

Tracheostomy

Richard Davis and Joseph Nderitu

Introduction:

The general indications for tracheostomy are prolonged orotracheal intubation and conditions in the upper airway that do not support a safe airway. These include tumors, severe soft tissue infections or trauma, and some surgical interventions.

Some surgeons prefer to perform open tracheostomy through a small incision, hoping to maximize the cosmetic appearance of the resulting scar. We disagree: a tracheostomy scar never looks good after tube removal. The poor cosmetic appearance is not due to the length of the incision, but to the tube passing through it. By using a slightly wider incision, the surgeon can safely achieve hemostasis and take measures to avoid excessive bleeding or tracheal stenosis, which we describe further below.

Some patients with airway obstruction are able to maintain an airway while awake but orotracheal or nasotracheal intubation is impossible. One example is a patient presenting with a near-obstructing laryngeal tumor who is still able to breathe, but with difficulty. These patients will require awake tracheostomy, a challenging but not impossible procedure. This operation can be done exactly as described below, with frequent and copious injection of local anesthetic.

Tracheostomy is never a suitable procedure for emergency airway access; cricothyroidotomy is much more appropriate in this situation. An obvious exception to this rule is an open neck injury with an exposed trachea, such as a “clothesline” injury. Cricothyroidotomy is described in a separate chapter.

Tracheostomy proceeds in the following general steps:

- Incision of the skin and superficial layer of the deep cervical fascia
- Elevation of sub-fascial flaps
- Division of the “strap” muscles at the midline
- Dissection of the pretracheal fascia and exposure of the trachea
- Preparation for entry into the airway
- Incision of the trachea and placement of anchoring sutures
- Insertion of the tracheostomy tube

- Skin closure and securing the flange of the tracheostomy

Steps:

1. Excellent communication with anesthesia personnel is essential. The patient should already be intubated and anesthetized. For awake tracheostomy, the patient must be very cooperative and copious local anesthetic must be used. In this situation, “light” sedation should be avoided: the patient may become confused and uncooperative, resulting in loss of the airway.
2. The patient’s neck is extended with a head ring and shoulder roll. Take care to make sure that the head is fully supported by the headring and the neck is not over-extended.

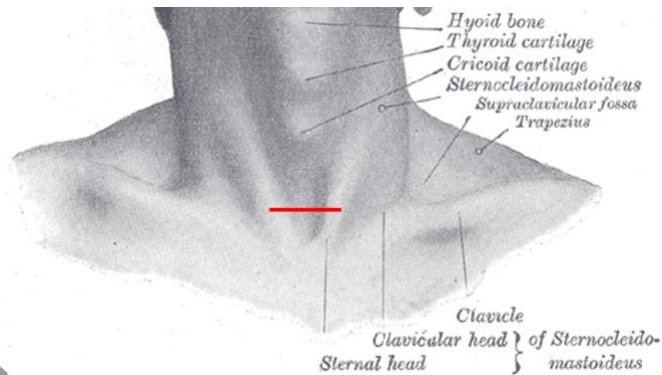


When the patient is in position, with neck extended and supported by head ring and shoulder roll, push gently downwards on the forehead to be sure that it is the head ring, not the spinal column, that is supporting the head.

3. A skin incision 4-5cm long is made one finger-breadth above the suprasternal notch and carried down to the superficial layer of the deep cervical fascia. Laterally, this layer is continuous with the platysma, but here at the midline it is a fibrofatty layer.

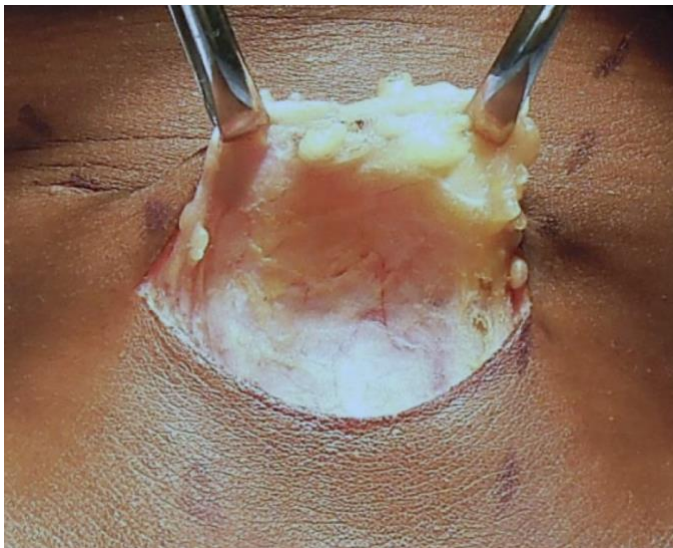
Tracheostomy

Richard Davis and Joseph Nderitu



An incision 5cm long is made one fingerbreadth above the suprasternal notch and carried through the fibrofatty fascia layer underneath.

- The fascia is retracted anteriorly and the sub-fascial plane is developed for 2cm in both a cranial and caudal direction. A self retaining (Weitlaner) retractor is placed horizontally to retract the skin and fascia.

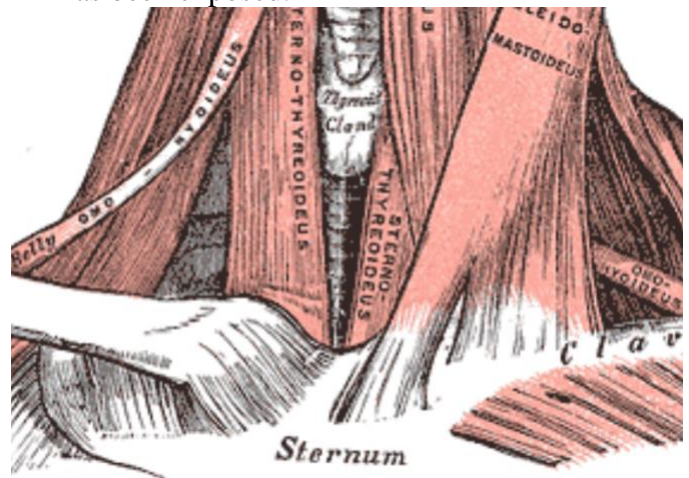


The plane deep to the superficial layer of the deep cervical fascia is dissected caudally and cranially (shown) until a 4cm wide space is cleared. Source: Eugenio Panieri and Johan Fagen-<https://vula.uct.ac.za/access/content/group/ba5fb1bd-be95-48e5-81be-586fbaeba29d/Thyroidectomy.pdf>



After flap elevation and retractor placement, the strap muscles are seen at the midline.

- The sternohyoid and sternothyroid muscles (the most medial of the “Strap muscles”) are separated where they meet at the midline. This dissection is extended cranially and caudally as far as the sub-fascial flaps have been raised. This will give a generous view of the trachea once it has been exposed.



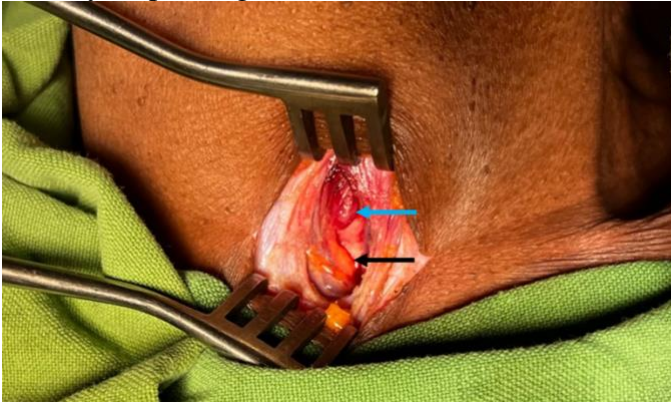
The sternothyroid and sternohyoid muscles meet at the midline just over the trachea: division at the midline allows the trachea to be reached in a relatively bloodless plane.

- Dissection continues in the plane between the “Strap” muscles, using a finger to palpate the trachea and dissect towards it.
- There will be a distinct layer of fat enveloped in fascia immediately anterior to the trachea. This

Tracheostomy

Richard Davis and Joseph Nderitu

fat can be resected or simply retracted out of the way, depending on its volume.



The strap muscles have been divided and the pretracheal fat pad (Black arrow) is seen. Part of the right lobe of the thyroid gland (Blue arrow) is also seen. In this patient, the gland was not obstructing tracheostomy placement so it was left alone. Alternatively it can be dissected off the trachea and retracted, or a “wedge” of it can be resected, taking care not to approach the posterolateral aspect of the trachea.

8. Clear the trachea for about 1/4 to 1/3 of its circumference. Do not go too far posterolaterally, both recurrent laryngeal nerves are vulnerable to injury here.



The trachea has been cleared of pretracheal fat and the rings are clearly visible.

9. If the middle lobe of the thyroid gland is blocking access to the trachea, try to retract it cranially. If this maneuver does not allow wide access to the trachea, resect the part of it that lies anterior to the trachea with electrocautery. Again, be careful

not to go too far posterolaterally, as you do not know exactly where the recurrent laryngeal nerve is.

10. In an obese patient, place a second Weitlaner retractor vertically, holding the Strap muscles and pretracheal fat that you have dissected out of the way.



A second self-retaining retractor oriented vertically holds the dissected strap muscles out of the way and allows hands-free access to the dissected anterior 1/4 of the trachea. The use of two self-retaining retractors is not essential for a thin patient, but is very useful for a muscular or obese patient.

11. It is not necessary to dogmatically count tracheal rings, as long as you are well below the cricoid cartilage. Select a space on the trachea where the curved tracheostomy tube will pass from the trachea to the skin incision without tension or torsion.
12. Prepare the equipment. Test the tracheostomy balloon and then be sure it is fully deflated. Familiarize yourself with the way that the inner cannula attaches to the tracheostomy. Then remove the inner cannula and place the obturator. Lubricate the tracheostomy tube with lubricating jelly or water, as the inside of the trachea will likely be desiccated and difficult to pass a tube into.

Tracheostomy

Richard Davis and Joseph Nderitu



Test the balloon of the tracheostomy.



Familiarize yourself with the way that the inner cannula connects to the tracheostomy. Once this is accomplished, remove the inner cannula and put the obturator in place.

13. If you are performing awake tracheostomy, it is crucial that you inject the wall of the trachea prior to cutting it, to prevent the patient from coughing excessively.
14. Inform anesthesia that you are about to enter the airway. Ask them to advance the endotracheal tube. This will help avoid cutting the balloon when you incise the trachea.

15. Prepare the team for this, the crucial step of the operation. Be sure that the surgical field is well visualized and hemostasis is adequate. The assistant and scrub tech should be prepared with the two stay sutures of 2-0 Nylon, an 11 blade, the tracheostomy tube, a syringe to inflate the balloon, and a functioning suction device.
16. Using the 11 blade, incise the space between two tracheal rings horizontally for a length of 10-12mm. Then incise the ring inferior to this incision, on both sides of the incision. This creates an inverted “U” flap (also known as a Bjork flap.) We do not use the electrocautery on the trachea, and we do not use dilators or any other device that would tear the tracheal tissue. The cut edge will ooze blood, this is acceptable. Tearing or cauterizing the trachea theoretically increases the chance that it will heal with a stenosis.



Make a horizontal incision in the space between tracheal rings about 1cm in length.

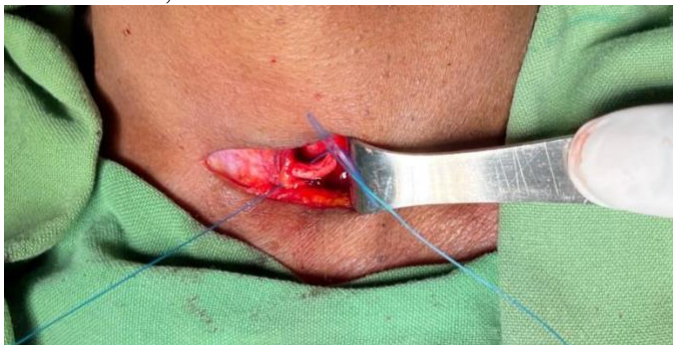


At each lateral edge of the tracheal incision, make another incision caudally through the tracheal ring, making an inverted “U” or “trapdoor.”

Tracheostomy

Richard Davis and Joseph Nderitu

17. Pass the 2-0 Nylon sutures through each corner of your inverted “U” flap. These “stay stitches” will allow you to open the flap by pulling gently. Leave each suture long enough that it will lie on the chest, and secure it with a hemostat.



Suture passed through one corner of the “trapdoor.” In this thin patient, maintaining both self-retaining retractors was not necessary. In a fat or very muscular patient, proper retraction is very valuable for performing this step quickly.

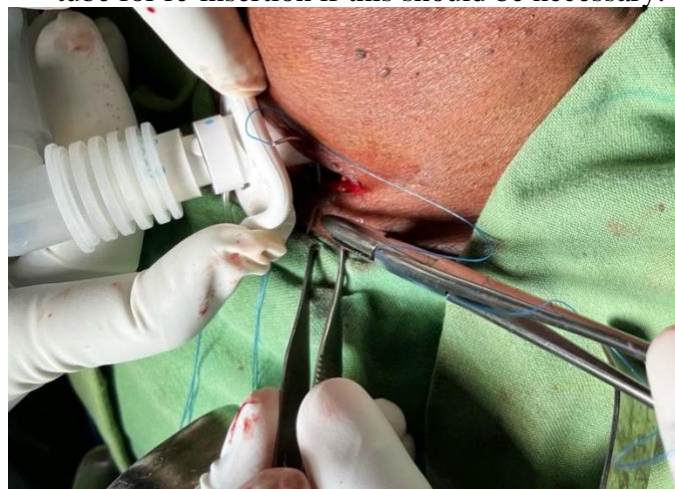
18. While you are suturing the flap, the anesthetist deflates the cuff and withdraws the endotracheal tube until its tip is no longer visible. It is still in the trachea and can be advanced to below your tracheotomy and reinflated if, for some reason, you are not able to secure the airway.
19. Hold the stay sutures in the non-dominant hand and gently pull them to open the tracheal flap. Insert the tip of the tracheostomy tube into the trachea. Before it is inserted all the way, have your assistant remove the vertically oriented Weitlaner retractor.



Gentle traction on the sutures opens the “trapdoor.” The tracheostomy tip has been lubricated with jelly. The surgeon

holds the tracheostomy like a syringe, with index and middle fingers on the flange and the thumb holding the obturator in place. It is introduced into the trachea, using a very gentle twisting motion if necessary.

20. Advance the tracheostomy tube fully into place and inflate the cuff. Remove the obturator and insert the inner cannula, securing it in the way that you practiced in step 12. Have your assistant attach it to the ventilator tubing while you hold the tube secure. Ideally a short piece of sterile ventilator tubing is used for this step, but it is not essential. Confirm that the tube is within the trachea through end tidal CO₂ or adequate tidal volumes.
21. Remove the horizontally oriented Weitlaner retractor.
22. Loosely close the skin under the tracheostomy flange with 2-0 Nylon, leaving space around the tube for re-insertion if this should be necessary.



The flange is elevated away from the skin (ideally with an instrument, not a finger!) The skin is closed with one or two interrupted sutures on each side of the tube, leaving some space should reinsertion of the tracheostomy be necessary.

23. Secure the flange to the skin using 2-0 Nylon and then with a tracheostomy tape.

Tracheostomy

Richard Davis and Joseph Nderitu



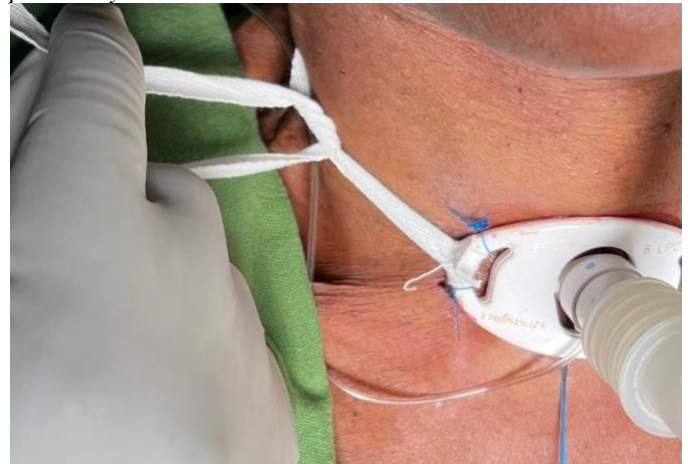
The flange is secured to the skin with two sutures per side.



The tracheostomy tape is cut into longer and shorter portions, a small longitudinal cut is made in the end of each one, and then each is passed through a side of the flange and secured.



The tape is passed through the longitudinal cut that was previously made.



The longer side of the tape is passed behind the neck and then the two pieces are tied together at the side of the neck.

24. Tie the ends of the two stay sutures and tape them to the chest. This tape can be labeled with instructions as below:

Tracheostomy

Richard Davis and Joseph Nderitu



The sutures are taped to the chest and labeled, "Pull Sutures to Re-Insert Tube."



Technique for suctioning tracheostomy tube. Take care to not pass the suction catheter beyond the tracheostomy tube itself. The proper placement of a split gauze under the tracheostomy device is also shown in this picture. Source: Doyle, G. R., McCutcheon, J. A. (2015). *Clinical procedures for safer patient care*. BCcampus. <https://opentextbc.ca/clinicalskills/>

Postoperative Care:

- The patient should be nursed in a visible area of the ward with immediate access to suction and O₂. Ensure availability of tracheostomy pack, appropriately sized suction catheters (i.e. no larger in diameter than half the diameter of the tracheostomy tube) and suction device.
- Humidification of the air entering the tracheostomy is very important. Use a facemask if you do not have a dedicated tracheostomy humidifier.
- Stoma area should be exposed, cleaned daily and as needed, and kept dry.
- Suction as needed using sterile technique ensuring not to advance the suction catheter any further than the length of the tracheostomy tube. Suction intermittently for 10-15 seconds and reapply oxygen in between suctioning to reoxygenate the patient. If thick secretions are encountered, nebulization with saline may loosen the secretion.

- Accumulation of thick secretions within the tube can lead to fatal obstruction of the airway. The best way to prevent this is to use a tracheostomy with a removable inner cannula, as shown in this chapter. Remove the inner cannula several times per day and clean it, completely removing any debris or impacted mucus with a brush. If a tracheostomy with a removable inner cannula is not available, it is important that the patient's air is humidified and the tracheostomy is suctioned frequently as described above. After 5 days post surgery, remove the tracheostomy and clean the lumen frequently.



Tracheostomy

Richard Davis and Joseph Nderitu

With the inner cannula removed, the entire lumen can be cleaned with a brush or swab. Source: Doyle, G. R., McCutcheon, J. A. (2015). *Clinical procedures for safer patient care*. BCcampus. <https://opentextbc.ca/clinicalskills/>

- Call the surgical team immediately if increased work of breathing, inability to pass suction catheter, bleeding, stridor or cyanosis is noted. The surgeon should immediately remove the tracheostomy of any patient who appears to have airway obstruction, as obstruction of the tube itself is the most likely diagnosis. Patient and relatives should be educated on cleaning and observation of stoma site.
- The best way to prevent early mortality after tracheostomy placement is to educate the nursing staff. Put these patients in Intensive Care if you have such a facility, and train the nurses on the above principles.

Pitfalls

- Excessive bleeding can occur postoperatively due to incomplete hemostasis during the operation. Be meticulous, especially with large vessels such as the anterior jugular veins. A small amount of bleeding is acceptable, as you did not use diathermy on the trachea itself. Most often, packing gauze around the tube and inside the wound will stop bleeding and the need for reoperation is rare.



Occasionally there will be veins running within the pretracheal fat pad. It is worthwhile to stop and individually ligate each one to prevent postoperative bleeding.

- Dislodgement of the tube during the first 5 days after surgery can be catastrophic. Instruct the nursing staff on proper technique for reinserting the tube, including gently pulling on the stay sutures to open the “flap” in the trachea.
- Blockage of the tube with secretions can be fatal. Humidify the air or oxygen that the patient breathes. Be sure that the inner cannula is removed and cleaned 2-3 times per day, more often if needed. We avoid tracheostomy tubes without a removable inner cannula because they cannot be cleaned without being removed, which is impossible in the first 5 days after operation.
- Purulent discharge from the stoma is most likely not due to a surgical site infection, but rather to pneumonia or tracheitis. Remove the tube and inspect the area carefully; if there is necrotic tissue or an abscess here it will need to be debrided under general anesthesia.
- Long term tracheal stomas can become blocked with excessive granulation tissue. This tissue can also become adherent to the tracheostomy tube and prevent its removal. Avoid this by instructing the patient with a long-term tracheostomy to have it changed every 4 weeks. If the tube is stuck and can not be easily removed, the patient will need debridement of the granulation tissue and tracheostomy tube change, which must be done under general anesthesia.
- Tracheo-innominate fistula is a very feared but rare complication. Most cases of blood in the tracheostomy are some other process rather than a “herald bleed.” In a resource-limited setting this complication, when it truly occurs, is not likely survivable.
- Tracheal stenosis can be prevented by avoiding over-inflation of any balloon in the trachea. Once it occurs, it is extremely difficult to treat. Make a habit of periodically checking that the balloon is not over-inflated on any intubated patient you care for. When a patient has tracheal stenosis, dilation of the trachea is unlikely to cause long-term resolution; tracheal resection and reconstruction is usually needed.

Tracheostomy

Richard Davis and Joseph Nderitu

Richard Davis MD FACS FCS(ECSA)
AIC Kijabe Hospital
Kenya

Joseph Nderitu MBBS
AIC Kijabe Hospital
Kenya

