

Needle Cricothyrotomy with Percutaneous Transtracheal Jet Ventilation

INTRODUCTION:

In a life-threatening situation in which tracheal intubation and bag-mask-valve ventilation cannot be performed to restore adequate gas exchange during acute respiratory failure, needle cricothyrotomy with percutaneous transtracheal jet ventilation (PTVJ) can be done as a viable interim maneuver.

PTJV is the surgical airway of choice for children younger than 12 years because of the small tracheal diameter on which an open cricothyrotomy would be nearly impossible.

PTJV can be used as an adjunctive measure while securing an airway, as a rescue airway procedure, and is the preferred surgical airway in children. It is to be noted, however, that PTVJ is not a definitive airway.

GOALS OF THE PROCEDURE:

- Obtain rescue airway allowing transtracheal oxygenation

INDICATIONS

- Failed or contraindicated intubation
- No definitive airway and inadequate oxygenation
- Surgical airway of choice for children younger than 12 years of age

GENERAL CONTRAINDICATIONS

- Infection overlying site of placement
- Distorted local landmarks due to trauma, mass, habitus, etc.
- Uncorrected coagulopathy
- Uncooperative patient

NEEDLE CRIC SPECIFIC CONTRAINDICATIONS

- Known significant damage to the cricoid cartilage or larynx
- Complete upper airway obstruction

COMPLICATIONS:

- Pneumothorax
- Aspiration
- Subcutaneous emphysema
- Pneumomediastinum
- Catheter blockage or obstruction
- Catheter misplacement or displacement
- Posterior tracheal wall perforation

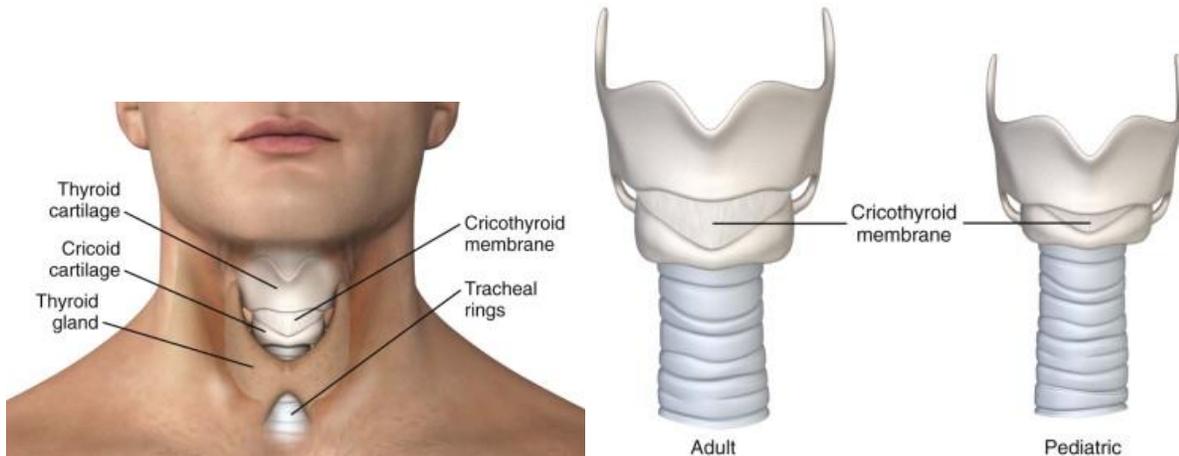
EQUIPMENT

- Sterile PPE (sterile gown & gloves, mask, face shield, hair net)

- 14-ga needle catheter (length ~2in)
- high pressure non-collapsible oxygen tubing
- oxygen source with flow at 10-15L/min
- plastic syringe, 3mL, Luer lock tip
- inner adapter of 7.5 mm endotracheal tube

*There are also several commercial needle cricothyrotomy kits available

ANATOMY



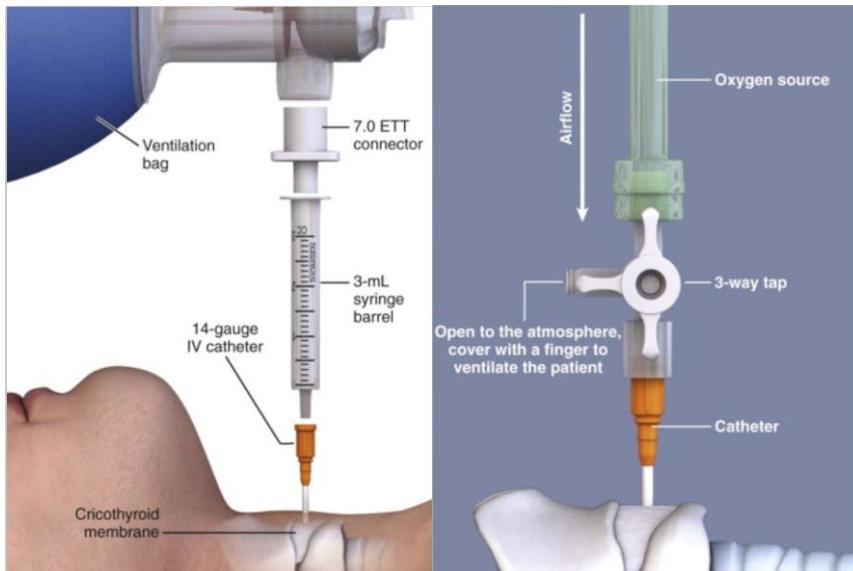
STEPS

Preparation & Positioning

1. Positioning:
 - a. Similar to surgical cricothyrotomy, place patient supine with head in neutral position
2. Set up materials listed above, attach 3-5mL syringe containing 1-2 cc of sterile NS to large bore needle catheter.
 - a. prep the neck with chlorhexidine. Put on sterile gear.

Approach

1. Hold the syringe using the dominant hand, direct needle 30-45 degrees caudally, hold and stabilize the larynx with the non dominant hand.
2. Insert the needle through the soft tissues, skin, and cricothyroid membrane, while aspirating with the syringe, insert the needle into the larynx. Air bubbles will signify successful entry into the larynx
3. After entering the larynx, advance the cannula into the larynx and trachea, and then remove the needle
4. Secure the cannula by suturing it to the skin or by placing a circumferential tie around the neck.
5. Connect the oxygen source to the cannula (see images below)



6. The hypoxic patient should receive 100% oxygen in intermittent bursts <50 psi at rate of 20 bursts per minute, for children 30 psi has been recommended.
 - a. The inspiratory phase or insufflation with the burst of oxygen should last approximately 1 second, and the expiratory phase should last long enough to allow for adequate exhalation, typically 3-4 seconds.
 - b. The flow rate recommended for children is 1L/min per year of age, adjust upward in increments of 1L/min according to oxygenation needs and chest wall movements of child
 - c. Children, especially those less than 5 require lower tidal volumes, therefore, use the bag instead of the jet ventilator

TROUBLE SHOOTING

- **Kinking the catheter**
 - Nicking the skin prior to procedure may prevent this
- **Coughing in the conscious patient** (usually not a problem given most patient's unconscious)
 - Insert a few milliliters of lidocaine into the larynx
- **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=aPiQA2XKkcs>

DEEP DIVE

- **Further Reading:**
 - Roberts & Hedges' Clinical Procedures in EM. 6th edition. pg 120-133
- **Recommended FOAM and other videos**
 - Life in the Fastlane

- Cannula Cricothyrotomy
 - <http://lifeinthefastlane.com/cc/cannula-cricothyroidotomy/>
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- ALiEM
 - Difficult Airway mnemonics
 - <http://www.aliem.com/mnemonics-for-difficult-airway-predictors/>
- EM Crit
 - Surgical Airway
 - <http://emcrit.org/podcasts/surgical-airway/>
- **PTVJ Pearls**
 - A small nick in the skin may be needed to facilitate passage through the dermis, this may also help to avoid kinking of the catheter
 - Be sure to adequately secure the cannula after insertion as to avoid subcutaneous emphysema
 - PTVJ can be done in all ages, but it is the surgical airway of choice for children younger than 12 years of age