Practitioners must become familiar with the signs, symptoms, interventions and preventive measures for catheter-related complications at all insertion sites.

**EXTERNAL JUGULAR (EJ)**

**LANDMARKS**
- external jugular vein
- sternocleidomastoid muscle
- clavicle
- manubrium
- supracleavicular fossa
- subclavian artery

**INSERTION ORIENTATION**
- Central: Insert needle at an angle of 30 degrees from the clavicle to the supracleavicular fossa. Insertion depth 3-7 cm.
- Ultrasound guided, transverse: Insert needle at a deeper angle (45-90 degrees) from the clavicle to the supracleavicular fossa. Insertion depth 3-7 cm.

**ADVANTAGES**
- easy to locate
- easy to maintain

**DISADVANTAGES**
- possible pneumothorax
- phrenic nerve injury
- carotid artery puncture
- pleural effusion
- subclavian artery perforation
- subclavian vein perforation

**ANATOMY**
- clavicle
- manubrium
- sternocleidomastoid muscle
- supracleavicular fossa
- subclavian artery
- internal jugular vein

**SUBCLAVIAN**

**LANDMARKS**
- clavicle
- sternocleidomastoid muscle
- supracleavicular fossa
- subclavian artery

**INSERTION ORIENTATION**
- Ultrasonographic: Insert needle at an angle of 30 degrees from the clavicle to the supracleavicular fossa. Insertion depth 3-7 cm.
- Ultrasound guided, longitudinal: Insert needle at a deeper angle (45-90 degrees) from the clavicle to the supracleavicular fossa. Insertion depth 3-7 cm.

**ADVANTAGES**
- easy to locate
- easy to maintain

**DISADVANTAGES**
- possible pneumothorax
- phrenic nerve injury
- carotid artery puncture
- pleural effusion
- subclavian artery perforation
- subclavian vein perforation

**ANATOMY**
- clavicle
- manubrium
- sternocleidomastoid muscle
- supracleavicular fossa
- subclavian artery

**AXILLARY**

**LANDMARKS**
- axilla
- deltopectoral groove
- subclavian artery

**INSERTION ORIENTATION**
- Ultrasound guided, transverse: Insert needle at an angle of 30 degrees from the clavicle to the supracleavicular fossa. Insertion depth 3-7 cm.
- Ultrasound guided, longitudinal: Insert needle at a deeper angle (45-90 degrees) from the clavicle to the supracleavicular fossa. Insertion depth 3-7 cm.

**ADVANTAGES**
- easy to locate
- easy to maintain

**DISADVANTAGES**
- possible pneumothorax
- phrenic nerve injury
- carotid artery puncture
- pleural effusion
- subclavian artery perforation
- subclavian vein perforation

**ANATOMY**
- axilla
- deltopectoral groove
- subclavian artery

**BASILIC VEIN**

**ADVANTAGES**
- easy to access
- easy to locate

**DISADVANTAGES**
- may be difficult to access
- subclavian vein perforation
- pleural effusion
- subclavian artery perforation

**ANATOMY**
- basilic vein
- radial vein
- brachial artery

**BRAHCHIAL VEIN**

**ADVANTAGES**
- easy to access
- easy to locate

**DISADVANTAGES**
- may be difficult to access
- subclavian vein perforation
- pleural effusion
- subclavian artery perforation

**ANATOMY**
- brachial vein
- axillary vein
- subclavian artery

**CEPHALIC VEIN**

**ADVANTAGES**
- easy to access
- easy to locate

**DISADVANTAGES**
- may be difficult to access
- subclavian vein perforation
- pleural effusion
- subclavian artery perforation

**ANATOMY**
- cephalic vein
- basilic vein
- radial vein
- brachial artery

**MEDIAN CUBITAL VEIN**

**ADVANTAGES**
- easy to access
- easy to locate

**DISADVANTAGES**
- may be difficult to access
- subclavian vein perforation
- pleural effusion
- subclavian artery perforation

**ANATOMY**
- median cubital vein
- basilic vein
- radial vein
- brachial artery

**PRINCIPLES OF VASCULAR ACCESS INSERTION**

- Secure, dress and confirm catheter placement
- Verify catheter tip position
- Reduce risks: Avoid hilly terrain, use single devices
- Check for signs of infection
- Use sterile techniques

**COLOUR KEY**

- VEINS
- ARTERIES
- NERVES

**REFERENCE**

Reference is available upon request. See contact information on the back of this sheet.
**PRINCIPLES OF VASCULAR ACCESS INSERTION**

**VASCULAR ACCESS DEVICE-DECISION TREE**

- **Patient requires IV therapy**
  - **Peripheral line**
    - Osmolality < 600 mOsm/L; for short term (<4 weeks) & non-irritant and non-vesicant infusions; or short term (<6 weeks)
    - Osmolality > 600 mOsm/L; or pH < 5 or pH > 9; or irritant or vesicant infusions; for both short term (<4 weeks) and long term (>4 weeks)

**SELDINGER TECHNIQUE**

- After administering local anesthetic, locate vein using thin-walled introducer needle. Vessel may be punctured with a smaller needle.
- Remove syringe. Confirm venous placement by using hemodynamic monitoring or checking for pulsatile blood flow. Palpable thrill is usually an indicator of inadvertent arterial puncture.
- Immediately exclude needle lumen to prevent air embolism or bleeding.
- Using a straightening tube, straighten tip of spring wire guide. Do not cut spring wire guide or withdraw spring wire guide back through the cannulation site. If vessel will not yield to gentle palpation, indirect ultrasound will aid in identification of vessel as this may result in vessel damage.
- Hold spring wire guide in place and remove needle.
- Hold spring wire guide in place and remove Raulerson syringe and needle.
- Thread tissue dilator with peelable sheath onto the wire and through exit hub.
- Remove dilator, place gloved finger onto the peelable sheath. Withdraw peel-away sheath from vessel.
- WARNING: Maintain a firm grip on spring wire guide at all times to avoid wire motion.
- WARNING: Maintain control of spring wire guide at all times to avoid needle entanglement.

**USING RAUROWSON SYRINGE**

- After administering local anesthetic, locate vein using thin-walled introducer needle attached to Raulerson syringe.
- Verify venous access by inserting dilated cannula transcutaneously into rear of Raulerson syringe and through imaging valve. Observe for venous placement via venous return obtained with a calibrated transcutaneous transduction transducer probe.
- Hold spring wire guide in place and remove Raulerson syringe and needle.
- WARNING: To avoid venous or arterial punctures, do not cut spring wire guide in absence of confirmation of venous placement.
- WARNING: To avoid arterial punctures, do not insert stiff needle immediately after dilator withdrawal. This may result in vessel damage.

**MODIFIED SELDINGER TECHNIQUE**

- Catheter/Needle assembly may be used in place of the thin-walled introducer needle.
- Remove needle and syringe, leaving arterial catheter in vessel.
- WARNING: To avoid possible catheter entanglement, do not remove needle introducer stylet from sheath.
- WARNING: Maintain a firm grip on spring wire guide at all times to avoid needle entanglement.
- WARNING: Maintain control of spring wire guide at all times to avoid needle entanglement.
- WARNING: Maintain a firm grip on spring wire guide at all times to avoid needle entanglement.
- WARNING: Maintain control of spring wire guide at all times to avoid needle entanglement.
- WARNING: Maintain a firm grip on spring wire guide at all times to avoid needle entanglement.

**SELECTION OF CATHETERS AND SITES**

- The risk and benefits of placing a central venous catheter depend on the patient’s needs and the potential for complications.
- Selection should be based on the patient’s condition and the site of venous access.
- Avoid the subclavian site in patients with advanced pulmonary disease, to avoid subclavian vein stenosis.
- Avoid the femoral site in elderly patients to prevent femoral artery puncture.
- Avoid the left internal jugular site in patients with previous left internal jugular placement.

**RECOMMENDATIONS FOR CENTRAL LINES INSERTION & REMOVAL**

**HAND HYGIENE AND ASEPTIC TECHNIQUE**

- Maintain hand hygiene, either by washing hands with conventional soap and water or with alcohol-based hand rubs (ABHR).
- Maintain aseptic technique for the insertion and care of intravascular catheter. Category IB.
- Grasping catheter near skin, advance into vein with a slight twisting motion. Hold spring wire guide in place and withdraw peel-away sheath from vessel.

**CENTRAL CATHETER INSERTION & REMOVAL**

- Use ultrasound guidance to place central venous catheters. Category IA.
- Use a subclavian site, rather than a jugular or a femoral site, in outpatient patients. Category IA.
- Use a subclavian site, rather than a jugular or a femoral site, in outpatient patients. Category IA.
- For patients on extracorporeal membrane oxygenation (ECMO), use an ipsilateral site to ECMO catheter. Category IA.

**REFERENCES**