

Catheter Occlusion Management

Study Guide

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Completion education. No accredited nursing contact hours awarded.

Course Description

Causes, prevention, assessment, and evidence-based management of partial and complete catheter occlusions, including alteplase (Cathflo Activase) de clotting per INS 2024 standards.

How to Use This Guide

This is a condensed, high-yield reference. Skim the key terms and the quick-reference tables, confirm you can explain each high-yield point, then read the section summaries to spot any gap. Return to the on-site lesson for full detail, and attempt the post-test cold. Passing score: 90%.

Key Terms at a Glance

Term	What it means
SASH / SAS	Saline – Administer drug – Saline – Heparin (where a heparin lock is indicated).
Positive-pressure technique	close the clamp while still injecting the final 0.5 mL of the lock so blood cannot reflux into the lumen tip as you disconnect.
Respect drug–drug compatibility	always flush between incompatible medications, and never co-infuse calcium-containing solutions with ceftriaxone in the same line.
TPN lines	use a dedicated lumen where possible and flush with adequate volume after lipid-containing infusions.
Secure the device	an engineered securement device limits micromotion and prevents the kinking and dislodgement that cause mechanical occlusion.
Adult dose	2 mg / 2 mL, instilled in a volume sufficient to fill the catheter lumen;
Dwell	approximately 30 minutes, then assess for blood return and flow.
Pediatric dosing	patients under 30 kg receive 110% of the internal lumen volume, not to exceed 2 mg;
Always aspirate the alteplase out	after the dwell — do not push it systemically into the patient.

Term	What it means
Cautions/contraindications	active internal bleeding, recent surgery or trauma, recent cerebrovascular accident, or known hypersensitivity.

High-Yield Points

- **Learning Objectives** Explain why catheter occlusion is a high-cost, high-frequency complication and how most cases are prevented. Classify occlusion by flow pattern and by etiology (mechanical, thrombotic, non-thrombotic). Perform a systematic bedside assessment of a suspected occlusion without causing harm. Select the correct pharmacologic agent for the occlusion type, including alteplase dosing and dwell. Recognize when to escalate to imaging, interventional radiology, or removal. Document an occlusion event completely and defensibly.
- **Central Principle** Diagnose before you treat. Mechanical, thrombotic, and chemical occlusions look similar at the bedside but require completely different interventions. Alteplase will not clear a closed clamp, and repositioning will not dissolve a calcium–phosphate precipitate.
- **Clinical Pearl** A line that infuses freely but yields no blood return is the signature of a fibrin sheath. It is tempting to keep using it — but absent blood return means you cannot confirm intravascular placement, and infusing vesicants or irritants through it risks extravasation along the sheath. Investigate, don't ignore.
- **Never Force-Flush** Forcing fluid against an occlusion can rupture the catheter, embolize a clot or a fragment of fibrin sheath, or drive the catheter tip into a new malposition. If it will not flush gently with a 10 mL syringe, stop and investigate.
- **Key Take-aways** Most occlusions are preventable: SASH technique, 10 mL minimum syringe, positive-pressure clamping, and compatibility checks. Differentiate mechanical, thrombotic, and chemical etiologies before you intervene. Never force-flush an occluded catheter. Alteplase 2 mg / 2 mL with a ~30-minute dwell is the standard for thrombotic occlusion; aspirate it out afterward. Chemical occlusions require pharmacy-directed agents matched to the drug class involved. If mechanical and pharmacologic measures fail, image and escalate to IR before abandoning the line.

Quick-Reference Tables

Pattern	Can infuse?	Can aspirate?	Typical cause
Complete occlusion	No	No	Intraluminal thrombus, precipitate, tight kink, or closed clamp
Partial / withdrawal (PWO)	Yes	No	Fibrin sheath or fibrin tail at the tip — the classic pattern
Sluggish flow	Yes, slowed	Yes, slowed	Partial intraluminal thrombus, kinking, or external compression

Category	Examples	Frequency
Mechanical	Closed clamp, kinked tubing, suture too tight, pinch-off syndrome, tip malposition/migration	Common; always rule out first
Thrombotic	Intraluminal clot, fibrin tail, fibrin sheath, mural thrombus	Most common cause of withdrawal occlusion
Non-thrombotic (chemical)	Drug precipitate (calcium–phosphate, ceftriaxone–calcium), lipid residue from TPN, mineral precipitate, drug–drug incompatibility	Less common but distinct management

Syringe barrel	Pressure risk	Use for flushing?
1–3 mL	Very high PSI — can exceed catheter burst pressure	No
5 mL	Elevated	Avoid for routine flushing
10 mL or larger	Safe, lower PSI	Yes — standard of practice

Cause	Clearing agent (pharmacy/provider directed)
Acidic drug precipitate (most common)	0.1 N hydrochloric acid (HCl)
Alkaline precipitate or phenytoin precipitate	Sodium bicarbonate 8.4% or sodium hydroxide
Lipid residue (after TPN)	70% ethanol or sodium hydroxide — verify catheter material first; ethanol is incompatible with some polyurethanes

Program element	What good looks like
Standardized flush & lock protocol	One written SASH/SAS standard, correct volumes, 10 mL minimum syringe, positive-pressure clamping — taught to every new hire and reinforced at competency checks
Compatibility safeguards	Pharmacy-maintained incompatibility list at the point of care; hard stop on calcium and ceftriaxone sharing a lumen
Early recognition	Shift assessment of blood return and flushability; positional occlusion checked before escalation
Declotting pathway	Standing protocol for alteplase and chemical clearance so the right agent is available and used without delay
Surveillance & feedback	Track occlusion events, alteplase use, and unplanned removals; review trends with the team monthly

Section-by-Section Summary

The key idea of each lesson section, condensed to the essentials. Use it to review fast and spot any gap before the post-test.

Catheter Occlusion Management

Estimated time 1–2 hours | Completion education; no accredited contact hours | Aligned to the Infusion Nurses Society Infusion Therapy Standards of Practice , 9th edition (2024)

1. Why occlusion matters

Catheter occlusion is the most common non-infectious complication of central vascular access devices (CVADs). Estimates place partial or complete occlusion in as many as one in four catheters at some point during their dwell.

The central message of this module is that occlusion is overwhelmingly a preventable complication. The clinician who flushes correctly, locks correctly, respects drug–drug compatibility, and secures the device well will see a fraction of the occlusions of a clinician who does not.

2. Classifying occlusion

3. Prevention is the best treatment

Nearly every occlusion-prevention practice comes back to disciplined flushing and locking. The evidence-based bundle:

- SASH / SAS: Saline – Administer drug – Saline – Heparin (where a heparin lock is indicated). Use pulsatile push-pause flushing with at least 10 mL of preservative-free 0.9% sodium chloride to create turbulence that clears the lumen wall.
- 10 mL or larger barrel syringes only: a narrow barrel generates high pressure per square inch and can rupture a catheter. Barrel diameter, not effort, determines pressure.
- Positive-pressure technique: close the clamp while still injecting the final 0.5 mL of the lock so blood cannot reflux into the lumen tip as you disconnect.
- Respect drug–drug compatibility: always flush between incompatible medications, and never co-infuse calcium-containing solutions with ceftriaxone in the same line.
- TPN lines: use a dedicated lumen where possible and flush with adequate volume after lipid-containing infusions.
- Secure the device: an engineered securement device limits micromotion and prevents the kinking and dislodgement that cause mechanical occlusion.

4. Bedside assessment of a suspected occlusion

Step 1 Check the obvious external causes first: a closed clamp, kinked tubing, a dressing applied too tightly, or position-dependent flow.

Step 2 Reposition the patient. Have them cough, raise or lower the arm, turn the head to the opposite side, perform a Valsalva maneuver, or shift body position.

Step 3 Assess catheter integrity and external length. Compare current external length to the documented baseline to detect migration.

Step 4 Attempt gentle aspiration with a 10 mL syringe. Never force.

Step 5 If mechanical correction fails, confirm tip position with imaging (chest x-ray for PICCs, ports, tunneled and non-tunneled CVADs) before pharmacologic measures.

5. Pharmacologic management

Thrombotic occlusion — alteplase (Cathflo Activase)

- FDA-approved tissue plasminogen activator for restoration of function in CVADs.
- Adult dose: 2 mg / 2 mL, instilled in a volume sufficient to fill the catheter lumen; do not exceed 2 mg per dose.
- Dwell: approximately 30 minutes, then assess for blood return and flow. If function is not restored, allow additional dwell and, if needed, aspirate and instill a second dose. Maximum two doses per occlusion event.
- Pediatric dosing: patients under 30 kg receive 110% of the internal lumen volume, not to exceed 2 mg; patients 30 kg and over receive the 2 mg dose.
- Always aspirate the alteplase out after the dwell — do not push it systemically into the patient.
- Cautions/contraindications: active internal bleeding, recent surgery or trauma, recent cerebrovascular accident, or known hypersensitivity. Verify a provider order and screen for these before instilling.

Non-thrombotic (chemical) occlusion

Every chemical intervention requires a pharmacy and provider order, a protocol-driven dwell, and aspiration of the agent afterward. Matching the agent to the chemistry of the precipitate is essential — the wrong agent will not work and may worsen the situation.

6. When pharmacologic clearance fails

- Re-image tip position with chest x-ray or fluoroscopy.
- Consider interventional radiology for fibrin sheath stripping or catheter exchange over a guidewire.
- If the catheter cannot be cleared and is no longer needed for therapy, remove it per provider order rather than leaving a non-functional line in place.

7. Documentation

Record the time the occlusion was identified, its type (complete, partial/withdrawal, or sluggish), the troubleshooting steps performed, the intervention used (drug, dose, and dwell time), the patient's response (blood return and flushability), and the provider notification. Complete documentation protects the patient, supports billing, and creates the trend line that tells the next clinician whether the line is recovering or failing.

8. Pinch-off syndrome — a mechanical cause worth knowing

Pinch-off syndrome occurs when a catheter placed via the subclavian route is compressed in the narrow space between the clavicle and the first rib. Early on it produces intermittent, position-dependent occlusion — the line flushes when the patient raises the arm or shrugs the shoulder and obstructs when they relax.

9. Building an occlusion-prevention program

Individual technique matters, but durable results come from standardizing practice across every clinician who touches the line. A high-performing vascular access program treats occlusion prevention as a bundle, audits adherence, and feeds the results back to staff.

For a mobile service like VAC, the same discipline applies across every facility served. When the flush standard, the compatibility list, and the declotting pathway travel with the clinician, occlusion rates fall and lines

last as long as the therapy requires — which is exactly the outcome that distinguishes a premium vascular access partner from a commodity one.

10. Pediatric and home-infusion considerations

Occlusion management flexes with the setting. In pediatrics , lumen volumes are tiny, so alteplase is dosed to the internal lumen volume (110% of lumen volume for patients under 30 kg, not to exceed 2 mg) rather than a flat 2 mg, and flush volumes are scaled to the device while still using a 10 mL or larger barrel to control pressure.

Reference Infusion Nurses Society. Infusion Therapy Standards of Practice , 9th ed.

Concepts Tested on the Post-Test

Each item is a topic the post-test probes. Exact wording may differ; the underlying concept is what you must be able to reason through. If any feels unfamiliar, revisit that section above.

1. The most common cause of withdrawal (partial) occlusion in a CVAD is:
2. The minimum syringe size recommended for flushing or locking a CVAD is:
3. SASH stands for:
4. A patient's PICC infuses normally but cannot be aspirated. The first step is:
5. The standard adult dose of alteplase (Cathflo Activase) for catheter clearance is:
6. After the alteplase dwell, the clinician should:
7. The recommended initial alteplase dwell time is approximately:
8. What is the maximum number of alteplase doses recommended per occlusion event?
9. A precipitate occlusion involving an acidic drug is best managed with:
10. Lipid residue occlusion (after TPN) may be cleared with:
11. Which is NOT a recommended preventive practice?
12. Pinch-off syndrome refers to:
13. Forced flushing of an occluded catheter is dangerous because it can cause:
14. Which medication combination is a well-known precipitation hazard requiring strict line separation?
15. Persistent Withdrawal Occlusion (PWO) typically presents as:
16. Before instilling alteplase, the clinician should verify all of the following EXCEPT:
17. Pediatric alteplase dosing for patients under 30 kg is:
18. Alteplase is contraindicated or requires caution in patients with:
19. Sluggish flow but successful infusion most likely indicates:
20. After mechanical and pharmacologic measures fail to restore patency, the next step is generally:
21. Positive-pressure clamping technique is:
22. An accurate documentation note for an occlusion event should include all EXCEPT:
23. A CVAD with confirmed mechanical kink and no thrombotic findings should be managed by:
24. Tip migration is best confirmed by:
25. The most cost-effective intervention for catheter occlusion is:

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