

Central Venous Catheterization

Preparation:

Assess need

- number and size of lumens needed
- monitoring (e.g., if eventual PA catheterization likely, want to place a catheter introducer and use sites with most direct access to the right heart (RIJ, LSCV))

Consent

Labs:

- coagulation tests

Optimal Site of Placement

- anatomic factors
- hardware / surgical issues
- laboratory factors affecting site of placement: for example, if coagulation tests are abnormal, avoid subclavian sites. Preferred sites include: femoral vein (FV), internal jugular vein (IJV), external jugular vein (EJV)
- Hemodynamic issues: Subclavian vein may be more easily located in patients with compromised volume status

Patient Positioning

- Visualize the vessels prior to catheter insertion with the site rite doppler.
- Femoral vein cannulation: the patient should lie flat while slightly rotating the leg externally
- Internal jugular vein cannulation: the patient should be flat or slightly hyperextended in the maximal modified Trendelenburg position (head down at 15 degrees) to diminish air embolism risks and to distend the target vein maximally. The head should be rotated away from the side of cannulation at 45 degrees.
- Subclavian vein cannulation: Trendelenburg position, a rolled towel or sandbag should be placed under the shoulders, transversely or longitudinally between the scapulae. An assistant can pull down (caudal) on the ipsilateral arm to displace the humeral head and allow optimal needle entry parallel to the coronal plane.

Skin Prep and Draping

- Operator should wear hat, mask, gown, gloves, and protective eye wear at all times. Use large drape except in emergent situation.
- Apply disinfectant by scrubbing outward in a circular pattern. Scrub 2 times. Allow 3 minutes for optimal skin sterilization.
- Scrub 5 cm peripheral to anticipated area of fenestration in drapes.
- Prep contiguous internal jugular and clavicular sites.

Anesthesia

- Local infiltration with 1 – 2% lidocaine (without epinephrine); 0.2-0.4 ml (1.0 cm wheal); infiltrate slowly
- Follow with 0.2 ml boluses per 2 mm increments. Always check back aspiration for blood before injecting.
- Maximum lidocaine dose: 2.0mg / kg body weight
- 1.0% lidocaine = 1.0 gm / 100 ml = 10 mg / 1 ml

Procedure Technique

- Flush catheter prior to insertion.
- Visualize the vessels prior to catheter insertion with the site rite doppler.
- Cannulate the vessel with search needle.
- Needle for wire or cannula insertion can then be inserted parallel to the search needle.
- Modified Seldinger technique can then be employed to insert the desired catheter into the vein.
- Multilumen catheters require 2 crossing skin incisions adjacent to the wire at 180 degree angles, 5 mm deep and 2 – 3 mm wide, using a No. 11 scalpel blade to facilitate insertion of the dilator through the skin.
- Fix the catheter in place with at least 2 sutures. Do not draw the suture too tightly against the skin.
- Dispose of all sharps appropriately. Discuss with the nurse the appropriate IV fluid, catheter flush, and catheter dressing.
- Obtain the appropriate radiographic study to confirm the catheter location and detect possible complications.
- Always write a procedure note which includes these elements: name of procedure, indication, medications used, physicians present, documentation of consent, anatomic location of procedure, type of catheter, description of procedure, position of catheter, complications, and follow-up procedures.

Anatomy of specific sites

Femoral Vein:

- At a level 2 – 3 cm below the inguinal ligament, the femoral artery lies 1 / 3 of the way from the public tubercle to the anterior superior iliac spine. The femoral vein lies 1 – 2 cm medial to the artery.
- All sticks must be below the inguinal ligament.
- The needle should be kept at a 45 degree angle.

Internal Jugular Vein:

- For the central approach, insert the needle at the apex of the triangle formed by the sternal and clavicular heads of the sternocleidomastoid muscle.
- The needle should be directed towards the ipsilateral nipple 20 – 30 degrees above the skin.
- Avoid directing the needle more medial than a line parallel to the spinal axis to avoid carotid artery puncture.
- The RIJ takes a straight path to the SVC. LIJV puncture carries the potential for thoracic duct injury and the dome of the pleura is higher on the left.
- Approximately 10% of patients will have an internal jugular vein that on one side is absent or in an unusual position. This is an advantage of using the site rite doppler.

Subclavian Vein:

- Check size of the vein and relationship to the subclavian artery with site rite doppler
- Infraclavicular: medial approach-sternal notch orientation. Needle enters the skin 1 – 2 cm below the junction between the medial and middle third of the clavicle. The needle is passed under the clavicle, between the clavicle and the first rib directed towards the sternal notch.
- Keep the needle – syringe assembly as parallel to the coronal plane as possible.
- The vein should be entered within 2 – 3 cm.

Catheter tip position

- Right sided catheter tips should be approximately 2 cm proximal to the right atrium for right sided approaches, and similarly placed or well within the innominate vein for left sided approaches.
- Distance to caval-atrial junction: 13 – 16 cm from RIJV or RSCV, 15 – 20 cm from left sided insertions.

Complications:

- Infection rate: 0.5 – 2%
- Carotid artery puncture: 5%
- Pneumothorax: 0.1% for IJV, 1 – 8% for SCV
- Bleeding: 1 – 5% from SCV
- Never leave intravenous needle or catheters open to atmospheric pressure given the risk of air embolism. If air embolism is thought to have occurred, place the patient in the left lateral decubitus position to ensure flow through the right ventricular outflow tract.