

PIV100: Understanding MAGIC

Study Guide

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Course Description

Learn about selection in the Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) to choose between a central line and a peripheral device.

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
Therapy duration	— how long will IV therapy be needed
Medication characteristics	— pH, osmolality, vesicant classification
Patient-specific factors	— vein availability, medical history, renal disease status
Clinical goals	— avoiding both under-treatment and over-treatment

High-Yield Points

- Central Principle Match the right vascular access device to the right patient at the right time. This means selecting the least invasive device that will safely meet the patient's clinical needs — avoiding both inadequate access and unnecessary escalation to central venous devices.
- Pre-MAGIC Practice Problems Unnecessary central venous catheters with associated CLABSI (Central Line-Associated Bloodstream Infection) risk Peripheral IVs placed for therapies that require central access — leading to extravasation injury Frequent PIV restarts causing patient discomfort, vessel damage, and lost access sites Increased healthcare costs from preventable device complications and length of stay increases Inconsistent practice patterns across providers, units, and facilities PICC overuse for therapies that could be safely delivered via midline or PIV
- MAGIC Evidence Impact Studies implementing MAGIC criteria show: Up to 30% reduction in unnecessary PICC placements Significant reduction in CLABSI rates and associated mortality Decreased thrombosis complications Lower healthcare costs from avoided complications Improved patient satisfaction through reduced invasive procedures
- Understanding Catheter Tip Location Peripheral tip location — PIV or midline tips reside in peripheral veins without entering the superior vena cava. Appropriate for: Osmolarity under 900 mOsm/L

Non-vesicant, non-irritant medications Solutions with pH between 5–9 Central tip location — PICC, CVC, tunneled, or port tips terminate in the superior vena cava or cavoatrial junction. The large blood flow in these vessels allows safe infusion of: Hyperosmolar solutions (TPN, concentrated dextrose) Vesicant medications (chemotherapy, vasopressors) Irritant solutions with extreme pH Multiple simultaneous incompatible infusions

- Duration-Based Device Selection Less than 5–6 days: Peripheral IV (PIV) is appropriate if therapy is compatible 5–14 days: Midline catheter if therapy is non-vesicant, non-irritant, and osmolarity less than 600 mOsm/L More than 14 days: PICC or central venous access device (CVAD) recommended

- Clinical Pearl Medication Osmolarity Examples Normal saline: ~308 mOsm/L (peripheral safe) D5W: ~252 mOsm/L (peripheral safe) Meropenem: ~286 mOsm/L (peripheral safe) Potassium chloride 20 mEq/L: ~357 mOsm/L (peripheral safe at this concentration) 3% hypertonic saline: ~1026 mOsm/L (central access required) TPN: 1200–1600 mOsm/L (central access required) D50W (dextrose 50%): ~2520 mOsm/L (central access required)

- Patient Factors to Assess Peripheral vein access: Poor access may warrant midline or PICC earlier History of difficult access: Consider device that can be placed once and left in place longer Patient preference and lifestyle: Some patients prefer longer-dwelling device to minimize procedures Renal disease: Preserve forearm veins for future arteriovenous fistula (dialysis access) Coagulopathy or anticoagulation: May affect site selection; document increased bleeding risk Compromised skin integrity: Avoid infected or burned sites History of thrombosis: Consider device and location carefully

- Reference PIV is the appropriate choice when ALL of these criteria are met Therapy duration is less than 5–6 days Medications are non-vesicant and non-irritant Solution osmolarity is less than 600 mOsm/L (typical medications: ~250–400) Solution pH is between 5 and 9 (most antibiotics: pH 6–8) Adequate peripheral vein access is available (18–24 gauge) Therapy involves intermittent infusions of compatible medications (not continuous high-dose vasopressors) No requirement for frequent large-volume blood draws (small amount OK; frequent labs may favor PICC)

- Central venous access (PICC, CVC, tunneled, or port) is required when: Therapy duration is greater than 14 days Prescribed therapy includes vesicant chemotherapy or other vesicant medications (vasopressors, etc.) TPN (Total Parenteral Nutrition) administration — hyperosmolar, osmolarity typically 1200–1600 mOsm/L Solution osmolarity is greater than 600 mOsm/L (e.g., concentrated dextrose >10%, 3% hypertonic saline) Continuous hemodynamic monitoring is required via CVC Frequent large-volume blood draws needed (reduces repeated PIV sticks) No viable peripheral vascular access available Multiple simultaneous infusions of incompatible or conflicting medications Extreme pH solutions (pH 9) — e.g., phenytoin, vesicant drugs

- Pre-MAGIC Approach Clinical decision: "Do I place a PIV or a PICC?" Midline mostly ignored or unknown When patient needed >5 days therapy, many defaulted to PICC PIVs restarted frequently as they failed Unnecessary PICC placements common Increased PICC complications (DVT, thrombosis, CLABSI)

- MAGIC Criteria for Midline Use Therapy duration 5–14 days Non-vesicant, non-irritant medications Osmolarity less than 600 mOsm/L (note: slightly lower than PICC which allows >900) pH between 5–9 Patient has poor peripheral IV access but does not require central access Therapy does not include TPN, vesicants, vasopressors, or high osmolarity solutions

- Critical Midline Distinction: Midline catheters are NOT central venous access devices. Their tips do not reach the superior vena cava or cavoatrial junction — they terminate in the axillary vein or just below the axilla. This is why they cannot be used for therapies requiring central access (TPN, vesicants, hyperosmolar solutions).

- CLABSI Risk Facts: CLABSI occurs in approximately 0.5–5 per 1,000 central line days Increases hospital length of stay by 10–15 days Increases hospital costs by \$30,000–\$50,000 per infection Associated mortality rate: 10–40% in high-risk patients Many CLABSI cases are preventable through appropriate device selection

- **MAGIC Impact on Infection Rates** Studies implementing MAGIC criteria in various healthcare settings show: 30% reduction in unnecessary PICC placements Significant reductions in CLABSI rates when PICC use is reduced Decreased thrombosis complications Lower overall vascular access-related morbidity Improved quality metrics and patient safety culture
- **MAGIC Clinical Pearl: Therapy Duration Assessment** When a patient says "we need IV therapy for a week," clinical judgment is required: Anticipated duration: How long is treatment planned? Best-case scenario: If everything goes well, therapy ends in ____ days Realistic duration: Account for delays, complications, clinical changes If uncertain: When in doubt between two device categories, select the less invasive option first (PIV before midline, midline before PICC)
- **Renal Disease MAGIC Approach** Prefer hand or upper arm for temporary IV access Avoid repeated punctures of basilic or cephalic veins if possible Consider midline or PICC only if absolutely necessary (place in other arm) Preserve veins for future dialysis access creation
- **Mastectomy Precaution** Avoid using the ipsilateral (same-side) arm for vascular access when possible. Use the contralateral (opposite) arm. This reduces risk of lymphedema and infection in the compromised limb.
- **INS 2024 Standard Alignment** MAGIC principles are reflected in INS (Infusion Nurses Society) Standards 26 and 27: Standard 26: Vascular Access Device Planning — Select based on therapy, duration, patient factors Standard 27: Site Selection — Ensure device selection matches prescribed therapy and anticipated use

Quick-Reference Tables

Device Category	Tip Location	Typical Dwell Time	Access Level
Peripheral IV (PIV)	Peripheral vein (forearm, hand, antecubital)	Up to 6 days (typically 3–4 days)	Peripheral
Midline Catheter	Peripheral vein, tip in axillary or below axilla	5–14 days (up to 4 weeks)	Peripheral (does not reach central circulation)
PICC Line	Central — tip at superior vena cava (SVC) or cavoatrial junction (CAJ)	Weeks to months (4+ weeks)	Central
CVC / Tunneled / Port	Central — tip at SVC or CAJ	Short-term to permanent	Central

Parameter	Acceptable for PIV	Acceptable for Midline	Acceptable for Central	Rationale
pH Range	5–9	5–9	Any pH	Extreme pH (9) causes chemical phlebitis in peripheral veins
Osmolarity	<600 mOsm/L	<600 mOsm/L	Any osmolarity	Hyperosmolar solutions damage fragile peripheral vein endothelium
Vesicant Status	Non-vesicants only	Non-vesicants only	All medications OK	Vesicant extravasation causes tissue necrosis; central access dilutes drug

Vesicant Category	Examples	Risk if Extravasated
Chemotherapy agents	Doxorubicin, vincristine, taxol, cisplatin	Severe tissue necrosis, loss of limb function
Vasopressor agents	Norepinephrine, epinephrine, dopamine (at vasopressor doses)	Vasoconstriction, tissue necrosis, gangrene
Other vesicants	Potassium chloride, chlorpromazine, calcium chloride, hypertonic saline	Chemical burns, tissue damage

Therapy Type	Examples	Typical Duration	PIV Appropriate?
Short-course IV antibiotics	Ceftriaxone, meropenem, piperacillin-tazobactam (3–5 days)	<6 days	Yes
Hydration therapy	Normal saline, D5W, balanced crystalloids	<5 days	Yes
Single-dose or brief IV medications	Magnesium, calcium, antibiotics x1 dose	<24 hours	Yes
Minor analgesics/antiemetics	Morphine, ondansetron, dexamethasone (intermittent)	<5 days	Yes

Therapy Type	Examples	Why Central Access?	Device of Choice
TPN	Lipid emulsions, dextrose, amino acids	Osmolarity >900 mOsm/L causes peripheral phlebitis	PICC or tunneled CVC
Chemotherapy	Doxorubicin, vincristine, taxol, cisplatin	Vesicant — extravasation causes severe tissue necrosis	PICC or port (preferred for long-term)
Vasopressor infusions	Norepinephrine, epinephrine, milrinone continuous	Vesicant properties; requires rapid infusion of concentrated solution	CVC (not PICC if continuous high-dose)
Long-course IV antibiotics	Antibiotic therapy >14 days (osteomyelitis, endocarditis)	Prolonged duration makes PIV impractical; frequent restarts	PICC or tunneled CVC
Hypertonic saline	3% NaCl (osmolarity ~1026), 7% or higher	Osmolarity far exceeds peripheral limit; causes phlebitis	CVC only

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.

PIV100: Understanding MAGIC

Michigan Appropriateness Guide for Intravenous Catheters — Evidence-based vascular access device selection

- Define MAGIC and its evidence-based framework for vascular access device selection
- Identify the four primary vascular access device categories and their appropriate uses
- Apply MAGIC criteria to determine when a PIV, midline, PICC, or CVC is most appropriate
- Evaluate therapy duration, medication characteristics (pH, osmolarity, vesicant status), and patient factors
- Recognize absolute and relative contraindications to peripheral IV therapy
- Understand the impact of MAGIC on preventing unnecessary central venous access and reducing CLABSI
- Differentiate between peripheral and central device classification
- Implement MAGIC-guided selection in clinical practice

1. What is MAGIC?

The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC) is an evidence-based framework developed through the RAND/UCLA appropriateness methodology, involving expert consensus from physicians, nurses, pharmacists, and other healthcare professionals. It was published in 2015 (Chopra et al., *Annals of Internal Medicine*) and updated in 2023 to reflect current evidence.

MAGIC provides clinicians with clear, actionable criteria to determine the most appropriate vascular access device (VAD) for each patient based on:

- Therapy duration — how long will IV therapy be needed
- Medication characteristics — pH, osmolarity, vesicant classification
- Patient-specific factors — vein availability, medical history, renal disease status
- Clinical goals — avoiding both under-treatment and over-treatment

2. Why MAGIC Matters in Clinical Practice

Before MAGIC, vascular access device selection was inconsistent and often driven by habit, convenience, or provider preference rather than evidence. This led to serious practice problems:

3. The MAGIC Device Categories — Clinical Classification

MAGIC organizes vascular access devices into four primary categories based on tip location, durability, and appropriate therapy types:

4. MAGIC Key Selection Criteria — The Decision Framework

Factor 3: Vesicant Medications Require Central Access

Vesicant medications can cause severe tissue damage if extravasated into surrounding tissues. Examples include:

5. When a PIV IS Appropriate — MAGIC Criteria Met

6. When a Central Line IS Appropriate — MAGIC Criteria Indicate CVADs

7. The Midline Catheter — MAGIC's Game-Changing "Middle Ground"

One of MAGIC's most significant contributions was elevating the midline catheter as a strategic bridge between short peripheral IVs and PICCs. Midlines had been underutilized, and MAGIC provided the evidence to justify wider adoption.

Clinical decision: "What is the least invasive device that will work?"

- PIV for <6 days with compatible therapy
- MIDLINE for 5–14 days if therapy is compatible
- PICC for >14 days or when central access is required
- Avoids unnecessary PICC placements
- Reduces complications and cost

8. MAGIC Device Selection Algorithm

9. MAGIC and CLABSI Prevention

A primary driver behind MAGIC's development was reducing unnecessary central line use and its associated risk of Central Line-Associated Bloodstream Infections (CLABSI). Every unnecessary central line represents preventable patient harm.

10. Applying MAGIC in Clinical Practice — The Decision Framework

When evaluating a patient for vascular access device selection, MAGIC recommends asking these questions in order :

- How long will IV therapy be needed? (Primary decision driver — duration)
- What specific medications or solutions will be infused? (Vesicant? pH? Osmolarity?)
- What is the osmolarity and pH of the prescribed therapy? (Detailed medication review)
- Are any medications vesicants or irritants? (Requires central access if yes)
- What is the current condition of the patient's peripheral veins? (Assess vascular access)
- Does the patient have any conditions that affect device selection? (Renal disease, mastectomy, thrombosis history, coagulopathy?)
- What is the least invasive device that will safely meet ALL of the patient's clinical needs? (Final selection — avoid over-treatment)

11. Special Patient Populations and MAGIC Considerations

Renal Disease Patients — Vein Preservation

Patients with chronic kidney disease or end-stage renal disease are candidates for hemodialysis and require arteriovenous fistulas. MAGIC specifically recommends preserving forearm veins (basilic, cephalic) in these patients:

Patients with Mastectomy and Axillary Lymph Node Dissection

Cancer patients who have had mastectomy with axillary lymph node dissection have impaired lymphatic drainage on the affected side. MAGIC recommends:

12. Common MAGIC Misapplications — What NOT to Do

- "Non-vesicant antibiotic × 4 days? PIV is appropriate"
- "Antibiotic × 8 days, compatible meds? Consider MIDLINE"
- "Vesicant chemo or TPN? Central access (PICC/CVC) required"
- "Uncertain about duration? Start with PIV, escalate if needed"
- "Remove device when no longer needed" — Daily assessment required

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. What does MAGIC stand for?
2. What is the primary goal of the MAGIC guidelines?
3. According to MAGIC, a PIV is appropriate for therapy lasting how long?
4. What osmolarity threshold requires central venous access according to MAGIC?
5. According to MAGIC, a midline catheter is most appropriate for therapy lasting:
6. Which of the following medications REQUIRES central venous access according to MAGIC?
7. What was one of the primary drivers behind developing MAGIC?
8. A patient needs IV antibiotics for 10 days. The medication is non-vesicant with osmolarity of 600 mOsm/L. According to MAGIC, what is...
9. Is a midline catheter considered a central venous access device?
10. According to MAGIC, which patient factor should prompt consideration of a midline or PICC instead of a PIV?
11. Which solution characteristic requires central venous access according to MAGIC?
12. TPN administration according to MAGIC requires:
13. What methodology was used to develop the MAGIC guidelines?
14. Studies show that implementing MAGIC criteria reduces unnecessary PICC placements by up to:
15. Which of the following is a MAGIC-appropriate use of a PICC line?
16. According to MAGIC, which question should be asked FIRST when selecting a vascular access device?
17. Why does MAGIC specifically address renal disease patients?
18. According to MAGIC, which device is described as the 'middle ground' between PIV and PICC?
19. Before MAGIC, what was the primary basis for vascular access device selection?
20. Which of the following is NOT a patient factor considered in MAGIC device selection?
21. A patient needs continuous hemodynamic monitoring. According to MAGIC, what device is appropriate?
22. Which INS 2024 Standard aligns most closely with MAGIC principles?
23. A midline catheter CANNOT be used for which of the following?
24. According to MAGIC, what is the least invasive principle of device selection?
25. Which of the following scenarios is INCONSISTENT with MAGIC guidelines?
26. What osmolarity limit applies to midline catheters according to MAGIC?
27. A solution with pH 3.2 and osmolarity 280 is ordered for a patient. What device does MAGIC recommend?
28. Why does MAGIC recommend avoiding mastectomy-side arm vascular access?