Vascular Access Device (VAD) Selection and Procedures

Disclaimer: *This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson's specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care.*

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CVAD = central venous access device

DEFINITIONS

Acute Care Procedure Team: A team comprised of specialized Advanced Practice Providers (APP) that are trained in placement, management, and removal of central venous access devices.

Apheresis catheter: A large bore CVAD that is typically greater than 10 French or more in size that is used for apheresis procedures as well as other infusions as indicated.

Central Venous Access Device (CVAD): Includes peripherally inserted central catheter (PICC) and all centrally inserted catheters including non-tunneled, tunneled, or implanted catheter with the catheter tip ending in the vena cava, such as a subclavian, femoral, and internal jugular.

Centrally Inserted Central Catheter (CICC) [also known as central venous catheter (CVC)]: Includes tunneled or non-tunneled central venous catheters.

Infusion Therapy Team (ITT): A team comprised of registered nurses who are skilled and educated in the management and care of central and peripheral venous access devices.

Implanted venous port: A surgically placed central venous catheter that is attached to a reservoir located under the skin.

Non-Tunneled Centrally Inserted Catheter (Non-Tunneled CICC): A catheter inserted by direct venous puncture through the skin in the subclavian, jugular or femoral areas without tunneling.

Peripherally Inserted Central Catheter (PICC): A central venous catheter inserted into an upper extremity vein that is threaded within the superior vena cava.

Tunneled Centrally Inserted Catheter (Tunneled CICC): A catheter that is tunneled under the skin before entering the venous system which can either be cuffed or non-cuffed. Cuffed indicates that the catheter has a small cuff promoting tissue growth for catheter adherence.

Vascular Access Device (VAD): Any device utilized for venous access regardless of location. These include peripheral intravenous catheter (PIV), peripherally inserted central catheter (PICC), centrally inserted central catheter (CICC), and implanted venous port.

Vascular Access Team: A team that is comprised of the Acute Care Procedure Team and the Infusion Therapy Team engaged in the planning and management of patients requiring vascular access.

CONSIDERATIONS FOR CVAD SELECTION

- Choosing the correct venous access device and location for patients requires a prior thorough assessment and evaluation. Priority is given to minimizing the risk of infection by avoiding sites like the femoral vein. In some cases, consideration may include availability of assistance from care giver for dressing changes and prior surgical history(*i.e.,* mastectomy). The patient's activity level and lifestyle (such as desire to swim or play sports) may also influence the decision between placement of a PICC versus an implanted port.

- Providers should be aware that the higher the number of catheter lumens, the higher the risk of a catheter related infection for the patient. The smaller the French size of the catheter, the lower the risk of thrombotic complications for CVADs. Selecting catheters with the least number of lumens and lower French size clinically necessary is important to minimize infectious and thrombotic complications.
  - Separating infusions over time and working with pharmacists may help reduce the need for multi-lumen devices, reducing cost and complications

- For patients with chronic kidney disease requiring central venous access (not for the purpose of hemodialysis), avoid placement of PICCs and subclavian approach CICCs. Based on observational studies demonstrating high rates of new central vein lesions after PICC placement, PICCs and subclavian CICCs are **not** recommended in patients with low glomerular filtration rates (less than 45 mL/minute or stage IIIb or higher kidney disease) to avoid complications (*i.e.,* deep vein thrombosis, venous stenosis) that may interfere with future hemodialysis arteriovenous access placement.

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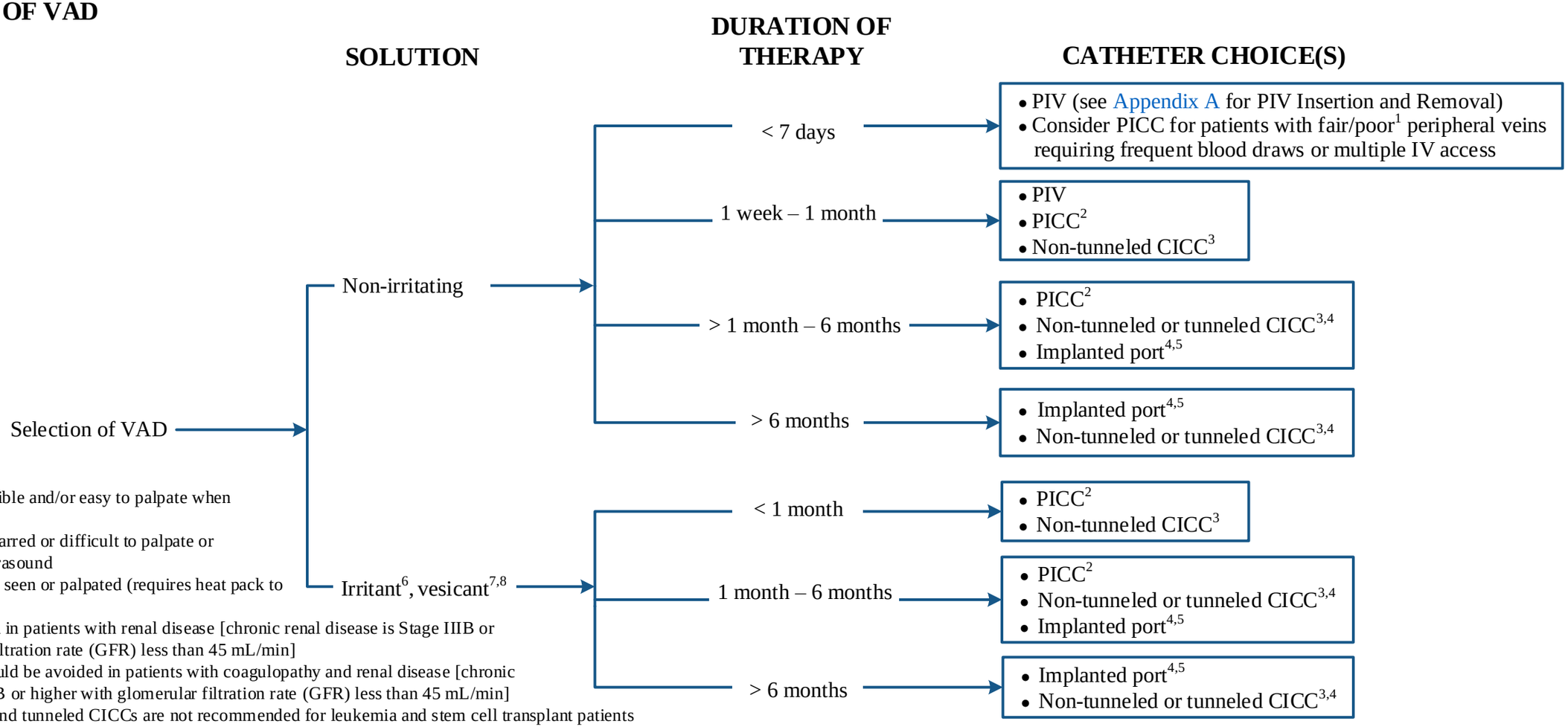
SELECTION OF VAD



[1] Good = vein is easily visible and/or easy to palpate when tourniquet is applied
Fair = veins are small, scarred or difficult to palpate or unable to access with ultrasound
Poor = vein unable to be seen or palpated (requires heat pack to aid vasodilation)

[2] PICCs should be avoided in patients with renal disease [chronic renal disease is Stage IIIB or higher with glomerular filtration rate (GFR) less than 45 mL/min]

[3] Subclavian catheters should be avoided in patients with coagulopathy and renal disease [chronic renal disease is Stage IIIB or higher with glomerular filtration rate (GFR) less than 45 mL/min]

[4] Implanted venous ports and tunneled CICCs are not recommended for leukemia and stem cell transplant patients

[5] Consider if duration of treatment is greater than 3 months

[6] Irritant = any agent (*i.e.*, chemotherapy, electrolytes) that causes inflammation or irritation characterized by aching, tightness, and phlebitis but without necrosis [see ATT1097 of the Vascular Vesicant/Irritant Administration and Extravasation Policy (#CLN0986)]

[7] Vesicant = any agent (*i.e.*, chemotherapy) that has the potential to cause tissue destruction, blistering, severe tissue injury, or tissue necrosis when extravasated [see ATT1097 of the Vascular Vesicant/Irritant Administration and Extravasation Policy (#CLN0986)]

[8] Chemotherapy special considerations: Continuous infusions of a vesicant can not be infused via an implanted port outside the hospital. For administration of a vesicant through a PIV, refer to Vascular Vesicant/Irritant Administration and Extravasation Policy (#CLN0986).

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PRE/POST-PROCEDURE EVALUATION AND INTERVENTIONS

PRE-PROCEDURE

POST-PROCEDURE

Pre/post-procedure evaluation and intervention[1]

- PICC insertion and exchange[2]
- Non-tunneled CICC exchange[2] to equal or lesser French size (performed by Vascular Access Team)

→ Consult Cardiac Device Clinic if patient has an implanted cardiac device (ICD)
→ Perform catheter insertion assessment[3]

→ A

→ Order post insertion chest x-ray

→ Is the tip of the CVAD in satisfactory position[4] on chest x-ray?

- Yes → CVAD ready for use, see VAD Management algorithm for Post-insertion Dressing & Maintenance and Flush Management
- No → For Catheter Reposition Interventions, see Appendix E

PICC/non-tunneled CICC/ femoral removal (performed by Vascular Access Team)

→ Perform catheter removal assessment[5]

→
- Apply petrolatum-based ointment[6] with gauze to exit site
- Apply sterile dressing over gauze
- Dressing can be removed after 1 day
- For platelets greater than 20 K/microliter: Hold pressure at site for at least 5 minutes; if bleeding persists, continue to hold pressure until bleeding resolves
- For platelets less than 20 K/microliter: Hold pressure at site for at least 10 minutes; if bleeding persists, continue to hold pressure until bleeding resolves

- CICC insertion
- Non-tunneled CICC exchange to a greater French size
- Implanted venous port removal
- Tunneled CICC removal (performed by the Acute Care Procedure Team or appropriately trained providers)

→ See Pages 6-7

[1] See Appendix B for Venous Access Procedure Orders and Appendix C for Flush Panel when indicated
[2] See Appendix D for Standardized Central Line Insertion Checklist
[3] Insertion assessment includes patient's renal function; vein ratio assessment; history of surgical or anatomical variant(s), venous thromboembolism, and/or multiple failed catheter attempts
[4] Tip of the CVAD is in satisfactory position when the tip resides in the superior vena cava or upper right atrium. See Central Vascular Access Device (CVAD) Assessment and Tip Position Verification Policy (#CLN1036).
[5] Removal assessment includes reviewing the ordering indication, patient labs, and medications
[6] Use single-dose petrolatum-based ointment packet

Vascular Access Device (VAD) Selection and Procedures

PRE/POST-PROCEDURE EVALUATION AND INTERVENTIONS - *continued*

PRE-PROCEDURE

- CICC insertion[1]
- Non-tunneled CICC exchange to a greater French size[1,2]

→

- Vascular Access Team performs patient evaluation and assessment to thoroughly review allergies, medications, medical and vascular access history. A subsequent APP assessment is performed if certain high-risk parameters are identified during evaluation. See Appendix F for High Risk Criteria for Insertion.
- **Imaging:**
  - Indicated if no prior chest imaging (*i.e.*, chest x-ray, CT chest) within last 6 months
  - For CICC insertion and exchange, chest imaging (*i.e.*, chest x-ray, CT chest) and/or bilateral venous duplex study indicated if: there is a history of prior upper extremity; chest or vascular surgery such as stenting, graft, mastectomy, lymph node resection and/or thoracic surgery; known history of SVC syndrome; history of upper extremity DVT; or multiple failed catheter attempts
- **Pre-procedure lab assessment:**
  - Order INR/platelets within **5 days** of procedure if patient has a history of:
    - Chemotherapy within 1 month - Liver disease - Coagulopathy - Recent history of thrombocytopenia
  - Order platelet count and INR within **2 months** of procedure if the above comorbidities do not apply
  - Discuss with proceduralist and contact primary team to correct INR or platelets prior to procedure: if INR greater than 2 or platelets less than 20 K/microliter for internal jugular (IJ), femoral, or subclavian catheters
- **Low platelet parameters (threshold to infuse platelets during procedure):**
  - Platelet count between 10-20 K/microliter for IJ and femoral catheters and between 20-30 K/microliter for subclavian catheters
- **Recommendations for anticoagulation management:**
  - See Peri-Procedure Management of Anticoagulants algorithm or contact the Vascular Access Team. No hold necessary for aspirin and other NSAID-type products.

POST-PROCEDURE

→ See Box **A** on Page 5 for Post-Procedure flow

[1] See Appendix D for Standardized Central Line Insertion Checklist
[2] Performed by the Acute Care Procedure Team or appropriately trained providers

Vascular Access Device (VAD) Selection and Procedures

PRE/POST-PROCEDURE EVALUATION AND INTERVENTIONS - *continued*

PRE-PROCEDURE

- Implanted venous port removal[1]
- Tunneled CICC removal[1]

→

- Acute Care Procedure Team performs patient evaluation and assessment to thoroughly review allergies, medications, medical and vascular access history
- **Imaging:**
  - Order chest x-ray if no existing prior chest imaging (*i.e.*, chest x-ray and CT chest) showing current port or tunneled catheter placement
- **Pre procedure lab assessment:**
  - Order INR/platelets within **5 days** of procedure if patient has a history of:
    - Chemotherapy within 1 month - Liver disease - Coagulopathy - Recent history of thrombocytopenia
  - Order platelet count and INR within **2 months** of procedure if the above comorbidities do not apply
  - Discuss with proceduralist and contact primary team to correct INR or platelets prior to procedure if INR greater than 2 or platelets less than 20 K/microliter
- **Low platelet parameters (threshold to infuse platelets during procedure):**
  - Platelet count between 10-20 K/microliter
- **Recommendations for anticoagulation management:**
  - See Peri-Procedure Management of Anticoagulants algorithm. No hold necessary for aspirin and other NSAID-type products.

→

POST-PROCEDURE

- Place sterile dressing post removal
- Remove dressing after 1 day

[1] Performed by the Acute Care Procedure Team or appropriately trained providers

Vascular Access Device (VAD) Selection and Procedures

APPENDIX A: PIV Insertion and Removal[1,2]

Insertion	
Indication and Assessment	**Procedure**
• Appropriate indication(s): short term usage (less than 7 days) for administration of peripherally approved infusions, diagnostic testing, and therapeutic blood sampling. If existing VAD is present, functional, and approved for use, utilize existing catheter in efforts for peripheral vein preservation. • Assessment: no existing vascular access, optimal site selection is available (forearm preferred), avoid sites where there is recent injury or compromised circulation (*i.e.* limb swelling or ipsilateral axillary lymph node dissection), veins are visible and palpable (ultrasound[3] or additional vein finder technology may be utilized if available)	• Insert and maintain using PIV standard clean technique[4] • CHG antiseptic swab/swabstick[5] should be used to cleanse skin and allowed to dry prior to puncture • Use a catheter with an integrated extension tubing (recommended best practice) and a neutral needleless connector cap • Catheter gauge and needle length should be selected based on intended purpose, expected length of therapy, infusion rate, condition and size of vein[3,6]

Removal	
Indication	**Procedure**
• Every 4 days, unless patient has inaccessible veins or difficult venous access[4,7] • If presence of unexplained fever or other signs of infections (i.e. suspected site or blood stream infection) • If infiltration or extravasation is noted[8]	• Remove utilizing clean technique • Hold pressure and apply sterile gauze and tape • If removed due to unexplained fever, phlebitis, or other suspected infection: assess removal site for signs of infection for next 2 days

[1] Insert, maintain, and remove PIV as clinically appropriate. For adult patients requiring a lower-extremity PIV or when insertion is contraindicated (*i.e.*, vesicant, noted lymphedema, swelling, or history of axillary lymph node dissection), an order from the primary team is needed for insertion.
[2] Refer to VAD Management algorithm for maintenance care
[3] Use ultrasound guidance for difficult IV access. Ultrasound PIV placement should be used with needle lengths longer than 1.25 inches.
[4] Refer to Infection Control Associated with Vascular Access Devices (VADs) Policy (#CLN0441)
[5] CHG antiseptic swab/swabstick is comprised of 3.15% chlorhexidine gluconate and 70% isopropyl alcohol
[6] Good = vein is easily visible and/or easy to palpate when tourniquet is applied
Fair = veins are small, scarred or difficult to palpate or unable to access with ultrasound
Poor = vein unable to be seen or palpated (requires heat pack to aid vasodilation)
[7] For catheters that are left longer than 4 days, consider a CHG impregnated disc with transparent dressing
[8] Refer to Vesicant/Irritant Administration and Extravasation Policy (#CLN0986)

Vascular Access Device (VAD) Selection and Procedures

APPENDIX B: Venous Access Procedure Orders[1]

Procedure	Per Parameter: No Cosign Required
PIV insertion and implanted venous port access	Lidocaine/Prilocaine 2.5/2.5% cream
PICC insertion/non-tunneled CICC exchange	Adult/Pediatric CVAD Flush Panel Lidocaine 1% 10 mL (buffered or non-buffered) Chest x-ray (2 view preferred)
Non-tunneled CICC insertion	Adult/Pediatric CVAD Flush Panel Lidocaine 1% 30 mL (buffered or non-buffered) Chest x-ray (2 view preferred) INR, platelets
PIV insertion and implanted venous port access and deaccess/routine CVAD flush	Adult/Pediatric CVAD Flush Panel
Resuture	Lidocaine 1% 10 mL (buffered or non-buffered)
Catheter patency problems	Adult/Pediatric CVAD Flush Panel Alteplase (Cathflo™ Activase®) 2 mg/2 mL Chest x-ray (2 view preferred)
Suspected site infection	Mupirocin 2% ointment (Bactroban®)
Non-tunneled CICC/PICC removal	Single dose petrolatum-based ointment packet
Malposition/ rapid saline power flush	Adult/Pediatric CVAD Flush Panel Chest x-ray (2 view preferred)
First time CVAD assessment	Adult/Pediatric CVAD Flush Panel Chest x-ray (2 view preferred)

APPENDIX C: Flush Panel[1]

Adult VAD Flush Panel

- Preservative-free (PF) 0.9% Normal Saline (NS) 10 mL flush syringe
- 0.9% NS 50 mL
- 0.9% NS 100 mL
- 0.9% NS 250 mL
- 0.9% NS 500 mL
- Lock-flush heparin[2] solution 2 mL (100 units/mL)
- Dextrose 5% in water (D5W) injection flush syringe 10 mL
- D5W 50 mL
- D5W 100 mL
- D5W 250 mL

Pediatric CVAD Flush Panel

- Preservative-free (PF) 0.9% Normal Saline (NS) 10 mL flush syringe
- For patients **less than or equal to 10 kg**:
  - Lock-flush heparin[2] solution 2 mL (10 units/mL)
- For patients **greater than 10 kg**:
  - Lock-flush heparin[2] solution 2 mL (100 units/mL)
- 0.9% NS 25 mL
- 0.9% NS 100 mL
- D5W 50 mL

[1] Selection of supply is dependent on manufacturer's availability
[2] If patient has heparin allergy, may use alteplase (tPA) or saline as directed by physician

APPENDIX D: Standardized Central Line Insertion Checklist

Before the Procedure
- Is the patient educated on the insertion process and need for central line?
- Have the appropriate insertion site, catheter type, and number of lumens been selected? (For adults: femoral insertions require documented justification)
- Is a standardized CVC insertion supply kit used?
- Have equipment and workspace have been properly disinfected and readily available?
- Has hand hygiene been performed prior to insertion?
- Has Time Out/Universal Precaution Checklist been completed including confirmation of patient allergies?
- Has maximum sterile barrier is used? (*i.e.*, cap, mask, sterile gown, sterile gloves, and full body drape)
- Was skin prep completed using CHG scrub and allowed to completely dry prior to puncture?

During the Procedure
- Was aseptic technique maintained throughout the insertion? (*i.e.*, traffic during the procedure minimized, procedure door is closed, assistant available)
- Were complicating factors around placement/procedure noted for documentation? (*i.e.*, emergent placement, number of stick, failed insertion, other)
- Were guidewires and stylets are removed and intact?

Post Procedure
- Were the required insertion properties documented in the patient's electronic health record?
- Is sterile dressing present and appropriately applied? (*i.e.*, insertion site is covered, dressing is intact, dressing is dated, antimicrobial disc is present)
- Is needleless connector[1] present? (when applicable)
- Is tip placement verified and documented?
- Have patient and/or caregiver been educated on post insertion instructions, maintenance, and CLABSI prevention?

[1]A neutral needleless connector should be used with all vascular access devices

Vascular Access Device (VAD) Selection and Procedures

APPENDIX E: Indication for Catheter Reposition

Rapid Saline Power Flush (RSPF)

Criteria:

- Tip malposition on chest x-ray review (*i.e.*, contralateral, internal jugular, azygous, subclavian)
- Catheter type: non-tunneled CVAD/PICC
- If no catheter movement noted on chest x-ray after first RSPF, proceed to catheter exchange
  - Limit RSPF to no more than two attempts
  - If catheter exchange fails, consult Vascular Access Team

Overwire Exchange

Criteria:

- Tip malposition
  - Degree of complexity (*i.e.*, figure of 8 loop, tip in mammary vein or anterior jugular vein)
  - Level of tip position[1]: catheter tip not located within the superior vena cava or extending into the proximal right atrium
- Catheter type: non-tunneled CVAD/PICC
- Exchange of same size catheter or from larger to smaller catheter – nursing exchange permitted
- Exchange of smaller to larger catheter – proceduralist exchange
- Exchange non-tunneled CVAD/PICC with an external catheter length greater than 3 cm
- Limit wire thread to no more than three attempts
  - If unsuccessful PICC exchange, consider contralateral PICC insertion (if applicable)
  - If unsuccessful non-tunneled CVAD exchange, consult proceduralist
  - Obtain bilateral venous duplex ultrasound for failed bilateral PICC insertion/exchange or unsuccessful non-tunneled CVAD exchange

[1] Refer to Central Vascular Access Device (CVAD) Assessment and Tip Position Verification Policy (#CLN1036)

APPENDIX F: High-Risk Criteria for Insertion

- Any procedure requiring sedation by anesthesia
- History of difficult or failed PICC and CVAD insertions
- History of deep vein thrombosis (DVT) and/or on anticoagulants or antiplatelets other than aspirin or other NSAIDs (*i.e.*, warfarin, clopidogrel)
- Presence of an automatic implantable cardioverter defibrillator (AICD) or pacemaker
- History of thoracic mass/surgery or axillary lymph node resection or mastectomy
- History of radiation near planned insertion site (*i.e.*, neck, thorax, groin)
- Wounds near insertion site
- Patient with BMI greater than 30 kg/m^2
- Chronic renal disease [stage IIIB or higher with glomerular filtration rate (GFR) less than 45 mL/min]

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SUGGESTED READINGS - *continued*

MD Anderson Institutional Policy #CLN0441 – Infection Control Associated with Vascular Access Devices (VADs) Policy
MD Anderson Institutional Policy #CLN0537 – Flushing of All Central Venous Catheters & Peripheral Venous Catheter Devices Policy
MD Anderson Institutional Policy #CLN0617 – Central Venous Catheters (CVCs) with Persistent Withdrawal Occlusion (No Blood Return) Policy
MD Anderson Institutional Policy #CLN0655 – Central Venous Catheters (CVC)/Midline Catheters-Percutaneous Removal Policy
MD Anderson Institutional Policy #CLN0656 – CVC Overwire Exchange: Assisting Physicians, Advanced Practice Providers, and Infusion Therapy Nurse-Performed Exchange Policy
MD Anderson Institutional Policy #CLN0857 – Care of Phlebitis Associated with Peripherally Inserted Central Catheter and Peripheral Venous Catheter Devices
MD Anderson Institutional Policy #CLN0859 – Central Venous Catheters (CVCs)-Restoring Patency to CVCs Due to Thrombotic or Precipitant- Occlusion Policy
MD Anderson Institutional Policy #CLN0986 – Vascular Vesicant/Irritant Administration and Extravasation Policy
MD Anderson Institutional Policy #CLN1036 – Central Venous Catheter Assessment and Tip Position Verification Policy
MD Anderson Institutional Policy #CLN1094 – Clinical Practice Patient Care Management Tools
MD Anderson Institutional Policy #CLN1154 – Percutaneous Central Venous Catheter (CVCs) - Suture Securement and Replacement Policy
MD Anderson Institutional Policy #CLN1165 – Central Venous Catheter- Peripherally Inserted Central Catheter (PICC) Insertion

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