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# Open Cricothyrotomy

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## Overview

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Open cricothyrotomy is an emergent surgical procedure. It is performed to establish an airway access by passage of a tube through an incision in the cricothyroid membrane. This is a procedure of choice in the feared "can't intubate, can't ventilate" scenario - when all other forms of endotracheal intubation have failed and the spontaneous ventilation is worsening or has become impossible.

The airway access is established via the tracheostomy tube. The tracheostomy tube consists of three parts: an outer cannula (or the tracheostomy tube itself), an inner cannula, and an obturator. During the procedure, the obturator is placed within the tracheostomy tube to guide the insertion, while the inner cannula is removed. The distal end of the obturator is rounded and protrudes through the end of the tracheostomy tube, allowing the practitioner to easily guide the tube into place without it being caught on the surrounding structures. In addition, the obturator prevents the tube clogging with tissue or the fluids during an insertion. Once the tube is placed, the obturator is removed and the inner cannula is placed within the tracheostomy tube. Alternatively, the procedure can be performed using the modified the endotracheal tube, which will be demonstrated in this video.

Cricothyrotomy is associated with significant complications and is performed only when less invasive measures have failed. However, it is preferred over tracheotomy (a procedure in which an opening is created between two tracheal rings), because of the lower risk of associated complications, relative rapidity with which it can be performed, and the predictable anatomy of the region.

Young age is considered a contraindication to open cricothyrotomy, as this procedure is associated with an increased risk of developing subglottic stenosis in children. However, there is disagreement among experts as to which age this procedure becomes acceptable. Opinions vary from 5 years to 12 years of age, and many consider this a relative contraindication. In young children, tracheotomy is preferred, and patients may be temporized with transtracheal jet ventilation through a needle cricothyrotomy for long enough to perform this more involved procedure. Other contraindications include fractured larynx or severe injury to the cricoid cartilage.

## Procedure

### 1. Patient Positioning and Preparation

1. Position the patient supine with the neck extended.
2. Gather supplies needed for cricothyrotomy, including a #11 scalpel, tracheal hook, Trousseau dilator, tracheostomy tube (or modified endotracheal tube), 10 cc syringe for inflating the cuff, and chlorhexidine.
3. If a tracheostomy tube is not available, prepare endotracheal tube by removing the bag-valve-mask (BVM) adapter at the distal end and cutting the tube just distal to site where the cuff insufflator enters. Reattach the BVM adapter.
4. If the situation calls for local anesthesia, such as when rapid sequence intubation medications have not been administered, and the patient is awake and alert, then gather a 5 cc syringe, 25-gauge needle, and 5 mL of 1% lidocaine with epinephrine 1:100,000.
5. If full sterile technique is observed, then gather sterile towels, face mask, bonnet, sterile gown, and sterile gloves. As with all truly emergent procedures, complete sterile technique is optional based on the time pressure of the situation.

### 2. Protocol

1. Test the cuff of the tracheostomy tube or the modified endotracheal tube by inflating and deflating it using the syringe.
2. Clean the anterior neck with chlorhexidine by vigorous scrubbing. Full barrier precautions should be undertaken if clinically possible: don mask, bonnet, sterile gown and gloves, and place sterile towels around the cleaned site to create a complete sterile field.
3. To optimize the access to the site, stand on the patient's right side if you are right-handed, and on the patient's left side if you are left-handed.
4. Locate the cricothyroid membrane by palpating the laryngeal prominence ("Adam's apple") and moving your fingers inferiorly into the depression below. If the palpation is difficult due to body habitus or pathology, the location of the cricothyroid membrane may be estimated as being four fingerbreadths above the sternal notch.
5. Confirm the location of the midline by grabbing the paratracheal structures and moving them around as a unit.
6. Administer local anesthesia by inserting the 25-gauge needle just into the skin, and creating a wheal in the midline of the expected location of the cricothyroid membrane. Extend the wheal superiorly and inferiorly by 3cm in both directions.
7. Make a 3-5 cm vertical incision in the midline through the skin and subcutaneous tissues using the #11 scalpel.
8. Attempt to feel the cricothyroid membrane through the incision with your non-dominant finger, and then extend the incision superiorly or inferiorly to fully expose the cricothyroid membrane.
9. Now make a 1 cm horizontal incision across the cricothyroid membrane at its inferior aspect. This position of the incision prevents lacerating the cricoid arteries.
10. Take the tracheal hook and pull the superior portion of the incision upwards. An assistant can hold the tracheal hook to keep the incision open.

11. Using your non-dominant hand, insert the Trousseau dilator through the opening in the cricothyroid membrane, placing the bills on the superior and inferior portions of the incision. If you are standing on the patient's right side, the handles will also be on the patient's right. If you are standing on the patient's left side, the handles will also be on the left.
12. Open the bills of the Trousseau dilator
13. Rotate the handle of the dilator to 90° so that it is vertically in relation to the patient. The bills of the dilator are now spreading away from the midline.
14. With your dominant hand, place the modified endotracheal tube through the cricothyroid membrane.
15. Remove the Trousseau dilator.
16. If using a tracheostomy tube, remove the obturator, insert the inner cannula of the tube, and inflate the cuff.

## Summary

A surgical cricothyrotomy is truly an emergency procedure. The procedure itself is straightforward and uncomplicated. Surgical cricothyrotomy is a lifesaving procedure in a patient who would otherwise suffer great morbidity or death from prolonged hypoxia.

Complications from a failed cricothyrotomy can be disastrous, as the loss of airway is loss of life. Most significant complications arise when an artery is lacerated, and the bleeding obscures the surgical field. The superior thyroid arteries run laterally on both sides of the midline and anastomose superficial to the inferior portion of the laryngeal prominence. With anatomic variance, it is not all that infrequent that these vessels may be encountered in the superior portion of the cricothyroid membrane, increasing the risk of laceration during the procedure.

Misplacement of the tracheostomy tube might occur even if the field is not obscured. The tube can be placed in the soft tissue when the opening is not well stabilized with the tracheal hook, or if the Trousseau dilator is not positioned within the incision in the cricothyroid membrane. Several seconds may pass before the complication is recognized, increasing the likelihood that each delivered breath distorts the recognizable anatomy. Therefore, a successful cricothyrotomy requires good knowledge of the surface anatomy, dexterity, and confidence.

 