

Module 5: Midline Catheter Insertion

Study Guide

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Completion education. No accredited nursing contact hours awarded.

Course Description

Master midline catheter insertion techniques, indications and contraindications, medication compatibility criteria, and evidence-based care practices.

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
What it is	A separate guidewire system — vein cannulated with introducer needle, guidewire advanced through needle, catheter threaded over wire via peel-away sheath.
Apply tourniquet; perform ultrasound assessment	— select optimal vessel;
Measure arm	— from insertion site to axilla;
Action	Remove needle/catheter immediately;
Prevention	Real-time ultrasound;

High-Yield Points

- **Common Clinical Error** Midline catheters are frequently confused with PICC lines. The most important distinction is tip location — a midline tip is PERIPHERAL (below the axilla) while a PICC tip is CENTRAL (distal SVC or CAJ). Therapies appropriate only for central access must NEVER be administered through a midline.
- **MAGIC Key Finding** PICC overuse is one of the most significant preventable patient safety problems in vascular access. MAGIC explicitly cautions against placing PICCs for therapy that could be safely delivered via midline. Always ask: "Could a midline safely deliver this therapy?"
- **Absolute Midline Contraindications** — Never Administer Via Midline: Medication/Therapy Reason TPN Hyperosmolar — typically >900 mOsm/L Chemotherapy Most are vesicants — risk of tissue necrosis Continuous vasopressors Vesicant properties — require central delivery Hypertonic saline (>0.9%) 3% NaCl is 1026 mOsm/L — far exceeds limit Dextrose >10% Hyperosmolar Phenytoin IV pH 10–12 — highly alkaline Amiodarone (continuous) Vesicant properties — causes thrombophlebitis

- **Vein Preferences for Midline Insertion** Basilic Vein (First Choice): Medial upper arm. Largest diameter — 5–8mm. Fewer valves. Most direct path. Runs near medial cutaneous nerve and brachial artery — ultrasound guidance essential. Cephalic Vein (Second Choice): Lateral upper arm. Smaller diameter — 3–5mm. More valves — greater resistance. Adequate for midline as tip does not need to advance as far as PICC. Brachial Vein (Third Choice): Deep vein flanking the brachial artery. Ultrasound mandatory. Highest risk of arterial puncture. Use only when basilic and cephalic unavailable.
- **Absolute Contraindications:** Prescribed therapy requires central venous access (TPN, vesicants, continuous vasopressors) Skin infection or burns at the intended insertion site Known venous thrombosis in the target vessel Severe uncorrectable coagulopathy
- **Relative Contraindications** Mastectomy with ipsilateral axillary lymph node dissection Ipsilateral AV fistula or dialysis graft History of DVT in the target vessel Therapy duration anticipated to exceed 14 days — PICC may be more appropriate
- **AST — Accelerated Seldinger Technique** What it is: An integrated catheter-over-needle unit where the catheter advances directly off the introducer needle without a separate guidewire exchange. Advantages: Faster — fewer steps Simpler — lower learning curve Less equipment required Well suited for straightforward venous access Limitations: Less versatile for deep or tortuous veins No guidewire to maintain access if advancement is difficult
- **When to Choose AST vs MST** Clinical Scenario Recommended Technique Superficial basilic or cephalic vein, straightforward access AST — faster and simpler Deep brachial vein access required MST — better control Difficult or tortuous vein MST — guidewire maintains access Less experienced inserter AST — lower learning curve Patient with limited venous access MST — maximizes success rate
- **Important** Midline catheters do NOT require radiographic tip confirmation before use. However if there is any clinical concern that the catheter may have advanced into the subclavian vein, obtain a chest X-ray before initiating therapy.
- **Never** force flush an occluded midline catheter.
- **Module Summary** The midline catheter is one of the most clinically valuable yet underutilized vascular access devices in healthcare. When applied correctly — using MAGIC criteria, careful medication compatibility assessment, appropriate technique selection (AST vs MST), and evidence-based maintenance — midlines safely bridge the gap between short peripheral IVs and invasive central lines. Avoid defaulting to PICC when a midline would safely and appropriately serve the patient's needs.
- **References** Infusion Nurses Society. (2024). Infusion Therapy Standards of Practice (9th ed.). Journal of Infusion Nursing, 47(1S). | Chopra V, et al. (2015). The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC). Annals of Internal Medicine , 163(6 Suppl):S1-40. Updated 2023.

Quick-Reference Tables

Device	Therapy Duration	Key Requirements
PIV	<5 days	Compatible medications, accessible peripheral veins
Midline	5–14 days	Non-vesicant, pH 5–9, osmolarity <600 mOsm/L
PICC	>14 days OR central access required	TPN, vesicants, vasopressors, osmolarity >900 mOsm/L

Parameter	Acceptable Range	Rationale
pH	5.0–9.0	Outside this range causes chemical phlebitis and vein damage
Osmolarity	<600 mOsm/L	Hyperosmolar solutions damage peripheral vein endothelium
Vesicant classification	Non-vesicants only	Vesicant extravasation causes tissue necrosis

Medication	pH	Osmolarity	Midline Appropriate?
Meropenem	7.3–8.0	~286 mOsm/L	Yes
Piperacillin-Tazobactam	4.5–6.8	~276 mOsm/L	Yes
Cefepime	4.0–6.0	~280 mOsm/L	Yes
Ertapenem	7.5	~308 mOsm/L	Yes
Ceftriaxone	6.7	~260 mOsm/L	Yes
Vancomycin	2.5–4.5	Varies	Caution Monitor closely — pH at lower end
Normal Saline (0.9%)	4.5–7.0	308 mOsm/L	Yes
D5W	3.5–6.5	252 mOsm/L	Yes

Medication/Therapy	Reason
TPN	Hyperosmolar — typically >900 mOsm/L
Chemotherapy	Most are vesicants — risk of tissue necrosis
Continuous vasopressors	Vesicant properties — require central delivery
Hypertonic saline (>0.9%)	3% NaCl is 1026 mOsm/L — far exceeds limit
Dextrose >10%	Hyperosmolar
Phenytoin IV	pH 10–12 — highly alkaline
Amiodarone (continuous)	Vesicant properties — causes thrombophlebitis

Clinical Scenario	Recommended Technique
Superficial basilic or cephalic vein, straightforward access	AST — faster and simpler
Deep brachial vein access required	MST — better control
Difficult or tortuous vein	MST — guidewire maintains access
Less experienced inserter	AST — lower learning curve
Patient with limited venous access	MST — maximizes success rate

Care Element	Frequency	Notes
Site assessment	Every 4–8 hours and with each medication	Use VIP scale; document findings
TSM dressing change	Every 5–7 days or when soiled/non-occlusive	Use ANTT; CHG prep; allow to dry
Needleless connector change	Every 96 hours or with dressing change	Scrub the hub 15 seconds before every access
Saline flush	Before and after each medication	5–10mL NS pulsatile technique
Saline lock when not in use	Every 8–12 hours	5–10mL NS positive pressure
External length assessment	Every dressing change	Any change from baseline may indicate migration
Daily necessity review	Daily	Remove when no longer clinically needed

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.

Module 5: Midline Catheter Insertion

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- Define midline catheters and differentiate them from PIVs and PICCs
- Apply MAGIC criteria to determine when a midline is the most appropriate device
- Identify clinical indications, contraindications, and medication compatibility for midlines
- Identify the relevant vascular anatomy of the upper arm for midline insertion
- Compare and contrast the AST and MST insertion techniques
- Execute midline insertion using ultrasound guidance
- Perform post-insertion care, maintenance, and documentation per INS Standards
- Recognize and manage midline-specific complications

1. What is a Midline Catheter?

A midline catheter is a peripheral vascular access device typically 3–8 inches (8–20 cm) in length, inserted via the basilic, cephalic, or brachial vein of the upper arm. The tip terminates in the axillary region or just below the axilla — it does not enter central circulation and is therefore classified as a peripheral device, not a CVAD.

The midline occupies a critical niche between the short peripheral IV and the PICC line, offering extended dwell time and improved stability while avoiding the risks associated with central venous access.

2. MAGIC Criteria — When is a Midline the Right Choice?

The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) — Chopra et al., *Annals of Internal Medicine*, 2015 (updated 2023) — provides the most comprehensive evidence-based framework for midline catheter selection.

3. Medication Compatibility

Evaluate three parameters before initiating any medication through a midline: pH, osmolarity, and vesicant classification.

4. Vascular Anatomy for Midline Insertion

5. Contraindications to Midline Insertion

6. AST vs MST — Insertion Technique Comparison

What it is: A separate guidewire system — vein cannulated with introducer needle, guidewire advanced through needle, catheter threaded over wire via peel-away sheath.

Advantages:

- Better control and versatility
- Guidewire maintains venous access in difficult cases
- Preferred for deep brachial vein access

- Same technique as PICC — familiar to experienced clinicians

Limitations:

- More steps — longer procedure time
- Higher learning curve
- Greater risk of air embolism during sheath phase

7. Insertion Procedure

Sterile precautions for midline insertion: sterile gloves, mask, cap, sterile drape over insertion field, sterile ultrasound probe cover. Sterile gown per institutional policy — recommended.

- Perform hand hygiene
- Position patient — supine, arm abducted 90°
- Apply tourniquet; perform ultrasound assessment — select optimal vessel; ensure catheter-to-vein ratio $\leq 45\%$
- Measure arm — from insertion site to axilla; this determines catheter length
- Apply sterile drape; don mask, cap, sterile gloves
- Prep insertion site — CHG friction scrub; allow to dry completely (minimum 30 seconds)
- Apply sterile probe cover and administer local anesthetic
- Cannulate vein under real-time ultrasound
- Confirm venous blood return — dark, non-pulsatile
- AST: Advance catheter directly off needle to pre-measured length; activate needle safety
- MST: Advance guidewire; remove needle; advance dilator and sheath; remove dilator and wire; thread catheter through sheath; peel away sheath
- Release tourniquet; confirm blood return; flush with 10mL NS pulsatile technique
- Apply CHG disk, stabilization device, and TSM dressing
- Label dressing — date, time, catheter length, French/gauge size, initials
- Document all insertion details

8. Post-Insertion Care & Maintenance

9. Midline-Specific Complications

Phlebitis

The most common midline complication. Remove at VIP score ≥ 2 .

Midline-Associated DVT

Less common than PICC-DVT but still significant. Do not remove midline immediately — notify provider; duplex ultrasound to confirm; anticoagulation per provider order.

Catheter Migration

Monitor external catheter length at every dressing change. If tip migration into subclavian vein is suspected, obtain chest X-ray before continuing therapy.

Accidental Arterial Cannulation

Signs: Bright red, pulsatile blood return; rapidly expanding hematoma. Action: Remove needle/catheter immediately; apply firm pressure minimum 10 minutes; notify provider; monitor for hematoma expansion.

10. Documentation Requirements

- Date, time, catheter brand, type, gauge/French size, and catheter length inserted
- Insertion technique used (AST or MST)
- Insertion vein and arm
- Number of insertion attempts and any complications
- External catheter length at hub (baseline)
- Blood return confirmed
- Flush solution, volume, patient response
- Medication compatibility verified — pH, osmolarity, vesicant classification
- Patient education provided and demonstrated understanding
- Clinician name, credentials, and signature

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. Where does a midline catheter tip terminate?
2. How does a midline differ from a PICC line?
3. Per MAGIC criteria, what is the appropriate therapy duration range for midline use?
4. What is the maximum osmolarity appropriate for midline infusion?
5. What is the acceptable pH range for medications administered through a midline?
6. A patient requires 7 days of meropenem IV (pH 7.3–8.0, osmolarity ~286 mOsm/L). What is the most appropriate device per MAGIC criteria?
7. Which medication is an ABSOLUTE contraindication for midline administration?
8. Why is TPN absolutely contraindicated for midline administration?
9. Which is the first choice vein for midline insertion?
10. Why is the basilic vein preferred for midline insertion?
11. What is the key MAGIC finding regarding PICC overuse?
12. What is the AST (Accelerated Seldinger Technique)?
13. What is the primary advantage of AST over MST?
14. What is the primary advantage of MST over AST?
15. For which clinical scenario is MST most recommended over AST?
16. Does a midline catheter require radiographic tip confirmation before first use?
17. How is arm measurement performed before midline insertion?
18. Maximum catheter-to-vein ratio for midline insertion?
19. Which antibiotic requires closest monitoring when administered via midline due to pH at the lower end of the acceptable range?
20. A patient with a midline has a VIP score of 2. What is the correct action?
21. What is the most common complication of midline catheters?
22. How frequently should a midline catheter be flushed when not in active use?
23. Midline catheter is suspected to have migrated into the subclavian vein. What action?
24. During brachial vein midline insertion, bright red pulsatile blood return is observed. What does this indicate?
25. Which is an absolute contraindication to midline catheter insertion?
26. What sterile precautions are required for midline insertion?
27. A patient requires 10 days of pib-tazo (pH 4.5–6.8, osmolarity ~276 mOsm/L). Most appropriate device per MAGIC?
28. What information must be documented when initiating therapy through a midline?
29. How frequently should external catheter length be assessed?
30. Why does cephalic vein have higher valve density than basilic, and what is the clinical significance?

31. A patient's midline therapy may extend beyond 14 days. What action?
32. Recommended flush volume before and after each medication through a midline?
33. Hypertonic saline (3% NaCl, osmolarity ~1026 mOsm/L) ordered for patient with midline. Correct action?
34. Patient has deep brachial vein and history of difficult access. Which technique and why?
35. What daily care requirement is unique to midlines compared to PIVs but similar to PICCs?

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