



Pigtail Catheter Placement for Pneumothorax Evacuation

Author Disclosure

Drs Vachharajani and Moore have disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

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NOTE: To learn to perform a procedure, there are both cognitive and procedural steps that should be followed. These steps are explained and demonstrated in this month's Video Corner and are summarized for quick reference in the list below.



Figure 1. Click here to view the video. (Reproduced with permission of Akshaya Vachharajani, MD, and The Saigh Foundation Pediatric Simulation Center, St Louis Children's Hospital and Washington University School of Medicine. Copyright 2012.)

Step by Step: Pigtail Catheter Placement for Pneumothorax Evacuation

1. Indications

Evacuation of a pneumothorax.

Evacuation of pleural and pericardial effusion.

2. Contraindications

- a) If a decision to redirect from intensive to compassionate care has been made after discussions with parents, then this procedure may be contraindicated. This would depend on the limits of interventions set during those discussions between the parents and the health-care team.

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- b) Insufficient personnel to perform this procedure may be a relative contraindication.

3. Consent

No consent, written or verbal, is obtained before the procedure at our institution. The procedure is explained to parents before the procedure is performed in neonates with pneumothorax who are hemodynamically stable.

4. Time Out (Pause)

- a) Identifying the patient.
- b) Marking the site of the needle insertion.

5. Equipment

- a) The catheter and accessories are available under different proprietary names. We use a catheter that is supplied along with the various accessories, packaged individually, in a single transparent package.
- b) Sterile towels.
- c) Sterile attire, including caps, masks, gowns, and gloves, for preferably 2 personnel.
- d) Povidone-iodine swab sticks.

6. Anatomy

- a) The needle is inserted in the fourth intercostal space in the anterior axillary line.
- b) The fourth intercostal space is located below the fourth rib and is approximately in the same space as the nipple.
- c) The layers of the chest through which the needle travels are (from superficial to deep): skin, subcutaneous tissue, intercostal muscles, parietal pleura, air (if there is pneumothorax), visceral pleura, and lung.

7. Preparation

- a) Explain the procedure to the parents if time and situation permit.
- b) Collect the equipment listed above.
- c) Review the chest radiograph to confirm the side of the pneumothorax.
- d) Ensure adequate analgesia with narcotic analgesics intravenously and additional topical anesthetic.
- e) The personnel performing the procedure need to scrub and don sterile apparel.
- f) Select the shorter of the 2 needles supplied and attach it to a 3-way stop cock and attach the stop cock to a 10-mL syringe.

- g) Identify the tissue dilator, the guide wire, and the catheter.
- h) Identify the adaptor that is to be attached to the external end of the catheter at the end of the procedure. The adaptor is then attached to the suction apparatus.

8. Performing the Procedure

- a) Even if performing the procedure in an emergency in a hemodynamically unstable neonate, time out is essential.
- b) There are essentially 4 steps to be completed sequentially:
 - 1) Insertion of a needle into the chest and aspirating the pneumothorax.
 - 2) Insertion of a guide wire through the needle.
 - 3) Insertion of a tissue dilator over the guide wire to dilate the tissues of the chest wall and make the insertion of the catheter easier.
 - 4) Insertion of the catheter over the guide wire and removing the guide wire.
- c) Identify the fourth intercostal space. It is the same space as the nipple.
- d) Clean and prepare the skin of the anterior chest wall over the fourth intercostal space with povidone-iodine swab sticks or gauze pieces soaked in the solution.
- e) Use sterile drapes and prepare a large sterile field to allow asepsis when using the equipment.
- f) One person inserts the tip of the needle (with the stop cock and the syringe attached) into the skin over the fourth intercostal space in the anterior axillary line above the upper border of the rib below. The tip of the needle should be directed towards the opposite shoulder. A second person opens the 3-way stop cock to the needle and applies suction to the syringe as the first person inserts the needle into the layers of the chest.
- g) The person inserting the needle stops advancing the needle into the chest when air is aspirated into the syringe.
- h) After the air is aspirated into the syringe, the stop cock is closed to the neonate and opened to the open port, and air is removed from the syringe.
- i) Turn the stop cock so that the syringe is now open to the needle and attempt aspirating air from the pleural cavity again.
- j) Stop attempting to aspirate air when no air is aspirated despite applying suction to the syringe and/or blood is aspirated from the needle into the syringe.
- k) Remove the syringe and the stop cock and hold the needle in place while it is still inside the infant's chest.

Ensure that the needle is held firmly to minimize movement of the needle with breathing.

- l) Insert the guide wire through the needle into the chest. Some manufacturers have marks on the guide wire and these serve as indicators for depth of insertion of the guide wire. Roughly speaking, the guide wire should be inserted deep enough into the chest so that it traverses the length of the needle and will project beyond the tip of the needle. It is very important to hold the needle steady while the guide wire is being advanced into the chest.
- m) The needle is now removed over the guide wire. It is important to withdraw the needle slowly while holding the guide wire in place and ensuring that the guide wire does not get removed from the chest along with the needle.
- n) Insert the tissue dilator over the guide wire and insert it into the layer of the chest wall (skin and subcutaneous tissue).
- o) Remove the tissue dilator over the guide wire.
- p) Insert the catheter over the guide wire and advance it into the chest wall until all the holes at the tip of the catheter are inside the chest wall.
- q) One may have to repeat steps **m** to **o** if the catheter cannot be advanced over the guide wire.
- r) Once the catheter is inside the chest wall, attach the adaptor to the external end of the catheter and attach the suction apparatus to the adaptor.
- s) Apply a clear dressing to secure the catheter against the chest wall. Securing the catheter to the chest wall with a suture is not mandatory. The tip of the catheter curls on itself like a “pig tail” and anchors itself in the pleural cavity.
- t) Obtain chest radiographs in anterior–posterior and cross-table views to confirm the complete evacuation of the pneumothorax and confirm the tip of the catheter is in the anterior mediastinum.

9. Complication

- a) Unsuccessful procedure with no air aspirated (no pneumothorax, or very small pneumothorax, or needle not advanced deep into the chest, or needle inserted at the incorrect landmark).

- b) Reaccumulation of pneumothorax.
- c) Lung transection.

10. Advantages of Pigtail Catheter Over Tube Thoracostomy

- a) Less traumatic.
- b) No chest wall skin incision required.
- c) The pneumothorax is aspirated with the needle insertion even though multiple subsequent steps are required to complete the procedure.
- d) Suturing of pigtail catheter to the chest wall is not necessary and hence may avoid a scar.

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American Board of Pediatrics Neonatal-Perinatal Content Specification

- Know how to prevent and manage air leaks.



Suggested Reading

- Brooker RW, Booth GR, DeMello DE, Keenan WJ. Unsuspected transection of lung by pigtail catheter in a premature infant. *J Perinatol.* 2007;27(3):190–192
- Cates LA. Pigtail catheters used in the treatment of pneumothoraces in the neonate. *Adv Neonatal Care.* 2009;9(1):7–16
- Dördelmann M, Schirg E, Poets CF, Ure B, Glüer S, Bohnhorst B. Therapeutic lung puncture for diffuse unilateral pulmonary interstitial emphysema in preterm infants. *Eur J Pediatr Surg.* 2008;18(4):233–236

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