Nursing Management of Venous Access Devices:

An Overview of Central Venous Access Devices

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Central Venous Access Devices (CVADs)

- Peripherally Inserted Central Catheters (PICCs)
- Non-tunneled catheters: Subclavian / Jugular / Femoral Lines
- Tunneled catheters: Hickmans / Broviacs / Groshongs / Small Bore
- Implanted ports: Port-a-caths / Passports

Central VADs

"...first line of defense, not a device of last resort"

- Candidates:
  - Long-term therapies (> one week)
  - TPN
  - Chemotherapy / vesicants
  - Drugs with pH <5 or >9
  - Long term antibiotic therapy
  - Hypertonic solutions (osmolality >600mOsm/L) ex.- 3% saline
  - Limited venous access

Verification of Central Lines

- Confirmation of type of central line and line placement MUST be verified before use
- Until verification is complete, the catheter must be marked with a red “unconfirmed catheter” sticker
- Pheresis and dialysis catheters will have a specific label attached to the dressing
- Refer to Nursing Policies and Procedures Trove 05-03-01 and 05-03-04

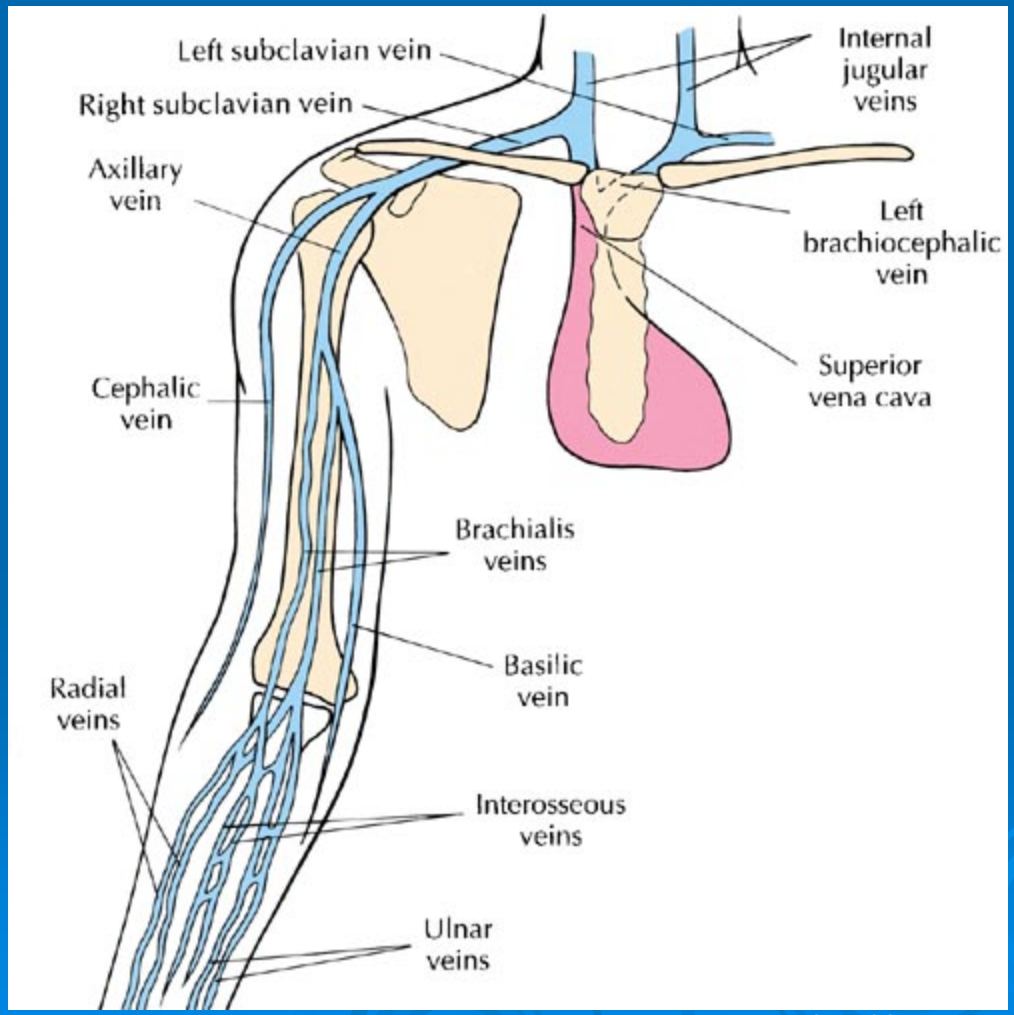
Sources to Use for Central Line Identification

- Chest x-ray or CT scan
- Interventional Radiology report
- Operative note
- Discharge summary
- Referring MD note
- Outside hospital transfer note
- Patient-provided documentation

Central VAD: Catheter Tip Placement

- Chest x-ray mandatory before initial use, and if patient is readmitted to the hospital with an existing PICC or undocumented VAD
- MUST be “central” –
  - Superior vena cava (SVC)
  - Cavoatrial junction (superior vena cava/right atrial junction (SVC/RA junction)
  - Right atrium (RA); exception is PICCs
  - Femoral lines: tip in thoracic inferior vena cava (IVC) above level of the diaphragm

Venous anatomy of upper extremity veins



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Central VADs: Malpositioned catheters

- Catheter should not be used as a central VAD until it is repositioned and tip is confirmed to be in a central location
- Interventions for PICCs:
  - Malpositioned PICCs are not automatically removed.
  - Pull-back: if tip in right atrium, right ventricle, some contralateral PICCs, or patient is experiencing cardiac irritability, the PICC may be pulled back by the IV nurse or interventional radiology.
  - Other tip locations may be exchanged by IV nurse or Interventional Radiology (IR).

Central VADs: Malpositioned catheters

- Interventions for PICCs (cont.):
  - Catheter exchange is considered if:
    - Tip is in the jugular, contra-lateral vein, coiled or looped. Most coiled or looped PICCs are managed by IR.
    - Patient needs more lumens for therapy or patient needs a non-violated line for TPN initiation.
- Individual patient anatomy or disease may not allow centrally-placed lines and need is determined on an individual patient case basis.

Vein Measurements

	Length	Diameter	Flow Rate
Cephalic	38cm	6mm	40-90ml/min
Basilic	24cm	8mm	90-150 ml/min
Axillary	13cm	16mm	150-350ml/min
Subclavian	6cm	19mm	350-800ml/min
Innominate	2.5cm	19mm	800-1500ml/min
SVC	7cm	20mm	2000ml/min

Central VAD Care and Maintenance: Flushing

- Always use a 10ml or larger syringe to flush or administer medications. Smaller syringes have increased flushing pressure that cause catheter rupture.
  - *Note:* some pre-filled syringes smaller than 10ml have syringe barrel equal to a 10 ml syringe and are acceptable to use
- NO heparin for heparin-induced thrombocytopenia (HIT) positive patients: flush with 0.9% saline 10ml
- Heparin NOT needed for 'saline only/valved' devices
- Flush IMMEDIATELY post-infusion and after blood drawing
- Use push-pause/pulsatile flush method
  (see module 1 for description)

Central VAD Care & Maintenance: Heparin

- To minimize risk of unintended systemic anticoagulation from frequent flushing, consider piggy-backing medications into an ordered infusion
  - Adult ‘guideline’: recommended maximum per 24 hours for intermittent flushes should not exceed 2,000 unit heparin
  - Pediatrics ‘guideline’: maximum heparin per 24 hours should not exceed 75 units per kg or 2,000 units in 24 hours

  -- Obtain order for VAD heparin flush to enable EMAR documentation
- “Fun fact”: heparin does NOT dissolve existing clots; it helps prevent future clots

Adult Heparinization Chart (per lumen)

MGH Nursing Policies and Procedures Trove 05-03-06

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Implanted ports: Port-a-caths Power ports Passports	Heparin 100 units/ml; flush with 5 ml (500 units).	After completion of any infusion or blood sampling. When deaccessing or doing a monthly flush to maintain patency if port is not in active use.
Hickmans (tunneled catheters)	Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion or blood sampling. When not in use flush at least 1-2 times a week.

Adult Heparinization Continued

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Small Bore Tunneled Central Line Catheters (e.g. Bard Powerline)	Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion or blood sampling, at least once every 24 hours.
Pheresis Catheters (large bore catheters used for pheresis, bone marrow transplant) [Note: May be confused with a Hickman or dialysis catheter.]	Heparin 1000 units/ml; instill volume of catheter (printed on each lumen) plus volume of cap (currently 0.2 ml for MaxPlus). If catheter volume not legible, contact CNS or Interventional Radiology for guidance. **Heparin must be withdrawn** from the lumen **prior to flushing or infusing** through the pheresis catheter, in order to avoid excess or inadvertent anticoagulation.	After completion of any infusion or blood sampling. When not in use, remove and reinstill MWF.

Adult Heparinization Continued

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Multiple Lumen Percutaneous Catheters (non-tunneled catheters)	Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion or blood sampling, at least once every 24 hours.
PICCs and power-injectable PICCs (e.g. Bard Power PICC)	Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion or blood sampling, at least once every 24 hours.
Saline-only PICCs and Valved catheters (e.g. Vaxcel or Bard PowerPICC SOLO)	Do NOT require Heparin. Use preservative-free Normal Saline: flush with at least 20 ml after blood draws or discontinuing TPN; 10 ml after meds or for routine flush.	Flush after each use or at least every 7 days when not in use. Although these do not require heparin, OK to use if needed. It is essential to use push-pause technique when flushing saline-only catheters.

Adult Heparinization Continued

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Hohn Catheters	Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion. When not in use, flush every 7 days.
Groshong Tip Catheters	Do NOT require Heparin. Use preservative-free Normal Saline: flush with at least 20 ml after blood draws or discontinuing TPN; 10 ml after meds or for routine flush.	Flush after each use or at least every 7 days when not in use. Although these do not require heparin, OK to use if needed. It is essential to use push-pause technique when flushing saline-only catheters.

Pediatric Heparinization Chart (per lumen)

MGH Nursing Policies and Procedures Trove 05-03-06

Type of Catheter	Routine Flushing	Frequency of Flush
Implanted ports: Port-a-caths Power ports [Ports are rare in infants]	Adolescents: Heparin 100 units/ml; flush with 5 ml (500 units).	After completion of any infusion or blood sampling. When deaccessing or doing a monthly flush to maintain patency if port is not in active use.
	Pedi/Toddlers/Infants: Heparin 100 units/ml; flush with 3-5 ml (300-500 units) depending upon size of child and port used.	When deaccessing or doing a monthly flush to maintain patency if port is not in active use.
	Heparin 10 units/ml; flush with 3-5 ml (30-50 units) depending upon size of child and port used.	If used for more than 1 med Daily; after completion of any infusion or blood sampling when pt remains accessed.

Pediatric Heparinization Chart Continued

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Hickmans/Broviacs (tunneled catheters)	Adolescents: Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion or blood sampling. When not in use flush at least 1-2 times a week.
	Pedi/Toddlers/Infants: Heparin 10 units/ml; flush with 2 mls (20 units).	After completion of any infusion or blood sampling, every 24 hours.
	Neonates/NICU: Heparin 10 units/ml; flush with 1-2 ml (10-20 units). Note: The volume of the flush should be equal to the volume of the catheter.	After completion of any infusion or blood sampling, every 12-24 hours.

Pediatric Heparinization Continued

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Small Bore Tunneled Central Line Catheters (e.g. Bard Powerline)	Adolescents: Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion or blood sampling, at least once every 24 hours.
	Pediatrics: -2F Catheter: Heparin 10 units/ml; flush with 1 ml (10 units. -2.6F or larger: Heparin 10 units/ml; flush with 2-3 mls (20-30 units).	 After completion of any infusion or blood sampling, at least once every 6 hours. After completion of any infusion or blood sampling, at least once every 12 hours.

Pediatric Heparinization Continued

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Pheresis Catheters (large bore catheters used for pheresis, bone marrow transplant) [Note: May be confused with a Hickman or dialysis catheter.]	Adolescents: Heparin 1000 units/ml; instill volume of catheter (printed on each lumen) plus volume of cap (currently 0.2 ml for MaxPlus). If catheter volume not legible, contact CNS or Interventional Radiology for guidance. **Heparin must be withdrawn** from the lumen **prior to flushing or infusing** through the pheresis catheter, in order to avoid excess or inadvertent anticoagulation.	After completion of any infusion or blood sampling. When not in use, remove and reinstill MWF.
	Pedi/Toddlers: Please refer to physician order.	

Pediatric Heparinization Continued

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Multiple Lumen Percutaneous Catheters (non-tunneled catheters)	Adolescents: Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion or blood sampling, at least once every 24 hours.
	Pedi/Toddlers/Infants: Heparin 10 units/ml (20 units).	After completion of any infusion or blood sampling, at least once every 24 hours.
	Neonates/NICU: Heparin 10 units/ml; flush with 1-2ml (10-20 units). Note: The volume of flush should be equal to the volume of the catheter.	After completion of any infusion or blood sampling, at least once every 12-24 hours.

Pediatric Heparinization Continued

Type of Catheter	Routine Flushing	Frequency of Flush
PICCs and power-injectable PICCs (e.g. Bard Power PICC)	Adolescents: Heparin 10 units/ml; flush with 5 ml (50 units).	After completion of any infusion or blood sampling, at least once every 24 hours.
	Pediatrics: -2F catheter: Heparin 10 units/ml; flush with 1 ml (10 units). -2.6F catheter or larger: Heparin 10 units/ml; flush with 2-3ml (20-30 units).	After completion of any infusion or blood sampling, every 6 hours. After completion of any infusion or blood sampling, every 12 hours.
	Neonates/NICU: Single lumen PICC lines are not heplocked. Unused lumens of multi-lumen PICCs may be heplocked in certain situations, such as fluid restriction.	All neonate/NICU infusions, including central line flushes, should be administered using a pump to reduce the risk of catheter fracture.

Pediatric Heparinization Continued

Type of Catheter	*Routine Flushing*	*Frequency of Flush*
Saline-only PICCs and Valved catheters (e.g. Vaxcel or Bard PowerPICC SOLO)	Adolescents: Do NOT require Heparin. Use preservative-free Normal Saline: flush with at least 20 ml after blood draws or discontinuing TPN; 10 ml after meds or for routine flush.	Flush after each use or at least every 7 days when not in use. It is essential to use push-pause technique when flushing saline-only catheters. Although these do not require heparin, OK to use if needed.
	Pediatrics: Generally not used.	

Pediatric Heparinization Continued

Type of Catheter	Routine Flushing	Frequency of Flush
Hohn Catheters	Adolescents: Heparin 10 units/ml; flush with 5 ml (50 units). Pediatrics: Generally not used.	After completion of any infusion. When not in use, flush every 7 days.
Groshong Tip Catheters	Adolescents: Do NOT require Heparin. Use preservative-free Normal Saline: flush with at least 20 ml after blood draws or discontinuing TPN; 10 ml after meds or for routine flush. Pediatrics: Generally not used.	Flush after each use or at least every 7 days when not in use. Although these do not require heparin, OK to use if needed. It is essential to use push-pause technique when flushing saline-only catheters.

To Clamp or Not to Clamp?

- Needleless connectors should be **primed** and changed every 96 hrs (usually 2 x week, once when dressing is changed) and PRN when cap is compromised.
- **Positive displacement needleless connectors (Maxplus):** flush using a pulsatile or “push-pause” technique. Remove syringe and ONLY then, may you clamp the catheter. Let the needleless connector do its job! You can expect a small fluid drop on end of cap. Wipe with a dry gauze.
- Clamps should NOT be used on PICCs or midlines while patient is “in-house”
- **Neutral displacement needleless connectors (micro-clave or q-syte) or direct connect:** flush using a pulsatile or “push-pause” technique. Maintain positive pressure by clamping line while injecting last ml. of fluid, or disconnect syringe while still flushing forward

Flushing Techniques

Type of catheter cap	**Flushing technique**
Needleless system cap **with** positive pressure feature (e.g. Max-Plus). Note: These are required for all central lines at MGH.	Flush using push-pause technique. Remove syringe, and ***only then*** may you clamp the catheter.
Needleless system cap **without** positive pressure feature (e.g. blue MicroClave)	Flush using push-pause technique. Maintain positive pressure by clamping line while injecting last ml of fluid.
None- Flushing when using a direct connection (e.g. during monthly maintenance flush of port).	Flush using push-pause technique. Maintain positive pressure by clamping line while injecting last ml of fluid.

Central VADs Care and Maintenance: Blood Drawing

- GENEROUSLY flush with 20-30ml saline post blood draw or checking for blood return
- Valved VADs require slightly different withdrawal procedure
  - Pull back slightly, pause and then continue withdrawing blood sample. Pause allows valve to open.

Discard Amounts

- ‘Discard’ amounts:
  - adults - 6ml of blood
  - pediatrics:
    - adolescents and older children - 3ml for tunneled catheter; 3 to 5ml for implanted port
    - child - 5 to 10ml maximum
    - Infant - 2ml maximum
    - neonate - 1ml maximum
- Refer to MGH Nursing Policies and Procedures Trove 05-03-07

Central VADs: Dressing Protocol

Refer to MGH Nursing Policies and Procedures Trove 05-03-05

- Chlorhexidine gluconate 2% is the preferred, CDC recommended method of site disinfection.
- Transparent semipermeable membrane [TSM] dressings (without gauze) are changed routinely **every seven days**.
- Gauze dressings that obscure the catheter or port needle site are changed every 48 hours. This includes Covaderm® dressings.
- Change dressing PRN when non-occlusive, soiled, bloody, or not dated.

Central VADs: Dressing Protocol (cont)

Refer to MGH Nursing Policies and Procedures Trove 05-03-05

- Protect dressing when patient showers
- Assess skin for s/s infection or tape reaction
  - Assess need for alternate dressing (Sorbaview®, Covaderm®)
  - Report s/s infections
- **NICU** PICC dressings are only changed PRN, not routinely, and only by the Nurse Practitioner that inserted the PICC.

PLEASE NOTE…

- All information provided is subject to review and revision. Please continue to refer to MGH Policies and Procedures in Trove as your primary resource

References

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