Venous Access Device Selection / CVC Protocols / Venous Access in Chronic Kidney Disease

For a printable pocket-card version of the guideline, please see Tools on Evidenced Based Practice site: Venous Access Device Selection Pocket Card

<table>
<thead>
<tr>
<th>Duration of Therapy</th>
<th>Venous Access*</th>
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<td>1–14 days</td>
<td>Peripheral Vein Availability <strong>Good:</strong> PIV or Midline&lt;br&gt;Peripheral Vein Availability <strong>Poor:</strong> Midline, PICC, or CVC</td>
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<tr>
<td>15–30 days</td>
<td>Midline or PICC (inpatient → home-going) or CVC (inpatient only)</td>
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<tr>
<td>31–90 days</td>
<td>PICC or TUNN</td>
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<tr>
<td>&gt; 90 days</td>
<td>PICC, TUNN, or Port (SCAP)</td>
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</table>

*See page 2 and 3 for possible contraindications

Hemodynamic Monitoring

- Pulmonary artery catheter (Swan Ganz).
- Triple lumen, open-ended, PICC line can be used for central venous pressure monitoring.

Definitions

- **CVC** – Central Venous Catheter (Non-tunneled)
  - Any catheter inserted with tip terminating in the vena cava regardless of the site of insertion or intended dwell time.
  - For the purpose of this guideline, CVC means a temporary (< 30 days) catheter inserted by physician or other credentialed clinician. CVCs are inserted in the IJ, subclavian, or femoral veins.
  - Ideally, CVCs are removed within 10 days.

- **PICC** – Peripherally Inserted Central Catheter
  - A central venous catheter inserted by the vascular access team (PICC RN) or radiology team in an upper extremity with tip terminating in the window of the SVC to the cavoatrial junction.
  - Catheter is indicated for short- or long-term use.
  - Dwell time 5–90 days or longer based on functional assessment.

- **PIV** – Peripheral IV.
  - **Midline:** 30 day dwell 8-20cm peripheral IV.
  - IV inserted by qualified personnel with or without ultrasound guidance.
  - Preferred site of insertion is upper extremity.
  - Dwell time depends on device function and patient assessment but at least 96 hours for PIV/30 days Midline.

- **TUNN** – Tunneled Catheter
  - A long-term central venous catheter inserted by a credentialed provider using a subcutaneous tunnel and entering the central circulation, with tip terminating in the window of the SVC and right atrium.
  - Dwell time > 30 days.

- **PORT** – Subcutaneous Access Port
  - A long-term central venous catheter completely implanted under the skin, with tip terminating in the window of the vena cava and right atrium.
  - Dwell time > 90 days.

Possible Contraindications and Tips for Long-Term Catheters Use: PICC, Port, Tunneled

- Acutely septic or febrile within 48 hours.
- Avoid using the subclavian or a PICC in chronic kidney disease (CKD) whenever possible.
- Positive blood cultures without repeat negative blood cultures x 48 hours.
- Ipsilateral mastectomy or lymph node dissection.
- Ipsilateral AV fistula or other dialysis access.
  - Applies more to PICCs than to tunneled lines or other centrally placed lines.
- Ipsilateral PACER / AICD < 3 months old.
- Blood clot in the intended vessel, any vessel in the intended extremity, ipsilateral IJ, or SVC.
- Superior vena cava syndrome.
<table>
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<tr>
<th>Venous Access Device Selection: Categories and Specifications</th>
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<tbody>
<tr>
<td><strong>Catheter Type</strong></td>
</tr>
</tbody>
</table>
| Peripheral Venous Catheter or Midline | • Routine IV therapy with osmolarity < 900mOsm/L. | • PIV  
  o Assessment dependent.  
  • Midline  
  o 30 days. | • PIV  
  o Bedside insertion.  
  • Midline  
  o PICC Nurse only. | • Osmolarity < 900mOsm/L.  
  • Non-caustic, non-hyperosmolar.  
  • Removal by any RN. |
| To order, type “Peripheral” or select order sets; type in “Midline”. | **PICC** | • Routine IV therapy and hypertonic/caustic solutions. | • Indefinite or Temporary  
  • Up to 12 months or longer based on assessment. | • Bedside insertion.  
  • Safe / few complications. | • Vascular access team (PICC Team) to place.  
  o Interventional radiology to place if recommended by vascular access team.  
  • Asymptomatic venous thrombosis is common.  
  • Avoid in chronic renal disease.  
  • Not ideal for same side as implanted device.  
  • Phentoin should not be infused.  
  • Removal by any RN. |
| To order PICC: select order sets; type in “PICC”. Include order sets.  
If IR to place, then type “IR Case”, then, under the procedure search, enter “PICC”.  
Remember to enter the number of lumens in the comments section. | Pulmonary Artery (PA) Catheter | • Accessory lumens used as CVC. | • Remove as soon as catheter is no longer needed. | • Bedside insertion.  
  • Hemodynamic monitoring. | • Placement requires physician or other credentialed provider.  
  • RN with documented competency may remove. |
| To order, type “PA catheter”. | Non-tunneled Antiseptic Coated CVC | • Routine IV therapy and caustic solutions. | • Temporary  
  • Remove as soon as catheter is no longer needed  
  o Ideally, remove within 10 days. | • Bedside insertion.  
  • Longer duration.  
  • Lower colonization rate than CVC without coating. | • Not for outpatient use but some LTAC will accept.  
  • Placement requires physician or other credentialed clinician.  
  • RN with documented competency may remove. |
| To order bedside insertion, type “CVC”, then select “Setup for CVC Placement”. | Tunneled Central Venous Catheter or Power Line | • Routine IV therapy and hypertonic/caustic solutions.  
  • Power injection (power line). | • Indefinite | • Subcutaneous cuff seals skin after 7-10 days.  
  • Power injectable (power line). | • Placement requires physician or other credentialed provider.  
  • Body image concerns for patient.  
  • Removal by IR, or other credentialed provider |
| To order, type “IR case”, then under the procedure search, choose “Insertion CVC Tunneled”.  
Use drop down box to choose catheter and number of lumens. |
<table>
<thead>
<tr>
<th>Catheter Type</th>
<th>Uses</th>
<th>Duration</th>
<th>Advantages</th>
<th>Other Considerations</th>
</tr>
</thead>
</table>
| Subcutaneous Access Port | - Routine IV therapy and hypertonic/caustic solutions.  
- Better for low frequency, intermittent access. | Indefinite | No dressings.  
- Unrestricted activity when not accessed. | Requires access with special, non-coring needle through skin.  
- Lowest rates of bacteremia.  
- Consider for solid tumor chemotherapy.  
- Placement and removal by IR staff or other credentialed clinician.  
- Requires maintenance catheter flush.  
  - See Pharmacy Flush/Dwell Policy. |  |
| Non-tunneled Catheters Used for Hemodialysis (HD)/Continuous Renal Replacement Therapy (CRRT)/Apheresis | - HD/CRRT (or intended therapies in apheresis) and BMT.  
- DO NOT use for routine IV therapy if being used for dialysis  
  - See Pharmacy Flush/Dwell Policy.  
- Avoid when feasible. | Temporary  
≤ 2 weeks. | Bedside insertion and removal. | Placement requires physician or other credentialed provider.  
- Removal by physician or RN.  
- Typically two sites used: femoral and IJ. If IJ site used, a chest x-ray is required (unless placed in IR). |
| Tunneled Catheters Used for HD/CRRT/Apheresis | - HD/CRRT (or intended therapies in apheresis) and BMT.  
- DO NOT use for routine IV therapy if being used for dialysis  
  - See Pharmacy Flush/Dwell Policy. | Indefinite | Can be used immediately after placement. | Low jugular vein preferred.  
- Placement and removal requires physician or other credentialed clinician. |
| Ultrafiltration Catheters | - Ultrafiltration only. | Temporary  
≤ 1 week. | Peripheral:  
Bedside insertion by vascular access nurse (PICC team).  
- Central:  
Placement requires physician or other credentialed provider. | Peripheral ultrafiltration catheters are not safe for MRI |

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通知, type "IR case," then, under the procedure search, choose "Insertion CVC-tunneled w/port pump".  
Use drop down box to choose catheter and number of lumens.

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Tunneled Catheters Used for HD/CRRT/Apheresis

To order, type “IR case,” then, under the procedure search, choose “Insertion CVC Tunneled”. Choose CVC Type ‘Dialysis/Apheresis-Tunneled-14.5F’.

Note: Your comments should include intended uses (i.e., dialysis, or intended therapies in apheresis).

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To order Peripheral, select Order Sets, and then type “PICC.” Please enter “Peripheral Ultrafiltration Catheter” in the comment and include the order set.

To order Central, type “CVC”, then select “Setup for CVC Placement”. Please enter “Double lumen”.

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Key Aspects of Care

- Encourage ultrasound guidance for all central venous catheter placements, unless a delay would be detrimental to the care of the patient.
- Initiate the CVC insertion order set in IHIS to obtain necessary supplies, alert nursing to the pending procedure, and for the subsequent monitoring and care of the CVC.
- Print the CVC insertion informed consent to be reviewed/signed with the patient or his/her designee.
- Document the CVC procedure in IHIS.
- Use the CVC insertion checklist.
- For central venous access for patients with CKD/ESRD/transplant, do not place subclavian catheters. Internal jugular, and femoral veins are preferred access points.
- For CKD/ESRD/transplant patients, peripheral IV access can be established from sites distal to a non-functioning dialysis AV graft/AV fistula (AVG/AVF). This is preferable to ordering/placing a PICC or midline catheters. However, this should not be considered a permanent IV access and plan for a long-term option must be collaboratively identified among peripheral vascular team and nursing staff.

Five-Step CVC Bundle

**Note:** Please see [OSUWMC Central Venous Catheter Insertion Checklist](#).

### 1. Hand Hygiene and Aseptic Technique

- Perform hand hygiene, either by washing hands with soap and water or with alcohol-based hand rubs (ABHR).
- Hand hygiene should be performed before and after palpating catheter insertion sites as well as before and after inserting, replacing, accessing, repairing, or dressing an intravenous catheter.
- Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained.
- Maintain aseptic technique for the insertion and care of intravascular catheters.
- Wear clean gloves, rather than sterile gloves, for the insertion of peripheral intravascular catheters, if the access site is not touched after the application of skin antiseptics. Sterile gloves should be worn for the insertion of arterial, central, and midline catheters.
- Use new sterile gloves before handling the new catheter when guidewire exchanges are performed.
- Wearing two pairs of gloves, with removal of the first pair after removal of the old catheter, is helpful.
- Wear sterile gloves when changing the dressing on intravascular catheters.

### 2. Maximal Sterile Barrier Precautions

- Use maximal sterile barrier precautions, including the use of a cap, mask, sterile gown, sterile gloves, and a sterile full body drape for the insertion of CVCs, PICCs, or guidewire exchange.
- Use a sterile sleeve to protect pulmonary artery catheters during insertion.

### 3. Time Out

- Document adherence to the [Universal Protocol](#).

### 4. Skin Preparation

- Prepare clean skin with an antiseptic (i.e., alcohol, or with a > 0.5% chlorhexidine with alcohol) before peripheral venous catheter insertion.
- Prepare clean skin with an antiseptic (i.e., alcohol, or with a > 0.5% chlorhexidine with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes.
  - If there is a contraindication to chlorhexidine, 70% alcohol or an iodophor can be used as alternatives.
- No recommendation can be made for the safety or efficacy of chlorhexidine in infants aged < 2 months.
- Antiseptics should be allowed to dry according to the manufacturer’s recommendation prior to placing the catheter.

### 5. Catheter Site Dressing Regimens

- Use gauze or antimicrobial transparent dressing to cover the CVC catheter site. SCAP-use transparent dressing only.
- If the patient is diaphoretic or if the site is bleeding or oozing, use a gauze dressing until this is resolved.
- Replace catheter site dressing if the dressing becomes damp, loose, or visibly soiled.
- Do not use topical antibiotic ointment or creams on insertion sites due to the potential to promote fungal infections and antimicrobial resistance.
- For dialysis catheters, povidone-iodine antiseptic ointment at the HD catheter site may be used only if the patient is allergic to CHG solution.
- Do not submerge the catheter or catheter site in water.
  - Showering is permitted but with careful steps to reduce the likelihood of infecting the catheter (e.g., protect the catheter and site with an impermeable cover during the shower).
- Replace gauze dressings used on CVC sites every 2 days/48 hours.
- Replace transparent dressings at least every 7 days, except in those pediatric patients in which...
the risk for dislodging the catheter may outweigh the benefit of changing the dressing.

- Replace transparent dressings used on tunneled or implanted CVC sites no more than once per week (unless the dressing is damp, loose, or soiled, until insertion site has healed.
- No recommendation can be made regarding the necessity for any dressing on well-healed exit sites of long-term cuffed and tunneled CVCs.
- Monitor the catheter sites visually when changing the dressing or by palpation through an intact dressing on a regular basis (each shift), depending on the clinical situation of the individual patient.
  - If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or blood stream infection, the dressing should be removed to allow thorough examination of the site.
  - Encourage patients to report any changes in their catheter site or any new discomfort to their provider.
- Ensure that catheter site care is compatible with the catheter material.

Orders

- Initiate CVC order set in IHIS to ensure Nursing is available and supplies are at the bedside.
- Request ultrasound machine.
- Documentation of procedure in IHIS to include:
  - Informed consent/use of CVC check list.
  - Medications used to anesthetize skin and those used to flush and dwell catheter lumens.
  - Use of ultrasound guidance.
  - Use of the 5-Step Bundle.
  - Orders placed for post-procedural care and transitional care to other units, facilities or home.
- Confirm tip in the vena cava (atrium for dialysis) prior to use either by x-ray (CVC) or by other technology (ECG) approved to determine tip location (PICC).
- Develop a plan for daily assessment and justification for CVC on rounds with the expectation that each nurse will personally assess catheter function each shift and address malfunction immediately.

CVC Procedural Considerations and Guidelines

- Decisions regarding the type of device, duration of use and intended therapy and frequency of replacement should be determined on an individual basis in consultation with primary service, vascular access team, Pharmacy, IR and or surgery if needed (inter-professional team).
  - Refer to the table on pages 2 and 3 (catheter categories and specifications) for guidance with selecting the proper venous access device.
- Consider consultation with Infectious Disease if a long-term catheter is to be inserted for purposes of administering antibiotics in case an equally effective oral agent may be available.
- Choose the device with the least number of lumens needed for the therapy to decrease the opportunities to infect the device.
- Encourage the use of ultrasound guidance for all vascular access.
- Use ultrasound guided low-jugular vein site for venous access device placement unless medically contraindicated (e.g., coagulopathy, anatomic deformity).
- Informed Consent begins with documentation that the plan of care, including vascular access, has been agreed upon by the patient or his/her designee.
  - A discussion of the risks, benefits and alternatives to the catheter should happen at the credentialed provider level.
- Designate trained personnel who have demonstrated competency and proficiency to insert venous access devices.
- TPN requires a consult to nutrition and prior approval by the surgeon. Patients on TPN require multi-lumen catheters with designated lumens for TPN only.
  - See OSUWMC’s Parenteral Nutrition Policy.
- Patients on treprostinil or epoprostenol therapies may require multi-lumen catheters to be used in special circumstances, however not preferred.
  - Multi-lumen catheters placed for these patients should have the approval of the pulmonary hypertension physician prior to placement.
  - A dual lumen catheter with staggered ends is preferred but not necessary.
- When access for intravenous chemotherapy is needed, the credentialed provider should designate the number of lumens required.
- Remove any intravascular device as soon as its use is no longer clinically indicated.
  - Discuss this on rounds DAILY and document in IHIS.

TIP Placement and Confirmation

- Tip confirmed and catheter approved for use by ordering team within 2 hours of insertion.
  - For inpatients that arrive with central lines in place, catheter tip should be confirmed with chest x-ray prior to use if no documentation of tip location is available from sending facility.
Exception: Patients admitted to the ED in need of emergent access with central lines already in place. Confirm tip location as soon as possible, under the direction and responsibility of the Emergency physician.

- The acceptable window of tip location for Central Venous Access is SVC to right atrium depending on the therapy.
  - Dialysis catheters should reside in the right atrium.
- Monitor CVCs inserted from the left to avoid tip perpendicular to the vessel wall.
- When catheter placement is the indication for x-ray, radiologists must comment on tip location.
- Central access placed under fluoroscopy guidance does not require initial x-ray confirmation.
- Femoral CVCs do not routinely require tip location confirmation by x-ray unless they are advanced above the diaphragm.

Blood Sampling from Central Venous Catheters

Blood Culture Indications
- If there is a suspected bloodstream infection related to a venous access device, send cultures from these sources:
  - Peripheral blood and the venous access device:
    - Use venous access device line evacuation kit with a two-bottle blood culture set, which includes an aerobic (10ml), an anaerobic (10 ml), two-bottle blood culture set from the venous access device as well as two-bottle set from a peripheral site.
  - Line culture from second venous access device (only in the patient with more than one venous access device site):
    - Withdraw 10 ml and inoculate only into an aerobic bottle.
    - Label with catheter site.
- A separate order is needed when AFB (TB) or fungal blood cultures are indicated.
  - Use the yellow bumble bee tube.
- See OSUWMC’s Blood Culture Policy.
- Catheters used for Hemodialysis should not be used for routine blood draws and require Nephrology approval prior to be accessed for non-dialysis uses.

- If there are no signs or symptoms of infection, NO surveillance culturing of the catheter is necessary.
- Do not use guidewire-assisted catheter exchange whenever catheter-related infection is documented or suspected.
  - If the patient requires continued vascular access, remove the implicated catheter, and replace it with another catheter at a different insertion site.
- Do not routinely replace non-tunneled venous access device as a method to prevent catheter-related infections, i.e., do not change line every 4-5 days.
- Use guide wire-assisted catheter exchange to replace a malfunctioning catheter or to convert an existing catheter if there is no evidence of infection at the catheter site or if the patient is at high risk for complications associated with replacement of a new venous access device at a new site.
  - It is recommended to use anti-infective coated catheter for guide wire-assisted catheter exchange.
  - Two pairs of sterile gloves are needed.
- DO NOT routinely remove IVs or non-tunneled CVC on the basis of fever alone or based on time without clinical indicators.
- In the setting of limited venous access such as chronic hemodialysis, if catheter-related infection is suspected, but there is no evidence of local catheter-related infection:
  - Remove the existing catheter and insert a new catheter over a guidewire.
  - Send the distal 5-cm (2-in.) segment of the removed catheter tip for culture.
    - If the catheter culture indicates infection, removal of the newly inserted catheter may be required.
    - Further course of action should be individualized based on the clinical circumstances, preferably after discussing the case with Infectious Disease and Nephrology.

Removal Process
- Certain catheters require removal by credentialed providers.
- See Categories and Specifications, page 2 and 3.

Note: Please see Elsevier (formally Mosby) Skill Central Venous Catheter: Removal for additional recommendations.
Recommendations for Venous Access for Patients with Established Hemodialysis Access (AVF/AVG)

- Do not use the AVF/AVG limb for blood pressure readings (use the other arm or a thigh or ankle cuff for blood pressure monitoring).
- The arm being preserved (either an active HD access or being saved for future placement) should have a limb restriction band placed on it while hospitalized.
- Coordinate lab draws with the time of dialysis to minimize venipuncture.
- If venipuncture is clinically required from AVF/AVG limb, Nephrologist must be consulted to determine if the graft/fistula is functioning or non-functioning and written order of approval must be obtained.
- For peripheral venipuncture in the limb with a non-functioning AVF/AVG, site selection and attempt should start at the dorsum of the hand or from the most distal point of the limb. The non-functioning AVF/AVG should not be cannulated.
- In renal transplant patients, using AVF/AVG for venipuncture must be performed by trained HD RN’s, trained renal transplant clinic RN’s, and MD’s. However, this should not be considered a permanent option and plan for long-term option must be identified.
- For CKD/ESRD/transplant patients, peripheral IV access can be established from sites distal to a non-functioning dialysis AV graft/AV fistula (AVG/AVF). This is preferable to placing a PICC or midline catheters. However, this should not be considered a permanent IV access and plan for a long-term option must be collaboratively identified among peripheral vascular team and nursing staff.

Venous Access in Patients with Chronic Kidney Disease (CKD) – “Save the Veins”

This information is designed to help providers choose the best venous access in CKD patients.

Background

- Upper extremity veins are the “ lifeline” for patients with ESRD. In addition, vein preservation is crucial for development and maintenance of future AV access in patients with CKD and those who have undergone kidney transplantation.
- Frequent venipuncture and the indiscriminate use of PICC lines or central venous catheters (CVC) can damage the veins and jeopardize future AV access construction or function. The preferred access for vein preservation and longer-term access is tunneled right IL.
- Studies have noted that PICC line complications include venous thrombosis in 23-32% of patients, central venous stenosis in 4.8, and central venous occlusion in 2%.

- Emerging data suggest that PICC line placement in CKD patients is associated with less likelihood of a future AV access maturation.

Recommendations for Venous Access for CKD

1. Identify
- Patients with CKD Stage 3-5 (eGFR < 60 ml/min), including ESRD patients currently receiving hemodialysis or peritoneal dialysis.
- Patients with a functional kidney transplant with eGFR < 60 ml/min.

2. Ascertain
- Evaluate for alternative therapy or dosing in patients who are expected to require long-term IV drug therapy (i.e., antibiotics).
- PICC line placement is NOT always required for patients going to long-term acute care facilities. Acceptable alternatives are:
  - Non-tunneled CVC
    - Preferred for short term, < 14 days
  - Tunneled catheter
    - Preferred for long term, > 14 days
  - Port
- If after exhausting all other access options a PICC Line is determined to be the appropriate access, approval from either the nephrology attending or fellow is required.

3. Choose the Right Vein
- Dorsal veins of the hand are the preferred location for peripheral venous access.
- Internal jugular veins are the preferred location for central venous access.
- External jugular veins are acceptable alternatives for venous access.
- CVCs inserted via the internal jugular vein that are intended for long-term use (> 2 weeks) should be tunneled.
- Use of subclavian veins MUST be avoided.

4. Coordinate
- Consult the vascular access team for line recommendation in all patients requiring long-term central vascular access.
  - The “PICC Line Order” should be viewed as a vascular access consultation.
  - If eGFR <45, consult nephrologist prior to line placement (if not already consulted).
  - May not be appropriate for acute change in eGFR if without CKD.

Quality Measures

- Incidence of central-line-associated bloodstream infections.
- Documented daily review of line necessity.
OSUWMC Resources

- OSUWMC Nursing Policy- Intravascular Access Devices: Peripheral and Central.
- OSUWMC Clinical Practice Alert- Removal of Central Venous Catheters by Nursing Staff.

References

- Infusion Therapy Standards of Practice, 2016; 39
- Vein Preservation and Hemodialysis Fistula Protection. AV Fistula First Breakthrough Initiative Coalition, 2011

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Guideline Approved


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