



**Science.  
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# **An Evidence-Based Guide to PIVCs.**

**Helping to enable better, smarter and safer  
clinical practice and outcomes when using  
peripheral intravenous catheters.**



# Bringing more attention to peripheral intravenous catheters.

Peripheral intravenous catheters (often abbreviated as PIVCs, PIVs or PVCs) are commonly used vascular access devices that deliver vital fluids and medications to patients across care settings. They're critical for patient care, but they can also come with risks. When placed improperly, misused or not cared for, PIVCs can affect health care costs significantly in terms of patient quality of life, morbidity, mortality and treatment expenses, particularly when coupled with increased length of hospital stay.<sup>1,2</sup>

Even though the reported incidence of bloodstream infections (BSIs) is lower in PIVCs compared to central venous catheters (CVCs), PIVCs are much more commonly used. The number of PIVC-BSIs is high because of the high number of patients undergoing PIVC insertion.<sup>3,4</sup>

Placement of a PIVC is one of the most common invasive medical procedures performed worldwide. It may also be one of the greatest sources of patient dissatisfaction, as well as patient and nurse anxiety.<sup>5</sup>

This guide and references are intended to be used as a resource for all members of the healthcare team involved in the assessment and management of PIVCs. It should be used in conjunction with good clinical practice. It is not intended for patient diagnosis or treatment.

## PIVCs are not innocuous.

CVCs often get more attention, but the cumulative duration of PIVC insertion is 15 times greater.<sup>3,4</sup>

Here are a few reasons to focus on PIVC maintenance:



Up to  
**90%**  
of inpatients have  
PIVCs inserted<sup>6</sup>



A failure rate of  
**63%**  
with a mean and  
median of 46% and  
43%, respectively<sup>6</sup>



**7-20**  
additional days in  
the hospital due  
to complications  
and infections<sup>6</sup>



**\$56K USD**  
additional cost per  
patient for catheter-  
related complications<sup>6</sup>



**81%**  
of health systems rate  
nurse PIVC competency  
as 'novice'<sup>7</sup>

# Common reasons why PIVCs fail.<sup>6</sup>

Knowing why PIVCs fail can help care teams identify future risks and areas where additional support is needed. Data shows that these three causes can lead to or contribute to PIVC failure.



**Caregiver's skills** during insertion, maintenance and care



**Technology used**, such as catheter material, dressing, securement device and add-ons



**Intrinsic patient factors**, such as comorbidities, body's response and activity

## The 5 modes of PIVC failure.<sup>6</sup>

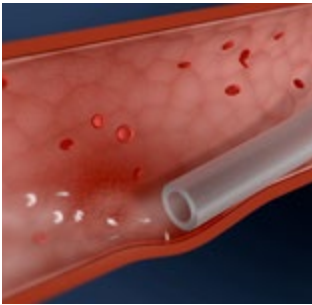
When PIVCs do fail, these are the most common complications patients face.

Complication	Range	Mean	Median
Catheter-related infection	0.0%-0.44%	0.2%	0.2%
Catheter-related phlebitis	0.1%-63.3%	15.4%	9.0%
Catheter mechanical failure	2.5%-32.7%	18.8%	22.8%
Catheter dislodgement	3.7%-9.9%	6.9%	7.0%
Catheter infiltration	15.7%-33.8%	23.9%	22.2%

*Prospective Randomized Controlled Studies, 1990-2014.*

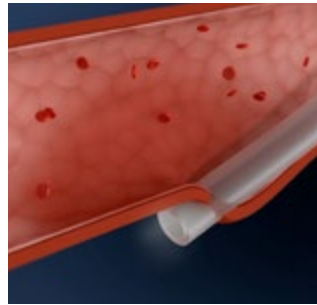


# Signs and symptoms of PIVC complications.



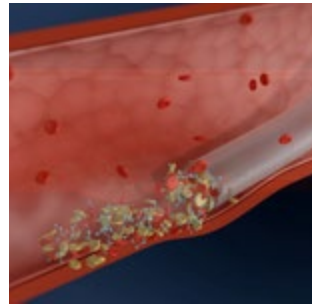
## Phlebitis

- ▶ Inflammation of the vein from mechanical, chemical, or bacterial sources<sup>8</sup>
- ▶ May present with pain, erythema, edema, streak formation, palpable venous cord, or purulent drainage<sup>8</sup>



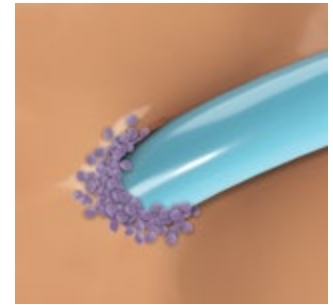
## Infiltration and extravasation

- ▶ The accidental infusion of fluid into the tissue, differentiated by infiltration being the infusion of a non-vesicant and extravasation being a vesicant<sup>8</sup>
- ▶ May present with pain, leaking from the insertion site, vesicle formation, swelling, edema, changes in color such as blanching or redness, changes in temperature such as cooling or warmth<sup>8</sup>



## Thrombophlebitis

- ▶ Inflammation of the vein secondary to the formation of a blood clot
- ▶ Signs and symptoms may be similar to phlebitis; pain, erythema, edema, streak formation, palpable venous cord



## Catheter-Associated Bloodstream Infection (CABSI)

- ▶ Bloodstream infection from any vascular access device including central vascular access device and peripheral intravenous catheters<sup>8,9</sup>
- ▶ May present with changes in body temperature, rigors, insertion site abnormalities such as pain, swelling, discharge, altered mental status, hypotension, and abnormal blood laboratory results<sup>8,9</sup>

## Extravasation prevention through infusate assessment.

An important step in preventing and managing extravasation is the recognition of vesicant infusates.



**Know your infusates and review** the provided drug information and a known vesicant list. Consult the pharmacist for drug information.<sup>10</sup>



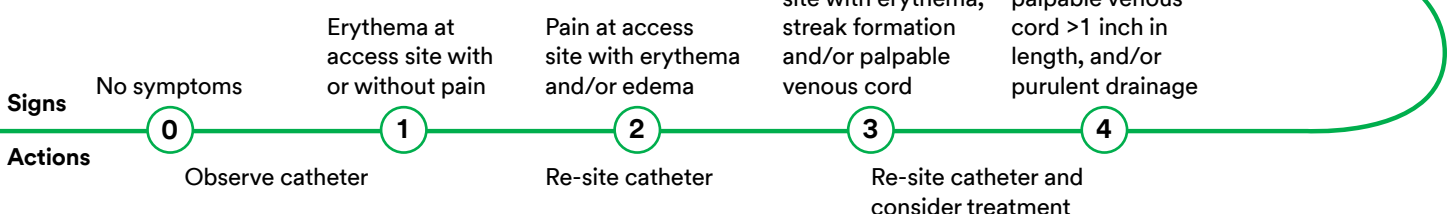
**Address infiltration and extravasation prevention** and management in policies and procedures.<sup>10</sup>



**Develop an extravasation checklist** that outlines risk reduction strategies, including early recognition of signs and symptoms.<sup>10</sup>

## Phlebitis scale<sup>8</sup>

Use the phlebitis scale to provide guidance on a visual rating system that can help you properly observe and treat phlebitis.



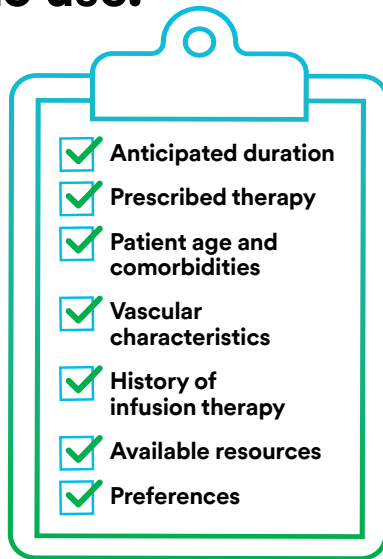
# Following best practice guidance can help to reduce the risk of PIVC complications.



While not intended to provide medical advice or replace facility protocols, this guide pulls from over 30 articles of clinical evidence to give your team more evidence-based PIVC education and information.

## Determining the right PIVC type and insertion method to use.<sup>8</sup>

The PIVC type you select should factor in the following considerations:



### Short peripheral intravenous catheter

For superficial peripheral veins, extremities, and scalp veins in neonates when the anticipated duration of therapy is less than five days<sup>8</sup>



### Long peripheral intravenous catheter

For use when a short PIVC isn't long enough to be inserted into the patient's superficial or deep peripheral veins<sup>8</sup>



### Midline catheter

For use when the anticipated duration of therapy is 5-14 days<sup>8</sup>

## Summary of PIVCs<sup>10-11,14</sup>

Type	Catheter characteristics	Insertion Method	Use	Anticipated dwell	Description
<b>PIVC</b>	<ul style="list-style-type: none"> <li>▶ Short (1.2"-2.3"; 3-6 cm)<sup>11,14</sup></li> <li>▶ Long (2.3"-6"; 6-15 cm)<sup>11,14</sup></li> </ul>	Direct visual approach of visual aid technology	<ul style="list-style-type: none"> <li>▶ Non-vesicant</li> <li>▶ Non-irritant</li> <li>▶ General purpose</li> <li>▶ Not intended for high osmolarity and/or extreme pH (&lt;5 or &gt;9)<sup>12,13</sup></li> </ul>	<ul style="list-style-type: none"> <li>▶ Five days or less</li> <li>▶ Removal when clinically indicated</li> </ul>	<ul style="list-style-type: none"> <li>▶ Very common</li> <li>▶ Low cost and lower infection risk</li> <li>▶ Placed by most health care professionals</li> <li>▶ Less invasive than central access</li> <li>▶ Consider using visual aid technology after multiple failed attempts, if there's an inability to identify veins or for difficult intravenous access (DIVA)</li> </ul>
<b>Midline catheter</b>	<ul style="list-style-type: none"> <li>▶ Midline (2.7"-10"; 7.5-25 cm)<sup>14</sup></li> </ul>	Ultrasound-guided technology	<ul style="list-style-type: none"> <li>▶ Non-vesicant</li> <li>▶ Non-irritant</li> <li>▶ DIVA patients</li> <li>▶ Not intended for high osmolarity and/or extreme pH (&lt;5 or &gt;9)<sup>12,13</sup></li> </ul>	<ul style="list-style-type: none"> <li>▶ Five to fourteen days</li> <li>▶ Removal when clinically indicated</li> </ul>	<ul style="list-style-type: none"> <li>▶ Single-lumen midline is preferred</li> <li>▶ For DIVA patients despite ultrasound-guided PIVC attempts</li> </ul>

# Consider a bundled approach to help reduce the risk of PIVC complications.<sup>8</sup>

You can't mitigate every risk factor. However, you can consider a bundled, best practice approach to PIVC care. Bundles are straightforward sets of evidence-based practices. When performed collectively and reliably, bundles have been shown to help improve patient outcomes.<sup>15</sup>

Given the success of bundles in helping to prevent BSIs in CVCs, bundles have also been promoted for PIVC use.<sup>12,16,17</sup> With more than 2,500 cited references and 120 reviewers from 14 countries, the Infusion Nurses Society's *Infusion Therapy Standards of Practice* provide a solid foundation to help develop PIVC insertion, maintenance and removal bundles.



## Insertion bundle.

All PIVC insertions should be done by a care team trained in these practices, and include documentation, care planning and patient education. (Std. 26, pg. S74)<sup>8</sup>

- 1 Use aseptic non touch technique** for all vascular access and infusion therapy procedures. Prepare the procedure tray and protect it from contamination. (Std. 18, pg. S56)<sup>8</sup>
- 2 Remove excess hair** around the site of insertion with single-use scissors or surgical clippers with a disposable head. (Std. 33, pg. S96)<sup>8</sup>
- 3 Perform skin antisepsis** using a single-use applicator containing antiseptic solution. (Std. 33, pg. S96)<sup>8</sup>
- 4 Select the appropriate catheter type and insertion site** for the prescribed therapy and patient. Avoid the wrist and areas of flexion. (Std. 27, pg. S81)<sup>8</sup>
- 5 Correctly apply** the appropriate securement dressing, securement device, short extension set and needleless connector. (Std. 38, pg. S109)<sup>8</sup>

### Additional considerations:

- ▶ Do not touch PIVC or associated equipment. Do not repalpate the insertion site. If repalpation is required after skin antisepsis use sterile gloves and adhere to surgical aseptic non touch technique principles.
- ▶ Personal protection equipment (gloves, mask, etc) is recommended anytime you are manipulating PIVCs and related equipment.
- ▶ Dispose of sharp immediately after its removal into a biohazard container that cannot be tampered with or punctured.
- ▶ Flush the PIVC with sterile, preservative free, 0.9% sodium chloride to maintain patency.

## Crucial hand hygiene moments.<sup>18</sup>

The World Health Organization (WHO) provides hand hygiene recommendations that should be incorporated into patient care. Below is an abbreviated list with full recommendations available on the WHO website.



- Before touching a patient
- Before clean/aseptic procedure
- After body fluid exposure risk
- After touching patient
- After touching patient surroundings



# Maintenance bundle.

Comprehensive, routine assessment, combined with a commitment to safety and quality, is important for the early detection and management of complications. With a maintenance bundle based on the following steps and considerations, you can help reduce the risk of catheter-related infections. (Std. 42, pg. S119)<sup>8</sup>

Help empower patients by providing knowledge on treatments, tools, procedures, rationales and signs and symptoms of PIVC complications.

- 1 Assess the insertion site**, entire infusion system, and patient at least every 4 hours. Assessment may be more frequent (every 1 to 2 hours) for those critically ill, sedated, or those with cognitive deficits. Assess hourly for pediatric and neonate patients. Assess more frequently for vesicant infusions. (Std. 42, pg. S119)<sup>8,19</sup>
- 2 Use non-sterile gloves** using standard aseptic non-touch technique. Use sterile gloves if key-sites (such as the insertion site) or key-parts must be touched. (Std. 18, pg. S56)<sup>8</sup>
- 3 Prepare skin at each dressing change** with 2% chlorhexidine gluconate in 70% alcohol following the manufacturer's instructions for use. (Std. 33, pg. S96)<sup>8</sup>
- 4 Change and correctly apply all components of the PIVC system;** securement dressing, extension set, needleless connector, etc. (Std. 36, pg. S105; Std. 37, pg. S107; Std. 38, pg. S110; Std. 42, pg. S119)<sup>8</sup>
- 5 Disinfect needleless connector or open female luer** using an active or passive, standardized method, each time the PIVC is accessed. (Std. 36, pg. S105)<sup>8</sup>
- 6 Re-site PIVCs when clinically indicated** and not routinely unless the device-specific manufacturer's instructions indicate otherwise. (Std. 45, pg. S133)<sup>8</sup>

## Additional considerations:

- ▶ Implement a prospective surveillance process for complications. Assess regularly, based on patient population, therapy, risk factors and vascular access site. Implement checks to prevent unnecessary variation in practice.
- ▶ Do not touch the PIVC or associated equipment unless you are compliant with hand hygiene precautions.
- ▶ Personal protection (gloves and mask) is recommended when completing any interaction that requires touching or manipulation of the VAD or associated equipment. A single-use disposable gown or apron is recommended when contact with blood or body fluids is anticipated.<sup>8</sup>
- ▶ Adhere to aseptic non touch technique at all times.
- ▶ Dispose of sharp immediately after its removal into a biohazard container that cannot be tampered with or punctured.
- ▶ Avoid disconnecting or disrupting the infusion unless clinically required.
- ▶ Label administration set with the due date to change: Continuous infusions no more frequently than 96 hours but at least every 7 days. Intermittent and parenteral nutrition infusions every 24 hours. Blood products every 4 hours.

## Assessment forms best practices.

Not all vascular access device assessment forms are as comprehensive as they could be. Abbreviated below, the I-DECIDED<sup>®</sup> clinical tool<sup>20-22</sup> includes evidence-based prompts with corresponding actions to incorporate into your PIVC practice. Full recommendations are available in the study.





# Removal bundle.

Healthcare providers should be trained in PIVC removal processes, including identifying potential complications, appropriate clinical intervention or emergency measures as needed, and patient and caregiver education. (Std. 45, pg. S133)<sup>8</sup>

- 1 Replace PIVCs inserted under emergent conditions** as soon as possible and no later than 48 hours. (Std. 45, pg. S133)<sup>8</sup>
- 2 Remove PIVCs** as soon as no longer clinically indicated. (Std. 45, pg. S133)<sup>8</sup>
- 3 Phlebitis, infiltration, extravasation or signs of local or systemic infection** should prompt PIVC removal. (Std. 47, pg. S143; Std. 50, pg. S154)<sup>8</sup>

## Additional considerations:

- ▶ Always consider your institutional policy for PIVC removal and consult with trained care teams and patients as required.

## Impact of clinically indicated PIVC removal on health economics.

According to a *Journal of Infusion Nursing* evidence-based practice study on before and after implementation, clinically indicated PIVC removal led to no significant PIVC-related infections<sup>23</sup> along with the following outcomes:



# 70

hours of nursing time saved over the course of 3 months

Could save 2 million hours annually<sup>23</sup>



# 14.2%

decrease in PIVC use

Could prevent 6 million PIVC insertions annually within the US<sup>23</sup>



# \$2,100

saved over the course of 3 months

Could save \$60 million annually<sup>23</sup>





## Guidelines and evidence about clinically indicated removal of PIVCs.

Research is evolving regarding clinically indicated removal<sup>1</sup> with some organizations and guidelines, including the Infusion Nurses Society (INS), Centers for Disease Control and Prevention (CDC), Royal College of Nursing and epic3, starting to recommend clinically indicated removal.<sup>8,24-26</sup> Some studies have shown there is a significant increased risk of infections with removing PIVCs when clinically indicated so strategies to mitigate that risk of infection may be appropriate.<sup>27,28</sup> Consult your organization and assess available resources before updating your practices regarding PIVC removal.

Organization	Recommendation
INS (2021) <sup>8</sup>	Yes
CDC (2011) <sup>24</sup>	Pediatrics only
Royal College of Nursing (2016) <sup>25</sup>	Yes
epic3 (2014) <sup>26</sup>	Yes



# Current PIVC clinical guidelines.

	Recommendation	INS 2021 <sup>8</sup>	CDC 2011 <sup>24</sup>
<b>Prepare and assess</b> 	Choose upper extremity for insertion	Forearm preferred for long and short length PIVCs	✓
	Avoid areas of flexion	✓	
	Designate personnel with IV therapy education, training and competency	Infusion vascular access specialists demonstrated lower PIVC complication rates	✓
	Use smallest gauge indicated	✓	
<b>Insertion</b> 	Prepare skin with antiseptic, allow site to dry	Use an alcohol-based CHG skin antiseptic	✓
	Practice aseptic technique	Do not palpate insertion site after skin antiseptis	Do not palpate insertion site after skin antiseptis
<b>Secure and protect</b> 	Consider securement device options for advanced catheter stabilization	✓	✓
	Use a sterile, transparent, semi-permeable polyurethane dressing	✓	✓
	Change dressing at least every 7 days or sooner if compromised	✓	✓
	Visually inspect insertion site at regular intervals	✓	
	Gather/collect data about PIV complications and culture sites when suspected of PIV-infection	✓	
	Disinfect injection port/access site	✓	✓
	Ensure disinfecting supplies are readily available at the bedside to facilitate compliance	✓	
	Disinfect needleless connector and add-on devices with active or passive disinfection cap	✓	
<b>Remove</b> 	Assess daily and remove if no longer included in the plan of care or not used	✓	
	Remove PIV catheters when clinically indicated	✓	CDC does not make a recommendation for adults but does support for pediatrics.
	Remove emergently placed catheters ASAP, within 24–48 hours	✓	✓

# Elevating PIVC care through education, tools and support.

Understanding and implementing these bundles can help you enable better, smarter and safer clinical practice and patient outcomes. As this guide explains, there are many ways you can help improve PIVC maintenance, including:



Being aware of the signs and symptoms of complications



Providing adequate training and education



Understanding interventions



Making documentation thorough and available to care teams



Assessing patients, insertion sites, skin condition, dressings, pain and devices often



Removing unnecessary catheters when treatment is complete and oral medications have been instituted<sup>10</sup>

A consistent approach is critical in helping to reduce complications, improve outcomes and enhance patient satisfaction. It can help you protect every IV line, every time. However, you don't have to do it alone.

## We are here when you need help.

This guide is just a start. 3M is here to help you in your mission of achieving the best possible outcomes with:



Actionable resources



Evidence-based products



Training and education

To get more support or to find education for your team, connect with your 3M Account Manager or visit [3M.com/PIVCare](https://www.3m.com/PIVCare)

# Definitions of related terms:

## **Catheter dislodgement**

When a catheter moves into a suboptimal position out of or into the site of insertion. This may include partial dislodgement, where the tip remains within the vein but in a suboptimal location or total dislodgement, where the catheter is completely removed from the vein.<sup>8</sup>

## **Catheter failure**

Unplanned removal of the vascular access device before the completion of intravenous therapy owing to any of the following complications: infiltration/extravasation, phlebitis, occlusion, partial or total dislodgement, and local/systemic bloodstream infection.<sup>6,8</sup>

## **Clinically indicated peripheral intravenous catheter (PIVC) replacement**

Replacement of a PIVC only if there are clinical indications to do so. Clinical indications include occlusion, pain, redness, infiltration, phlebitis, swelling, leakage, accidental removal, suspected infection, and when the therapy is completed, or the catheter is no longer necessary for the plan of care.<sup>8,29,30</sup>

## **Irritant**

An agent that can cause burning, discomfort, stinging or other pain. This can be caused by irritation in the internal lumen of the vein. There might not be visible signs of vein inflammation externally right away.<sup>8</sup>

## **Necrosis**

Unprogrammed form of cell death that occurs in response to overwhelming chemical or physical tissue insult (e.g., chemical stress, extreme temperature, pressure, toxins, hypoxia, loss of blood supply, and osmotic shock).<sup>31</sup>

## **Non-peripherally compatible**

Do not use short PIVC, long PIVC or midline catheters for repeated or prolonged (> 30 minutes) administration of solutions that are not peripherally compatible (i.e., irritants, vesicant, parental nutrition >850 mOsm/L).<sup>13</sup>

## **Non-vesicant**

Solutions or medications that do not cause tissue damage if accidentally delivered into the tissue right under the skin; However, large amounts of non-vesicant can contribute to tissue damage through compartment syndrome. It wouldn't cause tissue destruction or result in blistering and necrotic tissue.<sup>8</sup>

## **Peripherally compatible solutions**

Solutions with pH 5-9; Drugs or solutions with osmolarity <600 mOsm/L; Parental nutrition with osmolarity <800-850 mOsm/L; Any drug or solution not associated with potential endothelial damage.<sup>13</sup>

## **Vesicant**

An agent that can cause tissue damage if it exists in the surrounding tissue, outside of the intended vascular pathway.<sup>8</sup>



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**3M Company**  
2510 Conway Ave.  
St. Paul, MN 55144 USA

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