



Nursing Professional Development

Central Venous Access Device (CVAD) Administration of Alteplase (Cathflo[®])

Resource Manual

*Quality, Patient Safety & Interprofessional Practice
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Certification Criteria

Only Registered Nurses (RN's) certified in Central Venous Access Device (CVAD) Access, Care and Maintenance will be able to be certified to administer alteplase (Cathflo) into an occluded or partially occluded CVAD. A Physician's Order is required for the administration of alteplase (Cathflo).

1. Attendance at a theory session focused on Central Venous Access Device (CVAD) troubleshooting of CVAD occlusions and administration of alteplase (Cathflo).
2. Achieve a minimum of 80% on the Administration of alteplase (Cathflo) certification test (Appendix B).
3. Supervision by a certified nurse who has achieved and maintained competence in this skill.
4. Completion of the Certification Skills Checklist during supervised attempt. (Appendix A).

Continuing Competence

It is strongly recommended that certified nurse's review all skills related to the care and maintenance of central lines on an ongoing basis to ensure continued competence. If at any time the nurse feels additional review/retraining is required, it is the responsibility of that nurse to seek additional education/resources from the manager, or clinical educator/delegate to ensure continued competence related to CVAD care and maintenance. Nurses are professionally responsible for ensuring that they have the requisite knowledge, skill and judgment necessary to provide safe and effective infusion therapy (CNO, 2002).

Introduction

What is a Central Venous Access Device (CVAD)?

A central venous catheter that is inserted **centrally** through the subclavian, internal jugular, or femoral vein, or **peripherally** through the basilic or cephalic vein (peripherally inserted central catheter: PICC). Central Lines may be tunneled or non-tunneled, which refers to how the line is inserted. A tunneled catheter is one in which a tunnel is made through the subcutaneous tissue, then the catheter is inserted through the tunnel and into the vein, such as a subclavian central line. Tunneled catheters are normally placed when longer-term use is required. Non-tunneled catheters are generally used for shorter term and/or emergency treatment. They are inserted directly into the vein and threaded into the superior vena cava from the point of insertion, including PICC lines, femoral, external and internal jugular lines. For **all** central catheters, the distal end of the catheter is positioned in the lower one third of the superior vena cava.

Types of Catheter Occlusion

A CVAD obstruction is characterized by the inability to infuse fluids or withdraw blood or fluid, or by sluggish flow through the catheter. If you encounter any of these problems during use of the device it is important to complete a thorough assessment of the patient and the catheter in order to evaluate and determine the cause of the problem or the type of occlusion. Occlusions may occur soon after insertion or during prolonged use of the catheter and may involve multiple factors. Further, the occlusion may be either mechanical or thrombotic.

Mechanical or Non-thrombotic Occlusion

In many cases a mechanical occlusion is easy to identify and correct and should be ruled out first.

A mechanical obstruction may result from:

- Kinked IV or catheter tubing
- Clamped catheter or IV tubing
- Catheter tip positioned against the wall of the vein
- Migrated catheter
- Drug or mineral precipitate

Thrombotic Occlusions

A thrombus is formed after vascular injury by activation of both the extrinsic pathway (disruption of the epithelium) and the intrinsic pathway (platelet activation), which triggers the coagulation cascade. This is a complex process by which prothrombin is converted to thrombin which in turn changes fibrinogen to fibrin. The fibrin forms a structure that is netlike, which traps all kinds of blood cells including platelets, red blood cells, and plasma to form a clot. Thrombotic occlusions can best be identified by where they occur in relation to the catheter. There are four types of thrombotic occlusions.

1. Intraluminal Thrombus

An intraluminal thrombus occurs within the lumen of the catheter and may cause either partial or complete obstruction. An intraluminal thrombus can occur as a result of inadequate or insufficient flushing techniques, reflux of blood into the catheter from changes in intrathoracic pressure resulting from forceful sneezing, coughing, vomiting, heavy lifting, or frequent blood withdrawals from the catheter.

2. Fibrin Tail

A fibrin tail, otherwise known as a fibrin flap, occurs when fibrin traps blood cells and platelets and adheres to the end of the catheter. These tails may

become quite long as more and more cells are deposited. This type of thrombus often causes what is referred to as a “withdrawal occlusion” because the fibrin tail acts as a one-way valve that allows the catheter to flush, but when aspiration is attempted the tail is pulled over the tip of the catheter making aspiration of blood impossible.

3. Fibrin Sheath

A fibrin sheath, otherwise known as a fibrin sleeve, occurs when fibrin forms around the outside of the catheter and has the potential to coat its entire external surface. A fibrin sleeve may resemble a sock, which covers the end of the catheter and may extend all the way to the insertion site. Any fluids infused have the potential to travel by retrograde flow along the sheath and cause tissue irritation depending on the nature of the solution. All catheters are at risk to develop a fibrin sheath, which may begin to form within seconds after the catheter is inserted.

4. Mural Thrombus

A mural thrombus is a result of the tip of the catheter causing vein wall irritation and injury. Fibrin from the vessel wall injury attaches to the fibrin on the outside of the catheter causing the catheter to adhere to the vessel wall and may lead to a veno-occlusive thrombus which totally occludes blood flow through the vein, or a deep vein thrombosis. Traumatic catheter advancement and catheter tip impingement against the wall of the vein may be damaging enough to trigger the initiation of a thrombus.

Prevention of CVAD Occlusions

Mechanical obstructions that are caused by buildup of drug precipitates can be prevented by ensuring incompatible drugs are not infused without flushing between doses. It is important to use a pulsing flushing technique which creates turbulent flow to wash away residue inside the catheter lumen. Proper flushing and positive pressure locking technique aid in preventing intraluminal thrombus by preventing reflux of blood into the catheter. Administration of alteplase (Cathflo) into the occluded lumen may be required, once the type of obstruction is identified.

Assessing CVAD Occlusions

A number of risk factors have been associated with increased occurrence of catheter occlusion:

1. Patients with venous stasis
2. Sluggish flow through vein
3. Patients with enhanced coagulopathy
4. Vessel wall trauma
5. Left sided placement
6. Larger diameter catheter
7. Length of duration of in-dwelling catheter
8. Catheter material (increased risk with “stiffer” materials)

Steps to take during assessment of CVAD occlusion:

1. Review the patient's medical record

- Check the insertion date
- Which vein was used for the insertion
- Was the tip verified by X-ray at the time of insertion

2. Assess the infusion therapy

- Evaluate the fluids that have been infused- compatible? or could there be drug precipitate occluding the catheter

3. Assess the patient

- Observe the path of the catheter for signs of thrombosis or extravasation:
Engorged veins on the chest
Neck or jaw pain
Swelling

4. Assess the catheter

- Evaluate patency -is there blood return? Does the catheter flush easily without resistance?
- Insertion site integrity - is the device secure? Is the dressing intact?
- Evaluate catheter length - is there evidence of catheter migration?
- Is there leakage around the insertion site?
-

5. Attempt manoeuvres to relieve mechanical obstruction

- The following manoeuvres may assist in relieving a catheter tip malposition:
- reposition patient by raising arm overhead and turning head away from CVAD site, and having the patient cough several times while gentle push/pull technique is attempted
- have patient roll from side to side while lying supine and then attempt gentle push/pull technique

6. Consider the need to administer alteplase

Mechanism of Action of Alteplase

During the normal process of vascular injury and healing, when the body no longer requires a clot that it produced in response to tissue injury, a naturally occurring enzyme called kinase forms a substance called plasmin. Plasmin converts the fibrin in the clot to fibrinogen and the clot dissolves.

Alteplase (tissue plasminogen activator [tPA], Cathflo[®]) is identical to the naturally occurring tissue plasminogen activator found in the body. It binds to the fibrin in the thrombus and converts entrapped plasminogen to plasmin to initiate local fibrinolysis or clot dissolution. Low dose alteplase (2 mg) is a much smaller dose than that used to treat myocardial infarction (max dose of 100 mg) therefore systemic effects from the procedure of instillation are unlikely to occur. The half-life of alteplase in the plasma is about 5 minutes; however fibrinolysis can occur for up to several hours once plasmin is bound to the fibrin clot.

Alteplase is unique from other fibrinolytic agents in that it has a selective affinity for fibrin bound plasminogen, meaning that it is highly clot selective with increased activity at the site of the clot. As the clot dissolves new fibrin binding sites are exposed that allows that drug to continue clot lysis. Other fibrinolytic agents such as streptokinase convert plasminogen found in the plasma to plasmin and therefore promote a systemic lytic state.

Administration of Alteplase (Cathflo) Procedure

Procedural Step	Rationale
1. Ensure troubleshooting to determine type of occlusion has been completed. Once thrombotic occlusion has been determined, notify Physician and obtain Order for alteplase administration.	<ul style="list-style-type: none"> • Mechanical occlusions can often be relieved with repositioning of patient. A thrombotic occlusion may be partial or complete and will require instillation of alteplase to resolve • A Physician's Order is required for the administration of alteplase
2. Confirm you have the correct patient through performing the 2 patient identifier process.	<ul style="list-style-type: none"> • 2 Patient Identifier Procedure is a Required Organizational Procedure (ROP) and ensures care is provided to the right patient at the right time
3. Obtain alteplase from omnicell and sterile water for dilution. Dilute according to directions and draw up 2mg/2 mL dose into a 10 mL syringe. Ensure the syringe is labeled with a medication label.	<ul style="list-style-type: none"> • 10 mL syringe is the minimum size required for use with a central line • The syringe will be left attached to the lumen during dwell time. A medication label will ensure that the lumen is not accessed by anyone during dwell time
4. Perform hand hygiene and don clean gloves.	<ul style="list-style-type: none"> • Adherence to the 4 moments of hand hygiene and infection control guidelines prevents central line infection
5. Explain procedure to patient. Position patient with head of bed elevated to 45 degrees, and position arm with CVAD insertion site below the level of the heart. Unclamp CVAD lumen.	<ul style="list-style-type: none"> • Information provided to patient reduces anxiety • Positioning decreases risk of thrombus travelling to heart
6. Cleanse cap of lumen by scrubbing with alcohol swabs x2 for 10 seconds each.	<ul style="list-style-type: none"> • Proper cleansing of the cap prevents central line infection
7. Instill the 2 mg/2 mL dose into the blocked lumen. If the lumen is completely occluded and instillation is difficult, pull back on the plunger and allow negative pressure to draw in the solution into the catheter. A very gentle push/pull technique may be necessary. Do not force the medication into the lumen. Once instilled, leave the labeled syringe attached. Allow the solution to dwell for 30 minutes.	<ul style="list-style-type: none"> • Alteplase is instilled into the lumen, not into the patient's general circulation. Dwell time of 30 minutes will allow alteplase to work on dissolving fibrin sheath. • Forceful instillation can cause catheter rupture or release of thrombus into the patient's systemic circulation causing serious complications
8. After 30 minutes, attempt to aspirate blood from the catheter. If blood return is evident, withdraw 5 mL and discard in biohazard container.	<ul style="list-style-type: none"> • Once patency is established a 5mL blood withdrawal for discard ensures all of the alteplase dose has been removed
9. If no blood return is evident, leave the solution to dwell for a further 90 minutes.	<ul style="list-style-type: none"> • Though the half-life of alteplase is 5 minutes, alteplase will continue to work once attached to a fibrin sheath
10. Aspirate for blood return after 90 minute dwell time. If lumen is unblocked, withdraw 5 mL blood and discard in biohazard container.	<ul style="list-style-type: none"> • Once patency is established, a 5 mL blood discard ensures alteplase has been completely removed from lumen.

Procedural Step	Rationale
1. If lumen remains occluded, notify Physician. A second dose of alteplase may be required. If so obtain Physician Order for second dose and follow steps 1 to 8.	<ul style="list-style-type: none"> • A physician order is required for the administration of alteplase
2. Once catheter patency has been re-established the line should be flushed well with 20 mL of sterile normal saline using turbulent flow.	<ul style="list-style-type: none"> • To maintain patency of central line
3. If catheter patency is not accomplished it is important to evaluate the catheter for other possible causes of occlusion and evaluation of the catheter by fluoroscopy may be necessary to determine the cause of the occlusion.	<ul style="list-style-type: none"> • Notify physician if not able to establish central line patency
Document the following: <ul style="list-style-type: none"> • Mechanical troubleshooting attempts • Dose(s) of alteplase administered • Patency of line and flushing post obstruction • If unable to relieve obstruction, that MD was notified and plan of care for patient 	<ul style="list-style-type: none"> • Documentation of patient outcomes is part of nursing standards of care

Potential Complications of Alteplase Therapy

Problem	Signs / Symptoms	Interventions
Infection/Sepsis	<p>Related to releasing a localized infected clot or fluid into the systemic circulation(occurrence less than 0.5%) symptoms of sepsis can occur within hours to days of alteplase use</p> <p>S/S sepsis: fever or hypothermia, chills, tachycardia, hypotension, tachypnea, confusion</p>	<p>Monitor patient’s vital signs and temperature if signs and symptoms of sepsis appear</p> <p>Report early symptoms to physician</p> <p>Antibiotic treatment will be required</p>
Catheter Rupture	<p>May be leakage around insertion site of CVAD indicating a rupture close to insertion site.</p> <p>If tip of catheter ruptures, patient may experience s/s of embolism: cyanosis, respiratory distress, hypotension, feeling of impending doom, may experience cardiac arrhythmias or loss of consciousness</p>	<p>To prevent catheter rupture, always use a minimum 10 mL syringe (not smaller) as smaller diameter syringes cause increased pressure in the line</p> <p>Never force alteplase into the lumen – use a gently push/pull and allow negative pressure to draw alteplase into the lumen. If embolism occurs, immediately do the following:</p> <p>Place patient in left side-lying trendelenberg position</p> <p>Administer 100% oxygen</p> <p>Obtain medical assistance immediately</p>
Bleeding/Hemorrhage	<p>Administering a thrombolytic medication increases the risk for bleeding. Alteplase is not meant to enter the systemic circulation and is a small dose, so studies have shown no significant bleeding, however patients at high risk for bleeding were excluded from studies. Be aware and monitor for bleeding in patients with hematological or liver disorders, on warfarin, ASA, NSAIDs or heparin.</p>	<p>Monitor patient for potential signs of hemorrhage: increased bleeding from wounds, petechiae, rectal bleeding, black tarry stools, coffee ground emesis, hematuria or sudden abdominal or back pain</p> <p>If any new symptoms, monitor vital signs, ensure patent IV access and notify physician immediately</p>

References

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Infusion Nurses Society (2011). Infusion nursing standards of practice. *Journal of Infusion Nursing* 34(1S). 1-110.

Registered Nurses Association of Ontario (2008). *Best Practice Guideline Supplement: Care and Maintenance to Reduce Vascular Access Complications*.

Roche product monograph (2003). Cathflo®

St. Joseph's Care Group (2009). Central Venous Access Device (CVAD) – Administering Alteplase to Declot CVAD's.

Appendix A

COMPETENCY CHECKLIST FOR ADMINISTRATION OF ALTEPLASE			
	Yes	No	Comment
1. Performs troubleshooting to determine mechanical, chemical or thrombotic occlusion. Articulates understanding of techniques to relieve mechanical occlusions. Performs gentle push/pull technique while assessing for occlusion.			
2. Check patient medical record for types of medications infused (?compatibility), is patient at high risk for bleeding (anticoagulants, hematological or liver disorders).			
3. Once thrombotic occlusion has been determined, notifies physician and obtains order for alteplase. Checks patient for prior allergy to alteplase, streptokinase or tenecteplase.			
4. Obtains alteplase dose and sterile water for dilution from omniceil. Dilutes medication appropriately into a 10 mL syringe. Confirms the correct patient by performing 2 patient identifier process.			
5. Explain the procedure to the patient. Is able to articulate the potential complications associated with alteplase administration.			
6. Uses gentle push/pull technique and allows negative pressure to draw alteplase into the blocked lumen. Articulates knowledge of dwell time (30 min initially, 90 minutes may be required). Leaves labeled 10 mL syringe attached to lumen throughout dwell time.			
7. If patency is established, removes 5 mL blood and articulates why this discard amount is necessary, then flushes line with 20 mL NS and checks patency of other lumens, if present.			
8. If patency not established, appropriately follows steps for obtaining second dose. (notifies physician, obtains order, follows instillation steps).			
9. Documents in patient record.			

Date: _____	Time: _____	RN Preceptor: _____
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Date: _____	Time: _____	RN Preceptor: _____
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On Completion Present this Form to Your Manager

Appendix A**Treatment of CVAD Occlusion Test**

1. One risk factor for catheter occlusion is
 - a. Right sided catheter placement
 - b. Patients taking anticoagulant medication
 - c. Patients with venous stasis
 - d. Catheter material that is flexible
2. Catheter occlusions can be either _____ or _____.
3. When assessing the catheter for patency what two things should be noted?
 - a. _____
 - b. _____
4. Evaluation of a CVAD for occlusion is necessary if you notice
 - a. Excellent blood return
 - b. Sluggish flow of IV fluids
 - c. The catheter is clamped
 - d. The catheter flushes easily
5. Drug or mineral precipitate is a / an
 - a. Mechanical occlusion
 - b. Thrombotic occlusion
 - c. External occlusion
 - d. Extraluminal occlusion
6. The substance which forms a net like structure to trap blood cells in clot formation is called
 - a. Plasmin
 - b. Fibrinogen
 - c. Fibrin
 - d. Prothrombin
7. Prevention of an intraluminal thrombus can be achieved by
 - a. Flushing the catheter with heparin solution
 - b. The patient taking a small dose of coumadin daily
 - c. Flushing the catheter twice daily
 - d. Positive pressure and turbulent flow techniques for flushing
8. Systemic effects of Alteplase used to de clot a CVAD are unlikely because the dose administered is very low.
 - a. True
 - b. False

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9. The initial dwell time for alteplase is
- 30 minutes
 - 15 minutes
 - 20 minutes
 - 40 minutes
10. Instillation of alteplase into a completely occluded catheter is accomplished by
- Forcing the solution into the catheter
 - Gentle push/pause technique
 - Positive pressure
 - Negative pressure
13. A second instillation of alteplase may be necessary to declot a CVAD if
- The nurse decides it is needed
 - The catheter is still occluded after the first instillation
 - The patient needs treatment that day
 - The physician orders it
14. An appropriate physician order for cathflo includes:
- Dosage of cathflo to be administered
 - Whether the order may be repeated
 - Instructions for each lumen
 - All of the above
15. List three potential complications of alteplase therapy and signs and symptoms for each.
- _____
 - _____
 - _____