Central Venous Catheters

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Central Venous Catheters

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**Background**

Central venous access was first described in 1929 by a German physician who punctured a vein in his own arm and advanced a plastic tube near his heart. In 1950, another physician published a paper describing venipuncture of the subclavian vein for central access. Since then central venous access has been a cornerstone of resuscitation and critical care. The technique has long since spilled out of the hospital and into prehospital medicine.

**Indications**

- Need for vascular access
- Volume resuscitation, multiple infusions
- Central venous pressure monitoring
Contraindications

- Other reliable access exists
- Distorted anatomy
- Existing infection at site
- Suspected proximal vascular injury
- Bleeding disorders
- Anticoagulation or thrombolytic therapy
- Combative patient
- Unfamiliar with technique

Seldinger Technique

The most commonly use technique for central venous cannulation. In summary, a needle is introduced into the lumen of the intended vessel. A wire is threaded through the needle into the vessel and the needle is removed. Now, the catheter is threaded over the wire into the vessel, the wire is removed and the catheter is secured.
Complications

Overall, the complication rate for central venous access is between 1 and 2 percent. The most consistent complication is infection. This includes both cutaneous infections as well as bacteremia associated with a central line. Second most common complication is pneumothorax. Complication rates are higher when focused upon specific entities and sites of access.

- Pneumothorax
- Hemothorax
- Hydrothorax
- Hemomediastinum
- Tracheal perforation
- Endotracheal cuff perforation
- Puncture/thrombosis of carotid artery
- Injury to phrenic nerve or brachial plexus
- Line infections
- Malposition of catheter
- Arterial-venous fistula
- Injury to peritoneum and bowel

Helpful Hints

- If the possibility of bleeding is a concern, choose an easily compressible site.
- If you have trouble advancing the guidewire, withdraw it slightly, rotate it a bit, and try to readvance it.
- Failure to create a large enough nick with the scalpel will result in difficult (or impossible) catheter insertion.
- Aggressive palpation of the carotid and femoral artery with the nondominant hand will decrease the lumen diameter of the internal jugular and femoral vein and make entry into the vessel difficult.
- Be sure to advance the dilator and catheter as a unit. If the catheter gets advanced ahead of the dilator, the leading edge of the catheter may kink, and proper insertion will be impossible.

Anatomy
**Internal Jugular Venous Access**

- Patient is supine, a rolled up towel behind the shoulder blades helps extend the neck.
- The head can be rotated slightly away from the side to be accessed.
- You are at the head of the bed.
- The sternocleidomastoid (SCM) muscle and the carotid artery are the main landmarks.
- Anterior approach – puncture at the anterior margin of the SCM muscle just above the carotid artery. Aim for the same side nipple.
- Middle approach – puncture at the “triangle” (bifurcation of SCM muscle) and aim for the same side nipple.
- Posterior approach – puncture at the posterior margin of the SCM muscle just above the “triangle” and aim for the sternal notch.
- In all approaches, palpation of the carotid artery as a landmark is recommended.

Hints:

Excessive head rotation increases overlap of the carotid by the internal jugular and may increase the risk for arterial injury.

Ask the patient to perform the Valsalva maneuver to distend the IJ vein for easier identification and cannulation.

If a pneumothorax occurs and central venous access remains a priority, subsequent attempts should be made on the same side of the thorax as the pneumothorax to prevent bilateral lung injuries.

If you are anticipating the use of a transvenous pacemaker or pulmonary artery catheter, use either the left subclavian vein or the right internal jugular vein. These approaches align the catheter with the superior vena cava and the right atrium.

**Subclavian Venous Access**

- Patient is supine, arm at the side, and head turned away slightly.
- You are at the shoulder of the side to be accessed.
- Landmarks are the sternal notch and the curve of the clavicle.
- With your nondominant hand, place your index finger in the sternal notch and thumb at the curve of the clavicle.
- Keeping your needle-syringe flat, puncture the skin at the curve of the clavicle and walk the needle down the bone.
- The needle will slip behind the clavicle and continue to aim at the sternal notch.

Hints:
Prep the internal jugular site at the same time as the subclavian site to allow a timely second attempt if the subclavian attempt is unsuccessful.

In the case of a patient who has undergone pneumonectomy, a subclavian line on that same side may be the site of choice.

A towel between the scapulae may compress the vein between the clavicle and the first rib and make catheterization more difficult.

**Femoral Venous Access**

- Patient is supine and legs at neutral position.
- You are at the patient’s hip on the intended side.
- Landmarks are the anterior superior iliac spine and pubic symphysis. Divide this distance into thirds. The junction of the medial and middle thirds will be the femoral artery. The femoral vein is just medial to this.

**References**

