

Central Line-Associated Bloodstream Infection (CLABSI): Central Venous Catheter Appropriateness



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Learning Objectives

- Define central venous catheter (CVC) appropriateness
- Use clinical case studies to apply tools for determining CVC appropriateness
- Explain how an algorithm can be used when patients have difficult venous access



Appropriateness Definition

A procedure is considered appropriate when the net benefit is much greater than the net harm, regardless of cost

CVC appropriateness:

When should a patient have a CVC placed?

If the determination for CVC is made, what type of CVC is most appropriate?

How many lumens?

What gauge?

What anatomic site?



Common Indications for CVC and Peripherally Inserted Central Catheter (PICC) Placement

Administration of vasopressors, chemotherapy or total parenteral nutrition (TPN)

Extended course of intravenous (IV) antibiotics

Support high-volume flow for therapy such as hemodialysis

Hemodynamic monitoring in critically ill patients

Provide venous access for placement of devices, such as cardiac pacemaker

Inadequate peripheral venous access

Need for frequent blood draws



(Lee-Llacer J, Lippincott Williams & Wilkins, 2012)



Limitations of Static Indications

Do not distinguish between types of CVCs

Risk of complication vary

Insertion versus downstream risk

Types of complication vary

Infectious versus thrombotic

Operator skill vary

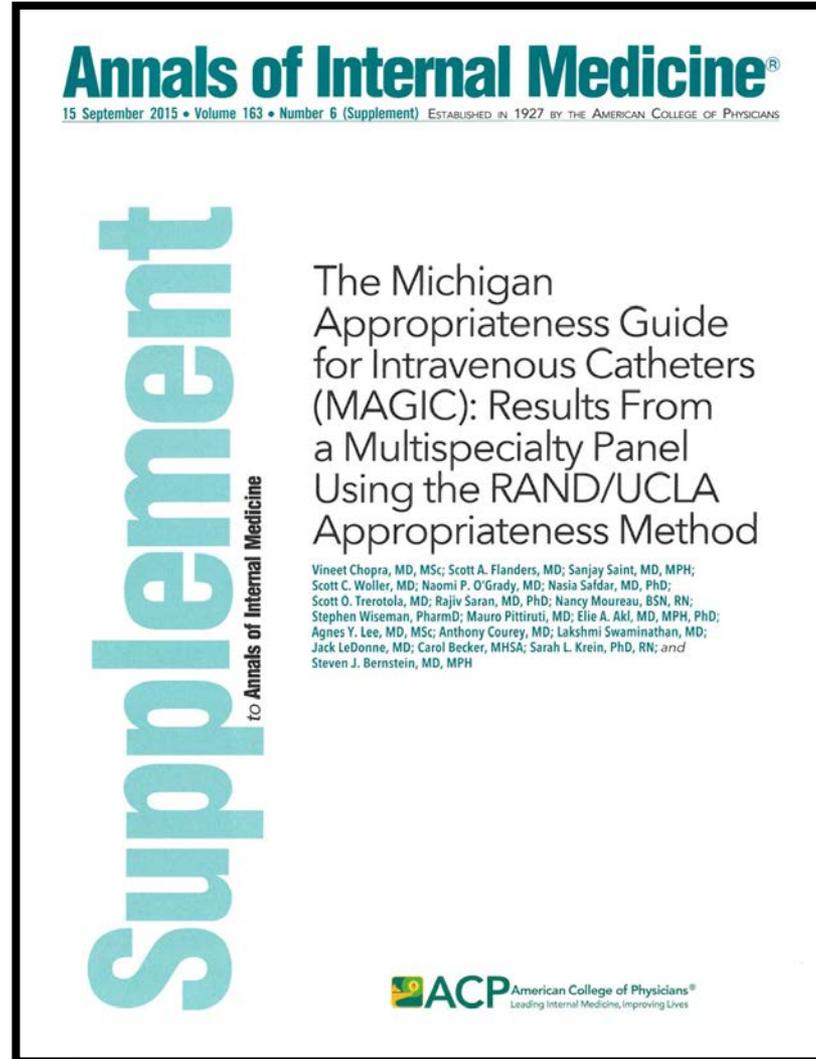
Availability of specific devices vary

Static recommendations do not account for duration of use

Duration should influence CVC choice



Michigan Appropriateness Guide for Intravenous Catheters



Appropriateness Criteria for Use of Venous Access Devices

The Michigan Appropriateness Guide for Intravascular Catheters (MAGIC)

Expert panel of 15

Included vascular access nurses; physicians trained in internal medicine, infectious disease, critical care, nephrology, hematology/oncology, surgery and interventional radiology; and a pharmacist and patient panelist

RAND/UCLA Appropriateness Methodology

677 scenarios involving use of 7 common venous access devices

Developed recommendations for when to use a PICC versus other venous access devices

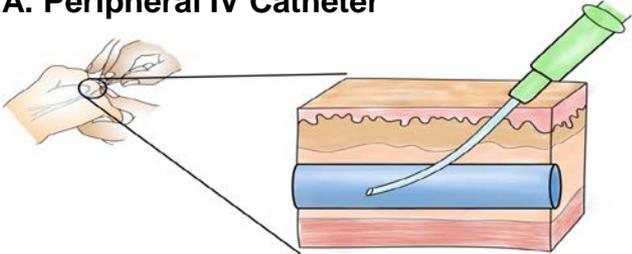


(Chopra V, Ann Intern Med, 2015)

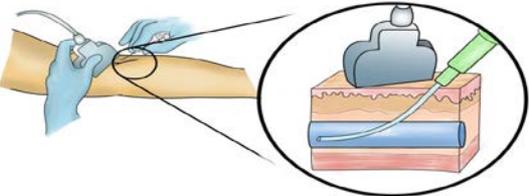


CVC Types

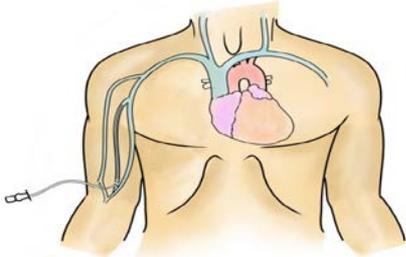
A. Peripheral IV Catheter



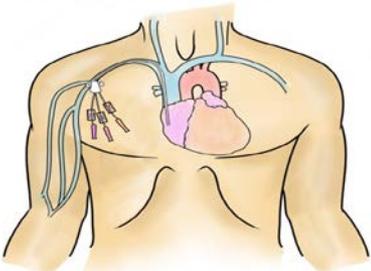
B. US-Guided Peripheral IV Catheter



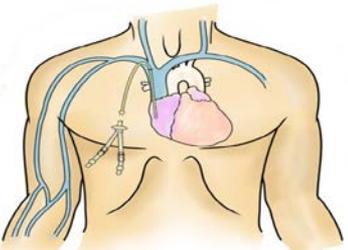
C. Midline Catheter



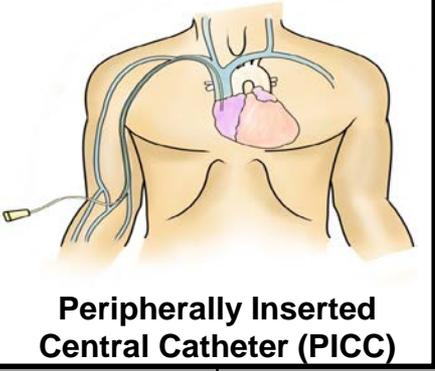
D.1 Non-Tunneled Central Venous Catheter



D.2 Tunneled Central Venous Catheter



Peripherally Inserted Central Catheter (PICC)



E. Implanted Port

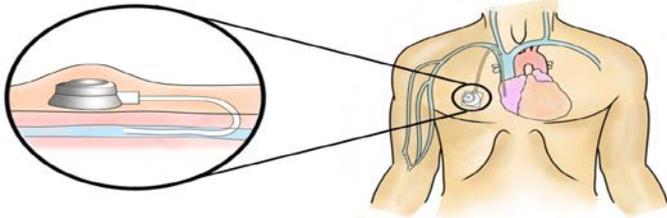


Figure 1. Venous Access Device Appropriateness Ratings For Infusion of Peripherally-Compatible Therapies In General Hospitalized Patients

Device Type	Proposed Duration of Infusion			
	≤ 5 days	6-14 days	15-30 days	≥31 days
Peripheral IV Catheter	<i>No preference between peripheral IV and USG PIV for use ≤ 5 days</i>			
Ultrasound Guided Peripheral Catheter	<i>USG Peripheral Catheters preferred to PIVs if proposed duration 6-14 days</i>			
Non-tunneled/Acute Central Venous Catheter	<i>Central Venous Catheters preferred in critically ill patients or if hemodynamic monitoring is needed for 6-14 days</i>			
Midline	<i>Midline preferred to PICC if proposed duration ≤14 days</i>			
PICC		<i>PICC preferred to midlines if proposed duration of infusion ≥ 15 days</i>		
Tunneled Catheter				<i>PICC preferred to tunneled catheters & ports for infusions 15-30 days</i>
Port				

Appropriate
Neutral
Inappropriate
Disagreement



(Chopra V, Ann Intern Med, 2015)



Figure 2. Venous Access Device Appropriateness Ratings for Infusion of Vesicants or Irritants (Non-chemotherapy) in General Hospitalized Patients

Device Type	Proposed Duration of Infusion			
	≤ 5 days	6-14 days	15-30 days	≥31 days
Peripheral IV Catheter	Inappropriate	Inappropriate	Inappropriate	Inappropriate
Ultrasound Guided Peripheral Catheter	Inappropriate	Inappropriate	Inappropriate	Inappropriate
Non-tunneled/Acute Central Venous Catheter	Central Venous Catheters preferred in critically ill patients or if hemodynamic monitoring is needed for 6-14 days		Inappropriate	Inappropriate
Midline	Inappropriate	Inappropriate	Inappropriate	Inappropriate
PICC	PICCs rated as appropriate at all proposed durations of infusion			
Tunneled Catheter	Inappropriate	Tunneled catheter neutral for use ≥ 15 days	No preference between tunneled catheter and PICC for proposed durations ≥ 15 days	
Port	Inappropriate	Inappropriate	Inappropriate	No preference between ports, tunneled catheters or PICCs for ≥ 31 days

Appropriate

Neutral

Inappropriate

Disagreement



(Chopra V, Ann Intern Med, 2015)



Clinical Cases for CVC Appropriateness



Case 1: Mr. Mantegna

Mr. Mantegna is a 68-year-old man who is admitted to the ICU with streptococcal sepsis and respiratory failure. He is intubated and hypotensive. He now needs vasopressor support and invasive blood pressure monitoring.

What type of access is most appropriate for this patient?

- a. Tunneled CVC
- b. Non-tunneled acute CVC
- c. PIV
- d. Ultrasound-guided peripheral catheter

Disclaimer: All case studies are hypothetical and not based on any actual patient information. Any similarity between a case study and actual patient experience is purely coincidental.



Figure 2. Venous Access Device Appropriateness Ratings For Infusion of Vesicants or Irritants

Device Type	Proposed Duration of Infusion			
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Peripheral IV Catheter	Inappropriate	Inappropriate	Inappropriate	Inappropriate
Ultrasound Guided Peripheral Catheter	Inappropriate	Inappropriate	Inappropriate	Inappropriate
Non-tunneled/Acute Central Venous Catheter	<i>Central Venous Catheters preferred in critically ill patients or if hemodynamic monitoring is needed for 6-14 days</i>		Inappropriate	Inappropriate
Midline	Inappropriate	Inappropriate	Inappropriate	Inappropriate
PICC	<i>PICCs rated as appropriate at all proposed durations of infusion</i>			
Tunneled Catheter	Inappropriate	Neutral	<i>No preference between tunneled catheter and PICC for proposed durations ≥ 15 days</i>	
Port	Inappropriate	Inappropriate	Inappropriate	<i>No preference between ports, tunneled catheters or PICCs for ≥ 31 days</i>

Appropriate

Neutral

Inappropriate

Disagreement



Case 2: Ms. Bond

Ms. Bond is a 49-year-old woman with worsening back pain. She is admitted to the hospital and found to have MSSA vertebral osteomyelitis. ID is consulted and recommends a total of 6 weeks of IV cefazolin. She currently has only one peripheral IV catheter. She is ready for discharge.

What type of CVC will be best for her antibiotic course?

- a. Internal jugular CVC
- b. Peripheral IV catheter
- c. Subclavian CVC
- d. Midline catheter
- e. PICC

Disclaimer: All case studies are hypothetical and not based on any actual patient information. Any similarity between a case study and actual patient experience is purely coincidental.



Figure 1. Venous Access Device Appropriateness Ratings For Infusion of Peripherally-Compatible Therapies In General Hospitalized Patients

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Port				

Appropriate
Neutral
Inappropriate
Disagreement



Case 3: Mr. Watt

Mr. Watt is a 78-year-old man admitted to the medical/surgical ward following a post-gastric bypass surgical incision dehiscence. Multiple attempts to obtain a peripheral IV by various staff have failed. The nurse asks for a PICC placement.

Is placement of a PICC appropriate in this setting?

- a. Yes
- b. No
- c. Unsure

Disclaimer: All case studies are hypothetical and not based on any actual patient information. Any similarity between a case study and actual patient experience is purely coincidental.



Difficult IV Access

PICC often used when peripheral IV cannot be placed

Selection of a PICC should not occur without considering appropriateness of use, including:

- Duration

- Infusion

- Patient Characteristics

Alternatives to PICCs should be considered

An algorithm can be helpful



Alternatives to PICC

Peripheral IV catheter (PIV) with Vein Finder

Ultrasound-guided PIV

Midline catheter

Short-term Non-tunneled CVC

Tunneled Catheter

Port



Other Considerations

Lumens

More lumens is not better

As number of lumens increase, so does gauge/thickness and risk of thrombosis

As number of lumens increase, so does risk of infection

Removal protocols may help

CVCs should be removed as soon as clinically reasonable to limit risk of complications

(Chopra V, Am J Med 2014; Chopra V, J Thromb Haemost, 2014; Evans RS, Chest, 2013; Shah H, Neurohospitalist, 2013)



Limitations

- Each patient is different
- These are general approaches
- When choosing CVCs, consider site, lumens, and gauge to prevent harm
- Evidence base for CVC and PICC use is limited
 - MAGIC provides input
 - Recommendations primarily designed to guide PICC use, but applicable to CVC use in ICU settings



Take-Home Points

- Appropriateness of CVC depends on patient, device and provider characteristics
- The MAGIC Guide can help decide if a CVC is appropriate and which type of CVC is best
- Alternatives to CVCs include peripheral IV catheters and midlines
- Remove CVCs as soon as possible



References

Chopra V, Flanders SA, Saint S, et al. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): results from a multispecialty panel using the RAND/UCLA appropriateness method. *Ann Intern Med.* 2015; 163(6): S1-S40.

Chopra V, Ratz D, Kuhn L, et al. Peripherally inserted central catheter-related deep vein thrombosis: contemporary patterns and predictors. *J Thromb Haemost.* 2014; 12(6): 847-54.

Chopra V, Ratz D, Kuhn L, et al. PICC-associated bloodstream infections: prevalence, patterns, and predictors. *Am J Med.* 2014; 127(4): 319-28.

Evans RS, Sharp JH, Linford LH, et al. Reduction of peripherally inserted central catheter-associated DVT. *Chest.* 2013; 143(3): 627-33.



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- Lee-Llacer J, Seneff MG. Chapter 2: Central Venous Catheters. *Irwin and Rippe's Intensive Care Medicine*. 2012; 7: 16-33.
- Shah H, Bosch W, Thompson KM, et al. Intravascular catheter-related bloodstream infection. *Neurohospitalist*. 2013; 3(3): 144-51.
- Simonov M, Pittiruti M, Rickard CM, et al. Navigating venous access: a guide for hospitalists. *J Hosp Med*. 2015; 10(7): 471-8.



Speaker Notes



Speaker Notes: Slide 1

This module, titled “Central Venous Catheter Appropriateness,” will review when central venous catheters are appropriate by reviewing existing guidelines on general indications and how to choose the best central venous catheter for a patient if one is necessary.



Speaker Notes: Slide 2

This module was developed by national infection prevention experts devoted to improving patient safety and infection prevention efforts.



Speaker Notes: Slide 3

This module will review when placing a central venous catheter—a CVC—is appropriate. The clinical scenarios in this module will teach you to use this information and other tools, including an algorithm, to help you the next time you need to make a decision about using a CVC.



Speaker Notes: Slide 4

Let's start with some definitions.

Appropriateness, in terms of medical procedures, is when the net benefit of having a procedure outweighs the net harm.

Specifically with placement of a CVC, indications for the CVC should outweigh the harms that can be associated with placement such as developing a CLABSI.

Appropriateness also applies to the location of the CVC, lumen size and gauge size, which can all affect risk of developing infection.



Speaker Notes: Slide 5

According to the literature, situations in which there is greater benefit than harm to placing a central line include:

- Administration of irritants such as vasopressors, chemo or total parenteral nutrition (TPN);
- Extended course of IV antibiotics
- Support of high-volume flow for therapy such as hemodialysis;
- Hemodynamic monitoring in critically ill patients;
- Providing venous access for placement of a device, such as a pacemaker; and
- Inadequate peripheral venous access.



Speaker Notes: Slide 6

Using these indications can be challenging because each patient is different, each hospital is different and operator skill of healthcare personnel placing the line can vary, so static indications are not perfect. In addition, few recommendations have taken into account duration of catheter use.



Speaker Notes: Slide 7

With these limitations in mind, a group of experts led by Dr. Vineet Chopra at the University of Michigan and Ann Arbor VA came up with a new guideline called MAGIC—The Michigan Appropriateness Guide to Intravenous Catheters—to help clinicians make a choice about what type of CVC to use.

The next slides will go into the best way to use the MAGIC guide within your clinical practice. This is an excellent tool to use the next time you have to make a decision about a non-emergent central line.



Speaker Notes: Slide 8

To develop these guidelines, fifteen experts were gathered to make up an expert panel: this included vascular access nurses; physicians trained in internal medicine, infectious diseases, critical care, nephrology, hematology/oncology, surgery and interventional radiology; as well as a pharmacist and patient panelist. Using a methodology that helps guide decision making in medicine called the RAND/UCLA Appropriateness methodology, they looked at 677 scenarios and agreement of the panel was tracked to help come up with the final recommendation.



Speaker Notes: Slide 9

The recommendations within this guideline are particularly helpful for when a PICC is indicated, but also include other CVCs, such as non-tunneled CVCs.

This slide illustrates the catheters discussed within the guideline. Images A, B and C are not considered central lines, but can often be used to avoid placing a central line if not indicated.

Using a vein finder or ultrasound, a peripheral IV catheter is often a good alternative when working with a patient who is difficult to access. Midlines are also a good alternative to a central line.



Speaker Notes: Slide 10

Here's a helpful graphic from the MAGIC guide.

As the title of the figure indicates, this is a useful graphic for patients who need infusions, like antibiotics, that can be given peripherally. Let's say you are looking at a patient who will need 12 more days of ceftriaxone. Go to the 6-14 days column. The yellow box at peripheral IV (PIV) indicates this was not considered appropriate or inappropriate by the group of experts. However, ultrasound guided peripheral catheters, non-tunneled acute CVC such as an IJ (internal jugular) or subclavian would be fine as well—but only if the patient is critically ill or hemodynamic monitoring is also needed. A midline seems to be best and is preferred to PICC since we only need it for 12 days.



Speaker Notes: Slide 11

This is another helpful graphic from MAGIC. As the title suggests, this is aimed at patients who will be getting an irritating solution through their IV, such as vancomycin.

Let's say you have a patient who is going to need three weeks of vancomycin for a shoulder infection. We see right away that PIVs, ultrasound guided PIVs, non-tunneled acute CVCs and midlines are considered inappropriate. Looking in the 15-30 days column, we see that a PICC line would be appropriate for this patient.



Speaker Notes: Slide 12

Next, we will use examples from the MAGIC guide to go through a formal clinical case.



Speaker Notes: Slide 13

Case 1: Mr. Mantegna is a 68-year-old man who is admitted to the ICU with streptococcal sepsis and respiratory failure. He is intubated and hypotensive. He now needs vasopressor support and invasive blood pressure monitoring.

What type of access is most appropriate for this patient?

- a. Tunneled CVC
- b. Non-tunneled acute CVC
- c. PIV
- d. Ultrasound-guided peripheral catheter



Speaker Notes: Slide 14

You know from the case presentation that Mr. Mantegna is acutely sick. He's in the ICU and not a general medical-surgical patient. He is also on vasopressors. Go to this table: the best option for him is a non-tunneled/acute central venous catheter.



Speaker Notes: Slide 15

Case 2: Ms. Bond is a 49-year-old woman with worsening back pain. She is admitted to the hospital in the medical/surgical ward and found to have methicillin sensitive *Staph aureus*, or MSSA vertebral osteomyelitis. Infectious diseases is consulted and they recommend a total of six weeks of IV cefazolin. She currently has only one peripheral IV catheter. She is ready for discharge. Which type of CVC will be best for her antibiotic course?

The options are:

- a. Internal jugular CVC
- b. Peripheral IV catheter
- c. Subclavian CVC
- d. Midline catheter
- e. PICC



Speaker Notes: Slide 16

In this case, Ms. Bond is on the medical/surgical ward and is hemodynamically stable, but will need a long course of antibiotics for her bone infection. The suggested antibiotic is not an irritant antibiotic and would be peripherally compatible so we look at this graphic.

According to the graphic, Ms. Bond will need more than 31 days of antibiotics. A PICC line is the preferred CVC for her.



Speaker Notes: Slide 17

Case 3: Mr. Watt is a 78-year-old man admitted to the medical/surgical ward following a post-gastric bypass surgical incision dehiscence. Multiple attempts to obtain a PIV by various staff have failed. The nurse asks for a PICC placement.

Is placement of a PICC appropriate in this setting?



Speaker Notes: Slide 18

The case presented here is a common scenario. PICC lines are often used when a peripheral IV cannot be placed. Before going straight to a PICC line, which is a central line, the medical team should consider how long access will be needed, what the access is for and patient characteristics.

Alternatives to PICCs should be considered, if possible.

An algorithm can be very helpful in decision making.



Speaker Notes: Slide 19

Often alternatives like a peripheral IV catheter placed with a vein finder, ultrasound guided PIV or a midline may be a choice that presents less risk for the patient.

Other central venous catheters that may be better could include a short-term CVC, or a tunneled catheter or port depending on the treatment.



Speaker Notes: Slide 20

Another consideration before placing a central line is lumen size. Research has shown CLABSI risk increases with the number of lumens. As lumens increase, so does the gauge and thickness of the line and the risk of a thrombosis. In addition to appropriateness of central line placement, once it is placed, health care teams should be focused on when the central line is no longer needed and should promptly remove unnecessary lines to avoid infection.



Speaker Notes: Slide 21

Each patient is different, and these approaches should be understood as general guidance rather than the rule. When choosing a CVC, always consider site, lumens and gauge size to prevent harm.

Remember the evidence base for CVC and PICC use is limited, but the MAGIC guide can provide some input and may help you in decision making.



Speaker Notes: Slide 22

As you consider integrating interventions to include a review of clinical indications and alternates to CVCs remember that:

- Appropriateness of CVC depends on patient, device and provider characteristics;
- Using clinical approaches like the ones highlighted in this course may help you make the best choice;
- Alternative options to CVCs include PIVs with help of a vein finder or ultrasound to guide placement and midlines;
- And most importantly, if a CVC needs to be placed, remember to remove it as soon as clinically possible to limit the risk of complications.



Speaker Notes: Slide 22 Continued

We know that approximately 23,500 CLABSI cases occur with an annual mortality rate from 12 to 25 percent. Avoiding placement of and removing a CVC when not indicated makes getting to zero infections more of a reality.



Speaker Notes: Slide 23

No notes.



Speaker Notes: Slide 24

No notes.

