Vascular Access Device (VAD)[1] Selection and Management Algorithm

This practice algorithm has been specifically developed for MD Anderson using a multidisciplinary approach and taking into consideration circumstances particular to MD Anderson, including the following: MD Anderson's specific patient population; MD Anderson's services and structure; and MD Anderson's clinical information. Moreover, this algorithm is not intended to replace the independent medical or professional judgment of physicians or other health care providers.

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[1]Vascular Access Devices (VADs) refer to all central venous catheters that are either placed percutaneously through direct puncture of the skin into the vein or surgically implanted/tunneled with the tip ending in the vena cava.

ITT = infusion therapy team

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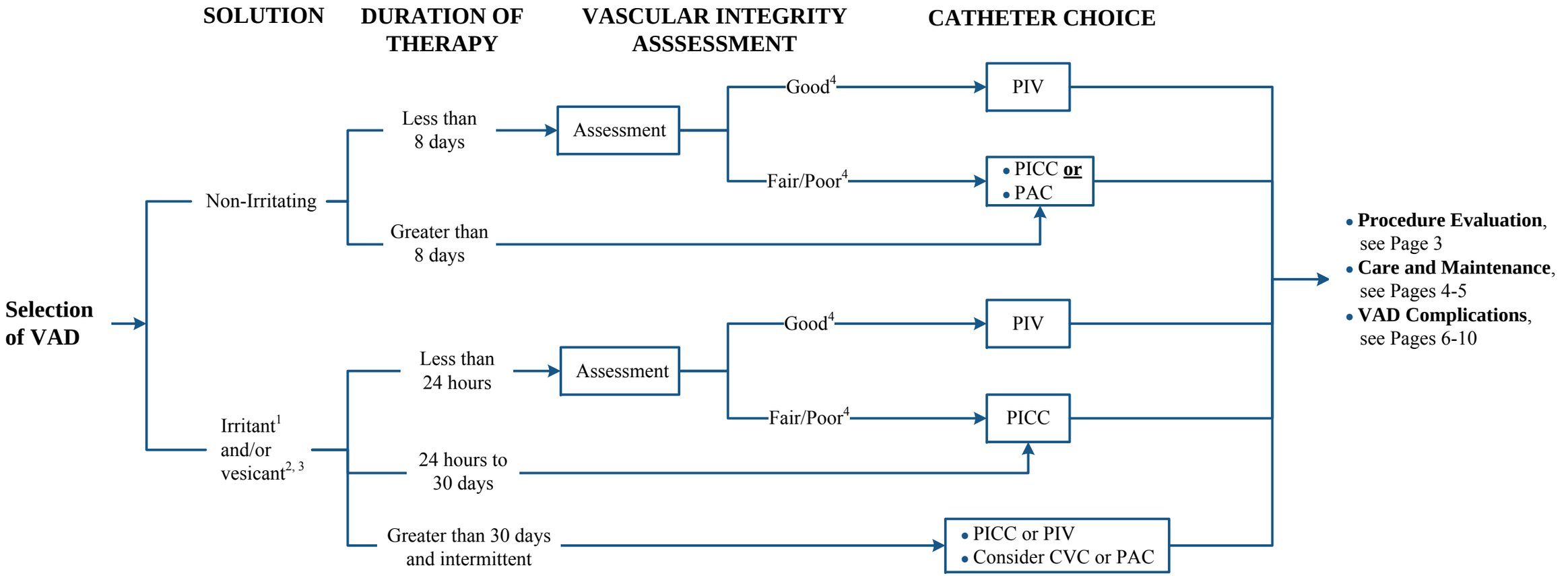

CVC = central venous catheter
PAC = port-a-cath (implanted venous port)
PICC = peripherally inserted central catheter
PIV = peripheral intravenous

[1] Irritant = any agent (*e.g.*, chemotherapy, electrolytes) that causes inflammation or irritation characterized by aching, tightness, and phlebitis but without necrosis

[2] Vesicant = any agent (*e.g.*, chemotherapy) that has the potential to cause tissue destruction, blistering, severe tissue injury, or tissue necrosis when extravasated

[3] Chemotherapy special considerations: Continuous infusions of a vesicant can not be infused via a PAC outside the hospital. Vesicants needing to infuse longer than 60 minutes must be infused via a CVC.

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

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PRE-PROCEDURE

ITT pre/post-procedure[1] evaluation

- PICC insertion
- ITT nurse exchange[2]

→

1. Consult Pacemaker Clinic if patient has an implanted cardiac device
2. Order lidocaine 1% subcutaneous for procedure (buffered lidocaine preferred)
3. Give midazolam syrup PRN as ordered by primary team

- CVC insertion
- CVC exchange
- Port removal
- Tunneled CVC removal[3]

→

1. Consult Pacemaker Clinic if patient has an implanted cardiac device
2. Order pre-insertion chest X-ray if none within 3 months
3. Lab parameters:
   a) Order PT/PTT/INR/platelets within 72 hours of procedure if patient has a history of:
      - chemotherapy within 6 months
      - liver failure
      - kidney failure
      - coagulopathy
      - cardiac disease

   b) Order platelet count within one month of procedure if the above comorbidities do not apply
   c) Contact primary team to correct PT/PTT prior to procedure if PT greater than 18, PTT greater than 60 sec, or INR greater than 1.5
4. Low platelet parameters:
   a) CVC insertion/exchange**:** platelet count between 20-40 K/microliter – order and hold 1 dose of platelets to be infused for procedures performed in ITT clinic
   b) Port/tunneled CVC removal: platelet count between 20-30 K/microliter – order and hold 1 dose of platelets to be infused during procedure
   c) Platelet count less than 20 K/microliter - Contact primary team to correct to 20 K/microliter or above and order 1 dose of platelets to be infused during procedure
   d) For ITT clinic performed procedures: ITT nurse to order platelets and call physician for premedication orders
   For ITT inpatient procedures: Inpatient nurse to contact physician for platelet and premedication orders
5. Recommendations for anticoagulation management:
   a) HOLD low molecular weight heparin (*e.g.*, enoxaparin)
      - 12 hours prior if taking 1 mg/kg dose
      - 24 hours prior if taking 1.5 mg/kg dose

   b) HOLD intravenous heparin infusion 6 hours prior to procedure
   c) HOLD aspirin/NSAIDS 3 days prior to procedure
   d) For patients taking warfarin, clopidogrel and other anti-platelet medications, a 5 day hold is recommended; ITT will contact primary team in regards to the patients ability to hold these medications. If holding medication is not an option primary team and proceduralist are to discuss procedure options
6. Order lidocaine 1% subcutaneous for procedure (buffered lidocaine preferred)
7. Give midazolam syrup PRN as ordered by primary team or APP

POST-PROCEDURE

Order post insertion chest X-ray (except for ports/ tunneled CVC removal)

- For CVC, PICC, and port insertions/exchanges, catheter may be used when documented by ITT: "Catheter verified in proper position for infusion."

[1] See Appendix A for Venous Access Procedure Orders
[2] PICC exchange of catheters of equal or lesser French size
[3] For PICC/percutaneous CVC removals, order triple antibiotic ointment single dose packet

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CARE AND MAINTENANCE

Routine catheter flush[1]

Adult central venous access devices (CVADs) 12 French or less (PICCs, non-tunneled/ tunneled CVADs excluding implanted venous ports)[2,3,4.5,6]

- Inpatient/Outpatient: Flush each lumen with preservative-free 0.9% NS 10 mL before and immediately after each use, every 12 hours for inpatient catheters not in use, upon hospital discharge and after completion of outpatient treatment.
- Home care: Flush each lumen with Preservative-free 0.9% NS 10 mL a minimum of three times per week (daily preferred).

Implanted venous ports, CVADs greater than 12 French, and pediatric CVADs[2,3,4.5,6]

Heparin allergy?

Yes

CVC/PICCs

- Inpatient/Outpatient: Flush each lumen with preservative-free 0.9% NS 10 mL before and immediately after each use, every 12 hours for inpatient catheters not in use, upon hospital discharge and after completion of outpatient treatment.
- Home care: Flush each lumen with preservative-free 0.9% NS 10 mL a minimum of three times per week (daily preferred).

Implanted venous port

- Inpatient/Outpatient: Flush port with preservative-free 0.9% NS 10 mL before and immediately after each use and every 12 hours for inpatient ports that are accessed and not in use. Upon hospital discharge, after completion of outpatient treatment, and for routine monthly maintenance flush port with preservative-free 0.9% NS 10 mL.

No

CVC/PICCs

- Inpatient/Outpatient: Flush each lumen with preservative-free 0.9% NS 10 mL before and immediately after each use and every 12 hours for inpatient catheters not in use. Upon hospital discharge or after completion of outpatient treatment, flush each lumen with preservative-free 0.9% NS 10 mL and heparin 2 mL (100 units/mL).
- Home care: Flush each lumen with heparin 2 mL (100 units/mL) a minimum of three times per week (daily preferred).

Implanted venous port

- Inpatient/Outpatient: Flush port with preservative-free 0.9% NS 10 mL before and immediately after each use and every 12 hours for inpatient ports that are accessed and not in use. Upon hospital discharge, after completion of outpatient treatment, or for routine monthly maintenance flush port with preservative-free 0.9% NS 10 mL and heparin 2 mL (100 units/mL).

PIV[3.4.5,6]

Flush with preservative-free 0.9% NS 10 mL before and immediately after each use, and every 12 hours when not in use.

Continued on next page

[1] For flushing/locking arterial catheters, dialysis catheters, or implanted peritoneal ports, follow specific institutional orders as directed by physician
[2] Outside/non-ITT assisted VADs may be used after documented by ITT: "Catheter verified in proper position for infusion"
[3] See Appendix B for Flush Panel
[4] See Appendix C for Pediatric Routine Catheter Flush
[5] See Appendix A for Venous Access Procedure Orders
[6] Insert and maintain PIVs, access and deaccess implanted ports, and manage central lines as clinically indicated. Access power injectable ports with power rated needles.

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CARE AND MAINTENANCE - *continued*

PICC/CVC dressing change protocol[1, 2] → Post insertion dressing: cloth adherent dressing with chlorhexidine (CHG) disc (*i.e.* Covaderm®, BioPatch®)

→
- Change initial dressing 4 to 7 days after insertion with a CHG transparent semi-permeable membrane dressing (*i.e.*, Tegaderm CHG®)
- Follow with routine weekly dressing changes

→ Complications?

- Yes → See Pages 7-11 for VAD complications
- No → Routine dressing changes as appropriate

Local anesthesia injection for PIV[2] **start and PAC access**[1] →

The following drugs may be used intradermally/subcutaneously for local anesthesia by nurses, APPs, or other providers competent to perform skill:
- Lidocaine 1% buffered with sodium bicarbonate 8.4% as a 10:1 solution **or**
- Bacteriostatic saline containing benzyl alcohol **or**
- Lidocaine 1% non-buffered

[1] See Appendix A for Venous Access Procedure Orders
[2] Insert and maintain PIVs, access and deaccess implanted ports, and manage central lines as clinically indicated. Access power injectable ports with power rated needles

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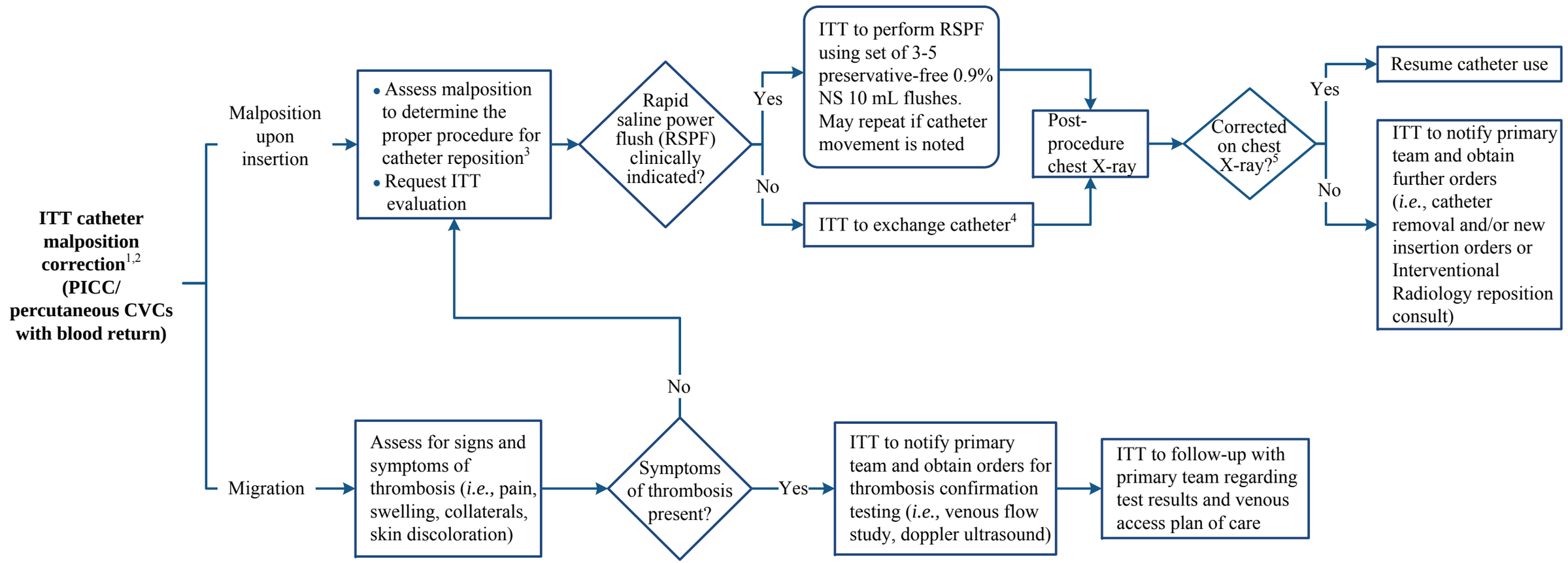
VAD COMPLICATIONS



[1]Tunneled catheter/implanted ports: Notify primary team to consider interventions as clinically indicated (*i.e.*, surgical intervention or IR reposition)
[2]Obtain chest X-ray if malposition is greater than 30 days from confirmation X-ray
[3]See Appendix D for Indication Criteria for Catheter Reposition
[4]See Appendix A for Venous Access Procedure Orders
[5]May repeat RSPF procedure a second time if positive catheter movement towards proper position noted on post procedure chest X-ray. Obtain new chest X-ray after second RSPF. If catheter still malpositioned, notify primary team to obtain further orders.

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VAD COMPLICATIONS - *continued*

Bleeding (CVC, PAC, PICC) → Apply pressure dressing over site with gauze pads and cloth adherent dressing (*i.e.,* gauze 2x2s with Covaderm® covered with Elastoplast®)

Lymph drainage/ duct leak (chyle) (CVC, PICC)[1] → Request ITT for site assessment and dressing change interventions (*i.e.,* Allevyn® Island Dressing, saline/gauze daily dressing changes)

Skin problems (CVC, PAC, PICC)[1]
- Sweating → Switch to a cloth adherent dressing with CHG disc (*i.e.*, Covaderm®, Biopatch®)
- Irritation → Request ITT for site assessment and dressing change interventions (*i.e.,* Allevyn® Dressing, Mepilex® Dressing, daily/biweekly saline/gauze dressings)

Problem resolved?
- Yes → Routine dressing protocol as appropriate
- No → Request ITT for further site evaluation. ITT to contact primary team to discuss venous access plan of care and obtain further orders as needed. (*i.e.,* hemostatic powder, catheter removal and new site insertion)

Suspected catheter site infection (CVC, PAC, PICC, PIV[2]**)** → Request ITT[3] nurse for catheter site evaluation if catheter site infection suspected. (*i.e.*, erythema, pain, drainage)

ITT[3, 4] **Interventions**
- Swab site and send for routine culture and sensitivity, gram stain and fungal culture
- Initiate daily dressing with sterile saline and CHG 4% solution (Hibiclens®) for 7 days, and apply Mupirocin 2% (Bactroban®) ointment (use topical triple antibiotic ointment if allergic to mupirocin)
- Notify primary team of suspected site infection and the initiation of the above interventions

- Inpatient → ITT nurse will preform daily dressing changes, document site assessment, and dressing status on the ITT communication board
- Outpatient →
  - Instruct patient to come to ITT clinic for daily dressing changes.
  - Monitor culture results daily. Notify primary team of positive results and for further orders.
  - Notify primary team immediately if patient has fever of 38.3°C or higher, or if no site improvement after 72 hours.
  - For patients unable to come to ITT clinic for daily dressing changes:
    1. Contact primary team for antibiotic ointment prescription.
    2. Teach patient daily dressing change procedure (sterile saline/CHG 4% solution/ antibiotic ointment) and to contact clinic if signs of worsening skin infection occur (*i.e.,* fever, drainage).
    3. Call patient every three days for follow up. Document status in telephone encounter.
    4. Instruct patient to return to ITT clinic on the 7th day for site evaluation.

[1] For cloth adherent dressings with CHG disc: change weekly. If patient allergic to CHG or disc not available, change dressing biweekly.
[2] Remove PIV if site infection suspected
[3] Suspected infection of catheter site evaluation and care to be done by ITT or ITT-trained HAL nurse or APP
[4] See Appendix A for Venous Access Procedure Orders

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VAD COMPLICATIONS – *continued*

Phlebitis (PICC, PIV) →

- Assess and grade phlebitis per Infusion Nurses Society Phlebitis Scale[1]
- Notify primary team if phlebitis is grade 3 or greater upon initial assessment, if no signs of improvement within 72 hours of treatment initiation, and/or if fever present
- Initiate phlebitis care[2] and continue care for 24 hours after symptoms have resolved

→ Inpatient →

- Inpatient nursing staff to initiate phlebitis care[2] and request ITT evaluation
- ITT nurse to see patient daily for follow up assessment/ grading and document on the ITT communication board.

→ Outpatient →

- ITT nurse to teach patient to do daily phlebitis care[2]
- Instruct patient to follow up with primary team every 24 to 48 hours for follow up assessment and documentation of phlebitis
- For patients unable to come to MDACC, call patient for follow up assessment and document telephone encounter. Educate patient on the importance to follow up phlebitis care and encourage them to visit their local medical physician for assessment, care, and evaluation.

Severed catheter (CVC, PAC, PICC) →

Urgent - notify physician immediately for further instruction and orders[3]

Ruptured/leaking[4] catheter (CVC, PICC) →

- Stop the infusion, close catheter clamp or apply non-serrated hemostat above ruptured portion immediately, and notify primary team.
- Request ITT to evaluate catheter
- ITT to repair catheter[5] with appropriate repair kit temporarily as clinically indicated and notify primary team for further orders (*i.e.*, catheter exchange).

Catheter resuture[4,6] (CVC, PICC) →

- Request ITT[6] to evaluate if loose, tight or missing sutures are noted on catheter
- ITT to reapply suture(s) to secure device using lidocaine 1% subcutaneously as local anesthesia

[1] See Appendix E Infusion Nurses Society Phlebitis Scale
[2] Phlebitis care: Apply warm moist heat to affected extremity 4 times a day for 30 minutes. Rest and elevate the affected extremity on 1 or 2 pillows.
[3] If patient showing symptoms of embolism (*i.e.*, shortness of breath, chest pain, weak pulse) position patient onto left side in Trendelenburg position, call Merit Team and place patient on oxygen.
[4] See Appendix A for Venous Access Procedure Orders
[5] Catheters repaired with glue can not be used for 24-48 hours depending on type of repair. ITT nurse will inform patient and staff.
[6] Catheter resutures may be performed by ITT or ITT-trained HAL nurses or APP.

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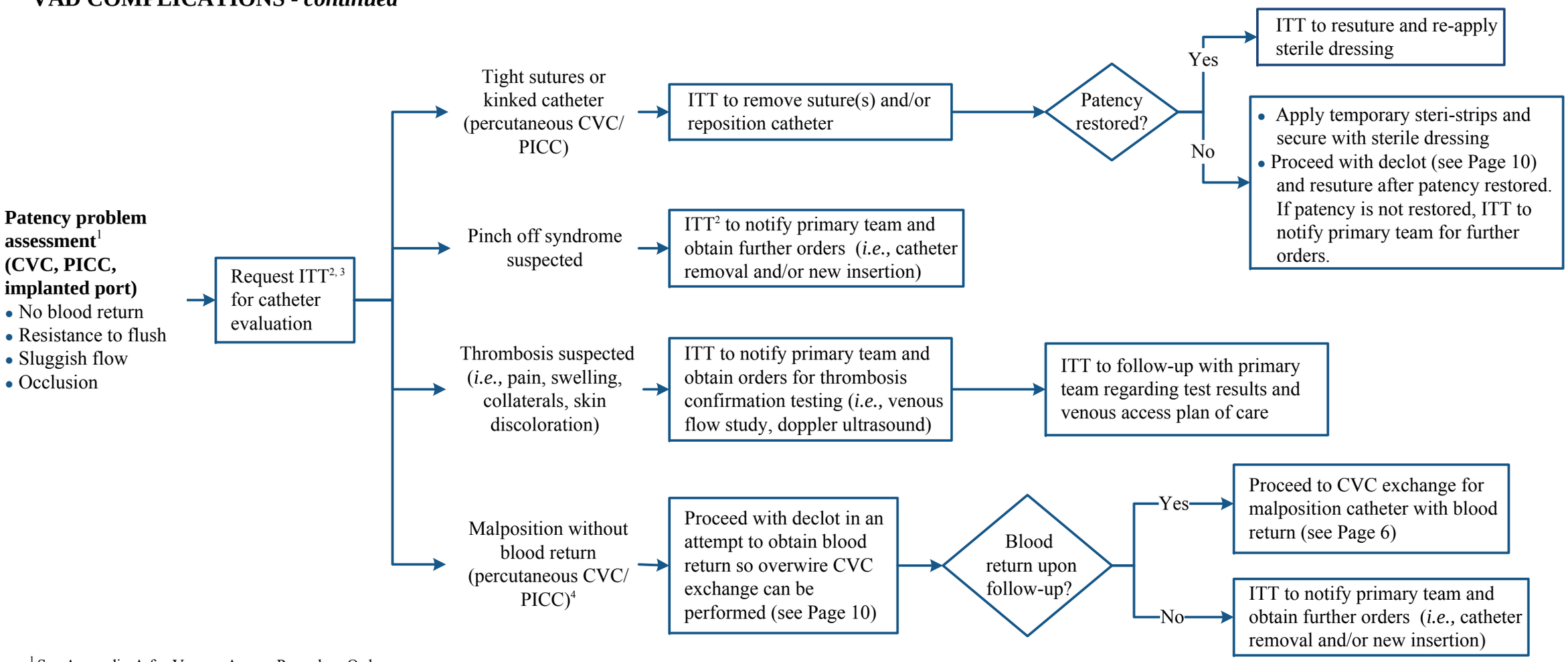
VAD COMPLICATIONS - *continued*



[1] See Appendix A for Venous Access Procedure Orders
[2] Catheter patency evaluation, resuture and declot to be done by ITT or ITT-trained HAL nurses or APP
[3] Review current chest X-ray, order new chest X-ray as clinically indicated (*i.e.*, history of multiple declots, suspected catheter kinks)
[4] Tunneled catheter/implanted ports: Notify primary team to consider interventions as clinically indicated (*i.e.*, surgical intervention or IR reposition)

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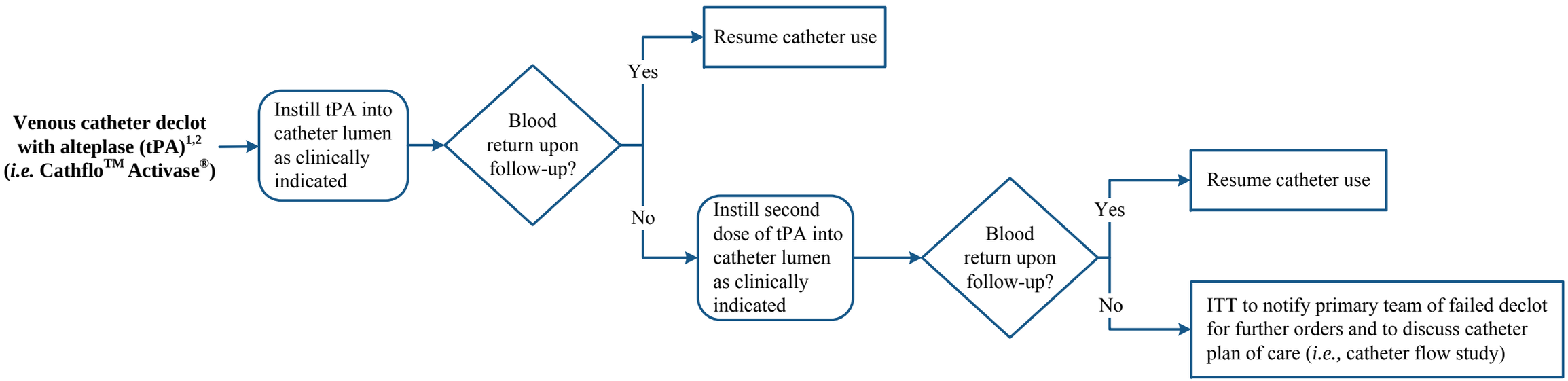
VAD COMPLICATIONS - *continued*



[1] Catheter declot with tPA to be done by ITT or ITT-trained HAL nurse or APP
[2] See Appendix A for Venous access Procedure Orders

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APPENDIX A: Venous Access Procedure Orders

Procedure	Per Parameter: No Cosign Required
PIV insertion, port access, port deaccess, routine CVC/ PICC/port flush	Adult/Pediatric VAD Flush Panel Bacteriostatic 0.9% NS 10 mL Lidocaine 1% 10 mL (buffered or non-buffered)
PICC insertion/ RN exchange	Adult/Pediatric VAD Flush Panel Lidocaine 1% 10 mL (buffered or non-buffered) Chest X-ray (2 view preferred)
CVC insertion/ APP exchange	Adult/Pediatric VAD Flush Panel Lidocaine 1% 30 mL (buffered or non-buffered) Chest X-ray (2 view preferred) PT, PTT, INR, platelets 1 dose platelets
Resuture	Lidocaine 1% 10 mL (buffered or non-buffered)
Catheter patency problems	Adult/Pediatric VAD Flush Panel Alteplase (Cathflo™ Activase®) 2 mg/2 mL Chest X-ray (2 view preferred)
Suspected site infection	Mupirocin 2% ointment (Bactroban®)
Percutaneous CVC/PICC removal	Triple antibiotic ointment single dose packet
Malposition/ rapid saline power flush	Adult/Pediatric VAD Flush Panel Chest X-ray (2 view preferred)
First time CVC/PICC/port assessment	Adult/Pediatric VAD Flush Panel Chest X-ray (2 view preferred)

APPENDIX B: Flush Panel[1]

Adult VAD Flush Panel

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

Pediatrics VAD Flush Panel

- Preservative-free 0.9% Normal Saline (NS) 10 mL
- Lock-flush heparin[2] solution 2 mL (10 units/mL) for patients less than or equal to 10 kg
- Lock-flush heparin[2] solution 2 mL (100 units/mL) for patients greater than 10 kg
- Sodium Chloride 0.9% NS 25 mL
- Sodium Chloride 0.9% NS 100 mL
- Dextrose 5% (D5W) 50 mL

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

APPENDIX C: Pediatric Routine Catheter Flush

Pediatric PICC/CVC/PAC

Heparin Flush: Daily and Deaccessing

Prior to heparin flush, flush lumen with appropriate pediatric volume of preservative-free 0.9% NS

- For patients **less than or equal to 10 kg:**
  - Flush each unused lumen once daily with heparin (PF) 2 mL (10 units/mL) IV
  - Prior to discharge/deaccessing, flush all lumens once with heparin (PF) 2 mL (10 units/mL) IV
- For patients **greater than 10 kg:**
  - Flush each unused lumen once daily with heparin (PF) 2 mL (100 units/mL) IV
  - Prior to discharge/deaccessing, flush all lumens once with heparin (PF) 2 mL (100 units/mL) IV

Pediatric Peripheral Intravenous Catheter (PIV)

Preservative-free 0.9% Normal Saline (NS)

Flush before and immediately after use. When not used, flush each lumen every 12 hours

- For infants **(up to 18 months old)**:
  - Flush with preservative-free 0.9% Normal Saline (NS) 3 mL
- For toddler/school age **(up to 4 feet)**:
  - Flush with preservative-free 0.9% Normal Saline (NS) 5 mL
- For all others:
  - Preservative-free 0.9% Normal Saline (NS) 10 mL

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APPENDIX D: Indication Criteria for Catheter Reposition

Rapid Saline Power Flush (RSPF)
Indication Criteria:
1. Tip malposition on chest X-ray review (*i.e.,* contralateral, internal jugular, azygous, subclavian)
2. Catheter type
   a. Non-tunneled PICC/CVC
   b. Silicone (single or double only)
   c. Power/polyurethane (single, double, triple)

Overwire Exchange
Indication Criteria:
1. Tip malposition
   a. Degree of complexity (*e.g.*, figure of 8 loop, tip in mammary vein or anterior jugular)
   b. Level of tip position
      If greater than 2-3 cm below atrial arch **or**
      If greater than 2 cm above carina
      Note: CVC pull back can be done
         If 2 cm or less below atrial arch for subclavian/jugular CVC **or**
         If 3 cm or less below atrial arch for PICC **or**
         If patient is symptomatic as warranted
2. Catheter type
   a. Non-tunneled
   b. Rigid/large bore (quinton/apheresis, triple lumen silicone catheters)
3. Same size catheters or large to small catheter - RN Exchange
4. External subclavian catheter greater than 2 cm or external PICC catheter greater than 3 cm
5. Small to large catheter - surgeon/APP exchange

APPENDIX E: Infusion Nurses Society Phlebitis Scale

Grade	Clinical Criteria
0	No symptoms
1	Erythema at access site with or without pain
2	Pain at access site with erythema and/or edema
3	• Pain at access site with erythema and/or edema • Streak formation • Palpable venous cord
4	• Pain at access site with erythema and/or edema • Streak formation • Palpable venous cord greater than 1 inch in length • Purulent drainage

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This practice algorithm has been specifically developed for MD Anderson using a multidisciplinary approach and taking into consideration circumstances particular to MD Anderson, including the following: MD Anderson's specific patient population; MD Anderson's services and structure; and MD Anderson's clinical information. Moreover, this algorithm is not intended to replace the independent medical or professional judgment of physicians or other health care providers.

SUGGESTED READINGS - *continued*

UTMDACC Institutional Policy #CLN1094 – Clinical Practice Patient Care Management Tools
UTMDACC Institutional Policy #CLN1165 – Central Venous Catheter- Peripherally Inserted Central Catheter (PICC) Insertion
UTMDACC Institutional Policy #CLN1036 – Central Venous Catheter Assessment and Tip Position Verification Policy
UTMDACC Institutional Policy #CLN0986 – Vascular Vesicant/Irritant Administration and Extravasation Policy
UTMDACC Institutional Policy #CLN0655 – Central Venous Catheters (CVC)/Midline Catheters-Percutaneous Removal Policy
UTMDACC Institutional Policy #CLN0656 – CVC Overwire Exchange: Assisting Physicians, Advanced Practice Providers, and Infusion Therapy Nurse-Performed Exchange Policy
UTMDACC Institutional Policy #CLN0857 – Care of Phlebitis Associated with Peripherally Inserted Central Catheter and Peripheral Venous Catheter Devices
UTMDACC Institutional Policy #CLN0858 – Local Anesthetic for Peripheral Intravenous (PIV) Catheter Insertion and Implanted Port Accessing
UTMDACC Institutional Policy #CLN0859 – Central Venous Catheters (CVCs)-Restoring Patency to CVCs Due to Thrombotic or Precipitant- Occlusion Policy
UTMDACC Institutional Policy #CLN1154 – Percutaneous Central Venous Catheter (CVCs) - Suture Securement and Replacement Policy
UTMDACC Institutional Policy #CLN0537 – Flushing of All Central Venous Catheters & Peripheral Venous Catheter Devices Policy
UTMDACC Institutional Policy #CLN0617 – Central Venous Catheters (CVCs) with Persistent Withdrawal Occlusion (No Blood Return) Policy
UTMDACC Institutional Policy #CLN0944 – Central Venous Catheters (CVCs)-Drawing Blood Policy
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Vascular Access Device (VAD) Selection and Management Algorithm

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