Subclavian - Central Venous Catheterization

INTRODUCTION:
Central lines are commonly placed in the ED for rapid infusion of fluids, placement of transvenous pacemakers, and administration of medications that needing reliable central access. Sites of placement are the internal jugular (IJ) vein, subclavian vein and femoral vein. A triple lumen is usually placed for medical patients but in the setting of trauma, a sheath introducer (Cordis) will be placed.

The subclavian commonly used in the trauma patient as it is quick, done by anatomical landmarks and often trauma patients have cervical collars. It has the lowest DVT and infection rate out of any central line.

GOALS OF THE PROCEDURE:
- Obtain reliable central venous access without complications

INDICATIONS
- High volume resuscitation
- Emergency venous access
- Inability to obtain peripheral access
- Administering medications needing central access (ie vasopressors)
- Insertion of transvenous pacemaker (left subclavian)
- Hemodialysis
- CVP or PCWP monitoring (not commonly done in ED)
- Infusion of hyperalimentation and other concentrated solutions

GENERAL CONTRAINDICATIONS
- Infection overlying site of placement
- Distorted local landmarks due to trauma, mass, etc.
- Uncorrected coagulopathy (particularly as it is noncompressible!)
- Prior vessel injury or procedures
- Pathological conditions (ie SVC syndrome or DVT)
- Uncooperative patient

SUBCLAVIAN SPECIFIC CONTRAINDICATIONS
- Trauma involving the clavicle, first rib or subclavian vessels
- Radiation to clavicular area
- Chest wall deformities
- Marked cachexia or obesity

COMPLICATONS:
- Arterial puncture and hematoma
- Pneumothorax
- Hemothorax
- Vessel injury
- Air embolism
- Cardiac dysrhythmia
- Nerve injury
- Infection
- Thrombosis
- Catheter misplacement

**EQUIPMENT**
- Sterile PPE (sterile gown & gloves, mask, face shield, hair net)
- Triple Lumen or Cordis Central Venous Catheter kit
- Extra Lidocaine for the skin (if patient awake)
- Tegaderm
- Antibiotic patch
- 3 dead heads
- 3 saline flushes (if sterile drop on field, if not sterile squirt into the catheter kit)

**ANATOMY**

*Infraclavicular Approach:*

![Infraclavicular Approach Diagram](image)

*Supraclavicular Approach*

![Supraclavicular Approach Diagram](image)
STEPS

Preparation & Positioning
1. Positioning:
   a. Supine with head in neutral position (infraclavicular approach)
      i. If attempting supraclavicular approach, turn head to opposite side
   b. Arm adducted to side
   c. Trendelenburg
   d. For difficult cases, place a small towel roll under ipsilateral shoulder or have assistant place caudal traction of approx. 5cm on the extremity
2. Set up central venous catheter tray, prep the chest with chlorhexidine and get sterile as described in the IJ approach

Infraclavicular Approach
1. Anesthetize the skin and periosteum of the clavicle
2. Insert your needle:
   a. Bevel facing inferomedially (towards heart)
   b. 1-2cm below the junction of the medial and middle thirds of the clavicle
   c. Aim your needle towards the suprasternal notch
      i. Place non-dominant index finger at suprasternal notch and thumb at costoclavicular junction as landmark reference, aim needle towards index finger
   d. Angle your needle as flat and flush to the skin as possible so it passes just underneath the clavicle, if you hit clavicle back up and change your angle
   e. Alternatively:
      i. Enter your needle lateral portion of the deltopectoral triangle and using a shallow angle aiming towards the suprasternal notch
3. Vein is usually entered at a depth of approx. 3-4cm
4. Continue central line placement as described in internal jugular approach

Supraclavicular Approach
1. Insert your needle:
   a. 1 cm lateral to the clavicular head of the SCM and 1cm posterior to the clavicle
   b. Needle directed 45° from the sagittal plane and 10-15° upward from the horizontal plane
   c. Aim towards the contralateral nipple
   d. Alternatively:
      i. Use the junction of the middle and medial thirds of the clavicle as landmark of entry
2. Vein is just posterior to the clavicle at depth of approx. 2-3 cm
3. Continue central line placement as previously described

TROUBLE SHOOTING
- Hitting clavicle
  o Take the needle out and start more laterally so you can get a more shallow angle and pass underneath the clavicle
- Punctured the subclavian artery with needle
  - Withdraw the needle immediately
  - Single SC artery puncture without laceration rarely causes harm
- **Guidewire troubleshooting**
  - See Internal Jugular section

**VIDEO INSTRUCTION:**
- [https://www.youtube.com/watch?v=drYXh9X40Pc#action=share](https://www.youtube.com/watch?v=drYXh9X40Pc#action=share)

**DEEP DIVE**
- **Further Reading:**
  - Roberts & Hedges’ Clinical Procedures in EM. 6th edition. pg 397-431

- **Recommended FOAM and other videos**
  - Life in the Fastlane
    - Central Venous Cannulation
  - EMCrit
    - Central Lines
      - [http://emcrit.org/central-lines/](http://emcrit.org/central-lines/)
    - Review article on central line complications and preventing them
  - ALiEM
    - Approach to difficult access
      - [http://www.aliem.com/approach-difficult-vascular-access/](http://www.aliem.com/approach-difficult-vascular-access/)

- **Subclavian Line Pearls**
  - Right side preferred:
    - Lower pleural dome
    - Avoids the thoracic duct
  - 5-6% of lines are misplaced lines into the IJ vein
    - To prevent apply pressure to the base of the IJ vein during guidewire insertion
    - Also angle your bevel inferiorly towards the heart
  - If patient’s throat tickles or they get ear pain during procedure the guidewire is in the IJ
  - If patient has a known pneumothorax, always place line on the SAME side to prevent bilateral pneumothoraces
  - Left subclavian vein has a more direct approach to the SVC and preferred for pacemaker placement and CVP monitoring
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<thead>
<tr>
<th>TECHNIQUE</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
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<tbody>
<tr>
<td>Internal Jugular</td>
<td>- Good external landmarks</td>
<td>- More difficult and inconvenient to secure</td>
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<tr>
<td></td>
<td>- Improved success with ultrasound</td>
<td>- Possibly higher infectious risk than with SV access</td>
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<td></td>
<td>- Less risk for pneumothorax than with SV access</td>
<td>- Possibly higher risk for thrombosis than with SV access</td>
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<td></td>
<td>- Can recognize and control bleeding</td>
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<td>- Malposition of the catheter is rare</td>
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<td>- Almost a straight course to the superior vena cava on the right side</td>
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<td>- Carotid artery easily identified</td>
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<td>Femoral</td>
<td>- Good external landmarks</td>
<td>- Difficult to secure in ambulatory patients</td>
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<td>- Useful alternative with coagulopathy</td>
<td>- Not reliable for CVP measurement</td>
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<td>- Higher risk for thrombus</td>
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<tr>
<td>Subclavian, infraclavicular</td>
<td>- Good external landmarks</td>
<td>- Unable to compress bleeding vessels</td>
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<td>- “Blind” procedure</td>
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<td>- Should not be attempted in children younger than 2 yr</td>
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<tr>
<td>Subclavian, supraclavicular</td>
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<td>- “Blind” procedure</td>
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<tr>
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<td>- Practical method of inserting a central line in cardiorespiratory arrest</td>
<td>- Unable to compress bleeding vessels</td>
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