

Cricothyroidotomy

Richard Davis

Introduction:

Cricothyroidotomy (also called cricothyrotomy) is an emergency airway procedure that is done when other attempts to secure a definitive airway have failed. The situation may be trauma, upper airway neoplasm, severe infection compressing the upper airway, or excessive secretions or debris that cannot be cleared in a timely manner. Recall from [Airway Management in Trauma](#) that a definitive airway is a cuffed endotracheal tube, with the cuff inflated, in the trachea below the vocal cords.

Cricothyroidotomy accomplishes this goal by accessing the airway through the cricothyroid membrane, immediately below the vocal cords. Therefore, it is possible to damage the vocal cords if this procedure is done carelessly. Also, cricothyroidotomy is contraindicated in small children for this same reason- the number most often quoted is 12 years of age or less.

If you are lucky you will get to practice this procedure on a cadaver. Otherwise, the first time you see it done, you may be the one doing it. The situation is usually so extreme that the most experienced clinician, the one who has done a cricothyroidotomy before, should be the one to do it, for the patient's sake. Multiple intubation attempts will have been made, resulting in upper airway edema; it may no longer be possible to ventilate the patient with a bag-valve mask and he may be desaturating or even becoming bradycardic from hypoxemia. He only has a few minutes left before brain hypoxia causes permanent damage.

Try to anticipate this situation: when we see anesthesia personnel struggling in a difficult airway, we will quietly ask someone who's not busy to have a #11 scalpel blade in the room, so that we can step in and perform a surgical airway rapidly. Most commonly this will be in a trauma situation, however it can also occur in the operating room during elective intubation of a patient with airway distortion due to tumor or infection.

Cricothyroidotomy can be done with very few instruments if necessary: A #11 scalpel blade attached to a scalpel handle and an endotracheal tube are all that is needed. Select an endotracheal tube that is one size smaller than you would use to orally

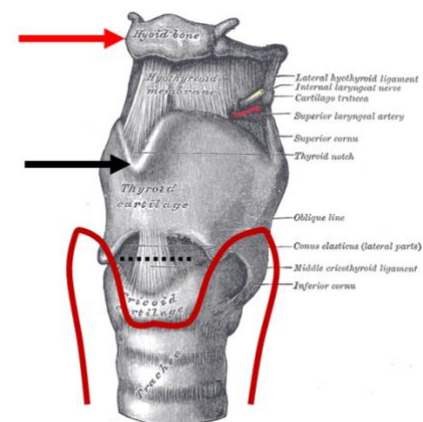
intubate the patient: In most adults, a 6.0mm endotracheal tube is an excellent choice. If available, a tracheostomy hook and a tracheostomy tube make things easier.

The steps to cricothyroidotomy are:

- Identify the tracheal cartilage and the cricothyroid membrane
- Make a vertical incision and spread the skin and subcutaneous tissue
- Make a horizontal incision through the cricothyroid membrane
- Insert the tube and inflate the cuff

Steps:

1. Preoperative considerations are as discussed above. The patient will almost always be in extremis without another airway.
2. Prepare the neck with betadine, chlorhexidine, or just an alcohol swab. This step can be omitted if none of these are immediately available. Personal protective equipment is highly encouraged, as the combination of a bleeding wound and the airway always results in wide dispersal of blood and secretions.
3. Palpate the thyroid cartilage (“Adam’s apple”) and the smaller, less obvious cricoid cartilage about 1-2 cm caudal to it (below it). The cricothyroid membrane is between these structures, immediately inferior to the thyroid cartilage.



The larynx seen anteriorly. The thyroid cartilage, sometimes called the “Adam’s Apple” (Black arrow) can easily be palpated: the cricothyroid membrane is just below this structure. It is incised transversely as shown by the Dotted line. The dark Red shape shows the relation of the thyroid gland to

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the cricoid membrane. The hyoid bone (Red arrow) is a smaller bony structure, higher up in the neck adjacent to the mandible. It should not be confused for the thyroid cartilage, otherwise damage to the vocal cords could occur if the membrane below it is incised.



Palpate the thyroid cartilage, the most prominent structure in the anterior midline neck. In this case, the neck is not hyperextended but the procedure can still be done. All of the photos in this chapter were taken from a cadaver dissection.

4. Using a #11 or #15 blade, make a vertical incision extending from just above the thyroid cartilage to just below the cricoid cartilage, about 3cm in length.



Make a vertical incision from just above the thyroid cartilage to just below the cricoid cartilage.

5. Spread the skin edges apart with your non-dominant hand.



Spread the skin horizontally, revealing the subcutaneous fat and the cricoid membrane. You can palpate the membrane at the center of the incision.

6. Make a horizontal incision in the cricothyroid membrane. You should feel a “pop” as the blade passes through the membrane. After the “pop,” gently move the knife up and down in a sawing motion to cut the membrane. Be careful not to go too deep with the knife, you can potentially enter the esophagus here.



Incise the cricothyroid membrane transversely with the scalpel, being careful not to cut too deeply and injure the esophagus.

7. Turn the knife over and insert the handle into the incision you just made, then rotate it 90 degrees to stretch the membrane. Be careful not to injure yourself with the scalpel blade.

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Once the cricothyroid membrane has been incised, reverse the scalpel and insert the handle through the membrane incision in a horizontal configuration.



It can be difficult to insert the tube through the incision, especially if you do not hyperextend the neck, as in a trauma patient. Spread the skin with the thumb and index finger of your nondominant hand to expose the hole that you made in the cricothyroid membrane. The tube is malleable and may be difficult to pass through the small hole: a stylet can be used to make it stiffer.



Rotate the scalpel handle vertically, stretching the cricothyroid membrane incision. Be careful not to injure yourself with the scalpel blade.



Two tracheostomy hooks.

8. Insert an endotracheal tube into the trachea, directing the tip downwards. A stylet inside the tube helps direct it inferiorly into the trachea. If you have a tracheostomy hook, use it to retract the cricoid cartilage anteriorly.



Pulling the cricoid cartilage downwards with the tracheostomy hook makes it much easier to insert the tube. Unfortunately, in an unexpected cricothyroidotomy, you usually won't have a hook available. Alternatives include a bone hook from an

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orthopedic set, or a skin hook from a plastic set. Be careful not to puncture the tube's balloon when you withdraw the hook.

9. Pass the tube no more than 4cm into the trachea and inflate the cuff. Confirm placement by auscultation and bear in mind that the tube may be inserted too far into one of the mainstem bronchi, usually on the right side.
10. Secure the tube to the skin with two separate Nylon sutures, to prevent accidental dislodgement.



A cricothyroidotomy done through a malignant thyroid tumor via a horizontal incision. The tube has been well secured, as the patient's life depends on it not being removed. Despite the small size of the tube, the patient was maintained in the ICU, sedated, and the surgical team returned for tumor debulking and formal tracheostomy the next day.

11. The conventional teaching is that cricothyroidotomy can remain in place for up to 24 hours. This teaching is being questioned recently. If you think the patient can be extubated within a few days, it is probably better to leave this tube in place rather than subject him to a tracheostomy. Otherwise, convert to a [tracheostomy](#) under elective conditions. Alternatively, a skilled anesthetist, with or without video equipment may be able to pass an orotracheal tube after some time under more controlled conditions.

12. Whenever the tube is removed, close the skin in an airtight manner. Make no attempt to repair the cricothyroid membrane, this is not necessary.

Pitfalls

- Misidentification of the thyroid cartilage, confusing some other bony structure in the neck for this one. This is surprisingly easy to do in an emergency situation, where you may be in a panic.
- Incising too deep and damaging the esophagus: maintain control of the knife and only cut the membrane: you will feel its resistance as you cut.
- Difficulty in passing the tube: this may be because you did not incise the cricothyroid membrane enough, you did not dilate it far enough with the scalpel handle, or the tube is not stiff enough to pass into the space. Try a smaller tube, or try holding it closer to the tip, or insert a stylet. A tracheostomy tube, stiffer and with a built-in curve, will be easier to insert than a floppy straight endotracheal tube.
- Damage to the balloon by the sharp tracheostomy hook as it is being withdrawn
- Injury to the vocal cords, which are immediately above the cricothyroid membrane.

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