Occlusion Management

Sarah Champ RN MN CON(C)
CNS Parenteral Therapy
Objectives

- Identify 3 types of occlusions
- Outline the steps to assess CVAD patency
- Utilize 4 interventions to deal with occlusions
- Outline steps to administer occlusion management agents
- Identify strategies to prevent occlusions
Introduction

Occlusions can result in:

• Disruption of infusion therapy
• Thrombosis of the blood vessel
• Infection
• Infiltration and extravasation
• Need for catheter removal or replacement

Occlusion is one of the most common complications associated with CVADs
Whenever possible…

Save that Line!
Occlusion Management Qualification

Specialized clinical competency

• Requires cognitive and psychomotor skill and qualification

Achieved by successfully completing:

• Review of Covenant Health policies, procedures and protocols
• Completion of learning module
• Pass of 85% on examination
• Skill demonstration as per checklist

https://www.flickr.com/photos/albertogp123/5843577306
Prevention of Occlusions

- Flush, flush, flush
- Minimum 10 mLs NS
- 20 if blood/viscous fluids infused
- Sodium Citrate/Heparinize if needed

Mariomanoficial
https://commons.wikimedia.org/wiki/File:BATER.jpg
Signs and Symptoms of Occlusion

- Frequent infusion pump alarms
- Inability to infuse or withdraw
- ↑ resistance when flushing

Does this define the cause? NO!
Occlusions - Assessment

How has the catheter been functioning?

What was infusing?
- Drug precipitate
- Occlusion from blood

Was the catheter used to draw blood specimens?

Are there signs of malposition or thrombosis?

Was there a recent dressing change – kink?
Occlusions – First Steps

- Is it clamped?
- Check for kinks in the line
- Change the caps
- Change the dressing
- Change filters
- Can you flush?
- Check external length
- Kink from SercuAcath?

https://www.flickr.com/photos/thomasletholse/6050828458/sizes/q/
Further Assessment

Attempt to flush with 10 cc NS
  • If able, attempt to aspirate blood

Assessment:
  • Fully occluded
  • Sluggish blood return
  • Flushes easily, poor/no blood return
  • Signs of migration? → CXR

Don’t wait for the line to become completely occluded!
Types of Occlusions

Complete Occlusion
- Unable to infuse fluids or flush
- Unable to aspirate blood

Partial Occlusion
- Able to infuse fluids and flush
- Unable to aspirate blood

Sluggish Catheter
- Increased resistance to flushing
- Treat as an occlusion before becomes complete
Main Causes of Occlusions

- Mechanical obstruction
  [Image](https://www.flickr.com/photos/albertogp123/5843577306)

- Chemical obstruction
  [Image](https://upload.wikimedia.org/wikipedia/commons/5/56/Sugar_2xmacro.jpg)

- Thrombotic obstruction
  [Image](https://www.flickr.com/photos/kittensmits)
Mechanical Occlusions

https://www.flickr.com/photos/albertogp123/5843577306
Mechanical Occlusions

Check that dressing
- Clamps?
- Tear, break in the catheter?
- Kinked tubing?
- Kink under securAcath?
- IVAD needle placement
- Clogged filter/needleless connector?
- Tight sutures?
- Reposition patient – take deep breaths
- Migration of line? May need CXR to confirm
Chemical Occlusions

https://upload.wikimedia.org/wikipedia/commons/5/56/Sugar_2xmacro.jpg
Chemical Occlusions

- Precipitates
  - Drug crystallization
  - Drug incompatibilities
  - Solution incompatibilities
- Poor flushing

Treatment dependent on cause
Examples of Drugs that may Precipitate

- Phenytoin
- Heparin
- Calcium and phosphate
- Lipids
- Midazolam
- Pipericillin
- Cloxacillin

Proper flushing between meds important
Thrombotic Occlusions

https://upload.wikimedia.org/wikipedia/commons/5/56/Sugar_2xmacro.jpg
Types of Thrombotic Occlusions

58% of occlusions are thrombotic

Images courtesy of Genentech, Inc. used with permission.

Fibrin Formation

- CVAD is foreign object
- Body reacts in minutes to protect itself
- Fibrin and biofilm form on catheter
- Fibrin allows thrombus to form
- Biofilm microbial organisms colonize

Photo courtesy of Penny Offer
Instillation Occlusion in IVADS
Thrombotic Occlusion Risk Factors

- Catheter size and composition
- Catheter tip malposition
- Left-sided insertion
- Duration of catheter use
- Improper maintenance
Thrombotic Occlusions and Infection

- Fibrin, biofilm and thrombi promotes bacterial growth
- Interaction of fibrin, blood components and biofilm attracts, encloses and protects bacteria
- Blood stasis at body temperature → culture for bacterial growth

Hadaway LC Nursing. 2005;35:54-61
Ryder M. N Dev Vasc Dis. 2001;2:15-25
Intraluminal Clot

Thrombus formation resulting from reflux
Fibrin Sheath
Fibrin Sheath
Persistent Occlusion

- Requires dye study to outline flow path
- N.B. Xray shows tip location NOT the presence of fibrin

Dye study showing flow into left innominate vein due to fibrin sheath at catheter tip
Note...

- Majority of catheter occlusions thrombotic
- Try thrombolytic first if unable to determine the cause and there are no contraindications
Occlusion Management

- Alteplase
- Specialized Clinical Competency
- Treat early before completely occluded
- Ensure enough time
Alteplase

- Instill do NOT flush
- Needs to “sit in the catheter”
- Partial/Withdrawal Occlusion: easy to manage
  - instill slowly using direct, syringe method
- Complete occlusion more difficult
  - Stopcock (if using small syringe size)
  - Negative pressure with syringe

Alteplase contact is with clot in line, little goes systemically
Length of Time to Leave in Catheter

Successful restoration of function to catheters after 120 minute dwell time

- Placebo: 17%
- 1st Dose: 74%
- 2nd Dose: 90%

COOL-1 Results
Length of Time to Leave in Catheter

COOL-2 Results

Rate of restoration of function to catheters by dwell time (cumulative rate) following 2 mg alteplase administration

% Restored Catheter Function

% of patients who were available for follow-up at 30 days had functional catheters

Early Intervention Increased Success

COOL-2 Results

- <24 hours (95% CI, 88.0%-92.8%)
- 1-14 days (95% CI, 79.3%-88.2%)
- >14 days (95% CI, 63.4%-88.2%)
- Unknown (95% CI, 29.8%-74.3%)

Alteplase Safety Profile

<table>
<thead>
<tr>
<th>Event</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepsis</td>
<td>0.4</td>
</tr>
<tr>
<td>Major hemorrhage</td>
<td>0.4</td>
</tr>
<tr>
<td>Gastrointestinal bleeding</td>
<td>0.3</td>
</tr>
<tr>
<td>Venous thrombosis</td>
<td>0.3</td>
</tr>
<tr>
<td>Intracranial hemorrhage</td>
<td>0</td>
</tr>
<tr>
<td>Embolic event</td>
<td>0</td>
</tr>
</tbody>
</table>

Adapted from Ponec D, et al and Deitcher SR, et al.\(^2\)

There were no ICH and no embolic events
Alteplase Administration

Concentration
- 2mg vial – 1 mg/mL

Preparation
- Add 2.2 mL of sterile water
- Do not shake vial → swirl/invert gently to mix
- Withdraw 2mL (2mg) of solution with filtered needle
- Change needle before administration

Stability
- Reconstituted vial stored for 8 hours between 2 - 30° C
- Unreconstituted vials must be refrigerated
Alteplase Administration

Instillation Volume
- 2 mL or equal to volume of catheter lumen, if indicated

Dwell Time
- 30 - 120 minutes
- May be left in catheter overnight if required
- Aspirate 4-5mLs and discard
- May repeat dose x 1

Monitoring
- Baseline BP, pulse, respirations and temperature
Alteplase considerations

Contraindications
• Known hypersensitivity to Alteplase or components

Precautions
• Active internal bleeding
• If within the following within 48 hours:
  • Surgery
  • Obstetrical delivery
  • Percutaneous biopsy of viscera or deep tissues
• Thrombocytopenia, other hemostatic defects
• Significant risk of bleeding
• Possibility of difficult to manage bleeding
• High risk for embolic complications
• Caution in pregnancy
• Known or suspected infection in the catheter
## Instillation of Alteplase

<table>
<thead>
<tr>
<th>Technique</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Instillation Technique</td>
<td>Withdrawal occlusion or sluggish catheter</td>
</tr>
<tr>
<td>Negative Pressure Technique Without Stopcock</td>
<td>Complete occlusion</td>
</tr>
<tr>
<td>Negative Pressure Technique Using Stopcock</td>
<td>Complete occlusion if using smaller sized syringe</td>
</tr>
</tbody>
</table>
Overfill and External Clot Burden

Three types of clots extend outside the lumen. Overfill increases the likelihood of lysis of the external clot.
Removal of alteplase

- Leave alteplase in line up to two hours
- Attempt to aspirate 4-5 mLs of blood
  - Flush with 20 mLs NS if able to obtain blood
  - If unable to aspirate, flush with NS
- If unsuccessful, repeat procedure, with a longer dwell time (minimum 2 hours – can leave in overnight)
- After dwell time, reassess catheter function
If You Think you have an Occlusion….

Do not label the end “Plugged” and leave it.
If You Currently DO NOT HAVE A PLAN…
YOU MUST GET ONE IN PLACE
Consider line removal if catheter clearance agent unsuccessful
Education and Documentation
Education

Before Instillation:
  • Explain the procedure
  • Possible adverse effects

Post instillation:
  • Safe behaviours and mandatory restrictions:
    • Adverse reactions
    • Lumen to remain labelled
    • Lumen not to be used until agent removed
    • Any agent specific precautions
Labelling

Label the lumen with “Medication Added” label:

• Do not use
• Medication
• Amount
• Date
• Time
• Signature
Documentation Post Instillation

In patient’s health record:

- Education
- Baseline vital signs (if required)
- Catheter clearance agent instilled
- Lumens instilled
- Do not use labeled lumen
- Dwell time required
Documentation Post Aspiration

In patient’s health record:

- Number of attempts
- Outcome of procedure
- Patient’s response to procedure
Learning Activities

Case Study
You notice that Mr. T’s 5FR dual lumen Groshong PICC has tape around the white lumen and it is labeled “blocked-do not use”. You note blood backed up into the needleless connector. The nurse tells you that it has been blocked for about a week, but they only require one lumen so they are not concerned.

• Do you agree with the nurse that you should not be concerned?
• What are the risks of leaving a lumen blocked?
• Considering what you know about the efficacy of Alteplase, if the lumen has been blocked for 1 week, is it worth trying to treat the occlusion?
Learning Activities

Case Study

Mr. G. has been in hospital for 6 days receiving ampicillin through his #4FR Groshong PICC. Inserted length 42cm, external length 3cm. Today the nurse infused ampicillin just after infusing an incompatible medication and she forgot to flush in between medications. Immediately after she started the pump it showed a downstream occlusion and she was unable to flush the catheter.

- Identify the most likely cause of the occlusion
- What are some steps you can take?
Summary

• Proper CVAD assessment is the key to identify potential occlusions
• Mechanical occlusion should be ruled out first
• Thrombotic occlusion is the most common and most treatable complication
• Chemical occlusion is something to consider if mechanical and thrombotic occlusion interventions fail
• Strategies to prevent occlusion are important to meet the collective goal of catheter salvage
Q. What happens if the catheter clearance agent is unsuccessful and you are not able to withdraw it? Can you attempt to flush the catheter?

A. The literature recommends withdrawing and discarding catheter clearance agents. However, this may not be possible. Unless, there is a clinical indication not to, you may need to flush the agent in to fully assess the patency of the catheter. If you have any concerns you should review the patient’s situation with his/her physician.
**Frequently Asked Questions**

**Q.** A power PICC solo has had several thrombotic occlusions which have been treated successfully with Alteplase. Flushing and locking technique is appropriate and the tip is positioned in the lower 1/3 of the superior vena cava. Is there anything else that should be tried to prevent further occlusions?

**A.** Some patients may have issues with hyper-coagulation. If your patient’s history indicates that this could be an issue, you may want to discuss with the physician whether a lock solution should be used to prevent further occlusions.
Frequently Asked Questions

Q. What if you can’t determine the most likely cause of the occlusion?

A. If your assessment suggests that it is appropriate to proceed with occlusion management – Alteplase should be the first catheter clearance agent used because the majority of catheter occlusions are thrombotic. Ensure that there are no contraindications to using Alteplase prior to proceeding.
Q. Do vital signs need to be taken immediately prior to instilling a catheter clearance agent?

A. Baseline vital signs are necessary to rule out such precautions as a catheter related infection. Vital signs also provide baseline data in case of any adverse reaction to the catheter clearance agent. If there are already documented vital signs for the shift, review these and if appropriate proceed with instillation. If there are no vital signs documented for the shift, obtain vital signs prior to instillation.
References


References


