.B.H.T. I.V. administration day and been assessed for competence and is aware of his/her professional responsibility under the UKCC.

Equipment needed:

Dressing pack
Sterile dressing towel
Latex gloves (powder free)
2 x 20ml syringes
3 way tap
Green needle
2ml Sodium Chloride 0.9%
2ml Water for Injection
urokinase 10,000 units
Alcohol wipes
Smartsite bung
Sharps bin

Procedure

1) Explain the procedure to the patient.

2) Wash hands and prepare equipment. Ensure that a doctor prescribes the urokinase.

3) Open the dressing pack and sterile towel. Tip needle, syringe, alcohol wipe and 3-way tap onto sterile field from pack. Place vial of urokinase, Sodium Chloride 0.9% and Water for Injection outside the sterile field.

4) Wash hands again, put on gloves and draw up 2mls of Water for Injection into one of the syringes.

5) Reconstitute the 10,000 units of urokinase with the 2mls Water for Injection and then dilute further with 2mls Sodium Chloride 0.9% to make a total volume of 4mls. Draw up 2mls of the urokinase solution (5,000 units) into syringe. Prime 3-way tap with Sodium Chloride 0.9%.
6) With an alcohol swab, remove the Smartsite bung from the end of the line and place sterile towel under hub of blocked lumen. Attach 3-way tap to blocked lumen (see diagram).

7) Attach the syringe containing 2ml of the reconstituted urokinase to one access point of the 3-way tap and the empty syringe to the other point.

8) Turn the off tap to the urokinase-filled syringe and gently pull back on the empty syringe to create a vacuum of 8-9 ml. Keeping the pull pressure on, turn the off switch to the empty syringe and a small amount of urokinase will then be drawn into the line. Remove the empty syringe and expire air.

9) Repeat this procedure approx every 5 minutes or until all the urokinase is inserted into the line. This can take up to 20 minutes to complete. Once all the urokinase is inserted, label the line clearly with date and time of insertion and leave in the line for as long as possible, preferably overnight.

10) When attempting to use the line again, first try to withdraw blood back to check for accurate positioning of the line and to remove any surplus urokinase.

11) Dispose of equipment as per hospital policy, wash hands and document in the patient’s notes.
PERSISTENT WITHDRAWAL OCCLUSION (PWO)

**Definition:**

Persistent Withdrawal Occlusion is a common problem associated with Venous Access Devices such as Central Venous Catheters e.g. Skin tunneled Groshongs and PICC’s. It can be defined as the inability to withdraw blood back despite the fact that the catheter may be flushing/infusing well.

**Causes:**

The most common causes are **Fibrin Sheaths/Tails**, which are attached to the catheter. During flushing this **Fibrin Tail/Sheath** moves away from the catheter tip allowing the infusion/bolus administration to be given. However when aspiration of blood is attempted, the **Fibrin Tail/Sheath** is pulled against the tip of the catheter, covering it and preventing this aspiration.

When Persistent Withdrawal Occlusion occurs, it is essential that the Nursing Algorithm is followed closely as there may be other possible causes for a sluggish/blocked line, which would require a different management approach.

Persistent Withdrawal Occlusion can be rectified by the use of **urokinase** administered as a slow bolus and locked into the line for a minimum of 1 hour. (See Algorithm)

As for Occluded lines, before the administration of any I.V. drug, the nurse should be willing to undertake the procedure, have attended the current U.B.H.T. I.V. administration day and been assessed for competence and is aware of his/her professional responsibility under the UKCC.
ACTION TO BE TAKEN WHEN PERSISTENT WITHDRAWAL IS CONFIRMED

Equipment needed:

- Dressing pack
- Latex gloves (powder free)
- 10ml syringe
- Green needle
- Urokinase 10,000 unit vial
- 2mls Water for Injection
- 2mls Sodium Chloride 0.9%
- Alcohol wipe
- Sharps bin

Procedure

Follow points 1-4 as procedure for total occlusion

5) Reconstitute the 10,000 units of urokinase with 2mls Water for Injection and then dilute further with 2mls Sodium Chloride 0.9% to make a total volume of 4mls. Draw up 2mls of urokinase solution (5,000 units) into the syringe.

6) Clean the Smartsite bung with the alcohol wipe and allow to dry. Attach the syringe of urokinase solution to the Smartsite bung and slowly insert into the line finishing under positive pressure.

7) Apply new Smartsite bung to the end of the line, label the line clearly with date and time of insertion and leave the urokinase solution in the line for a minimum of 1 hour. After 1 hour has passed, try to withdraw the urokinase lock and attempt to flush the line as per policy using a push/pause technique, finishing with positive pressure. A push pull technique may be necessary.

8) This procedure can be repeated if unsuccessful after 1 hour.

9) Dispose of equipment as per hospital policy, wash hands and document in the patient's notes.