



SURGICAL CLOSURE TECHNIQUE OF TRACHEOESOPHAGEAL FISTULAE (TOF)

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Tracheoesophageal fistula (TOF) speech is the optimal method for postlaryngectomy speech rehabilitation (*Figures 1-3*).

Advantages include:

- No external device required
- Doesn't rely on a battery
- More natural, intelligible voice
- Uses patient's tidal volume ~500mL as energy, and therefore allows the patient to speak louder with a more sustained voice without any pauses

However, problems do arise from time-to-time with the TOF and tracheoesophageal voice prosthesis^{1,2}

- Enlarging fistula around prosthesis causing leakage of saliva and food and aspiration pneumonia (*Figure 4*)
- Leakage of saliva and food through the prosthesis
- Granulations around the prosthesis
- Failure of tracheoesophageal speech due to pharyngoesophageal segment spasm
- Fungal colonisation of the prosthesis causing it to leak
- Dislodgement and aspiration of the prosthesis into the tracheobronchial tree
- Obstructed swallowing secondary to the prosthesis
- Failure of tracheoesophageal speech because of lack of motivation and cost of the prostheses

When the fistula enlarges with leakage of saliva and food around the prosthesis, or a decision is made to discontinue fistula speech and the TOF is no required, the TOF needs to be allowed to close or be closed.

*Risk factors for an enlarging TOF include*³

- Local infection
- Erosion by a feeding tube

- Ventilatory cuff injury
- Tracheal or oesophageal malignancy
- Caustic or foreign body ingestion

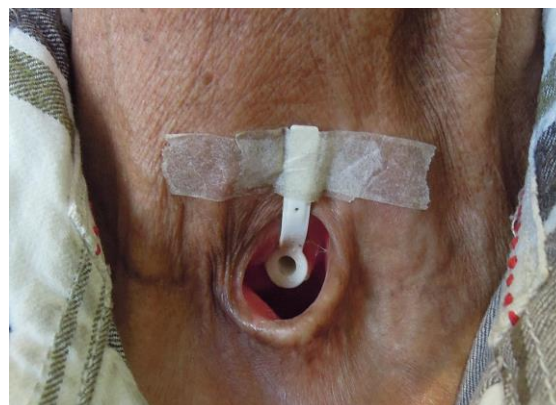


Figure 1: Voice prosthesis in situ



Figure 2: Occluding tracheostomy for voicing

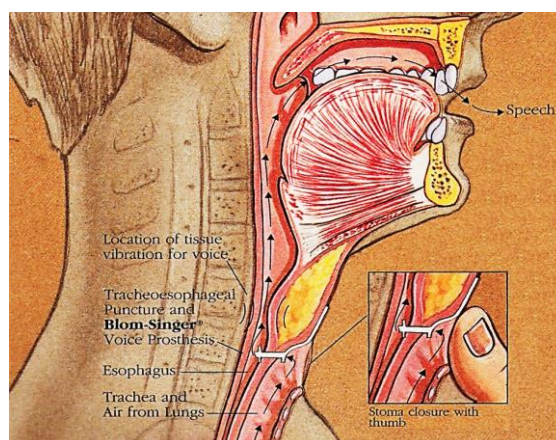


Figure 3: Mechanism of fistula speech (*Adapted from [Current Status of Voice Restoration Following Total Laryngectomy](#)*)



Figure 4: Very large TOF with the nasogastric feeding tube visible in the oesophagus

Conservative management

- Most enlarged TOFs causing salivary leaks respond to conservative measures to *shrink the diameter of the fistula* such as *reducing the size of the prosthesis* or replacing it with a *smaller sized urinary catheter*
- Some patients may have to *abandon tracheoesophageal speech* because of continued leakage with aspiration, or failed phonation.² In such cases the prosthesis is removed and the patient is fed via a nasogastric feeding tube until the fistula seals spontaneously, usually within 2 weeks after removal of the prosthesis
- If the fistula *remains patent but is small*, *silver nitrate* or *electrical cauterisation* may be applied to the fistula⁴
- *Alternative methods* include
 - Insertion a silicone septal button⁵
 - Purse-string suture around the TOF
 - Fat⁶ / collagen / Teflon injection around the TOF⁷

Surgical closure of TOF

If above conservative treatments fail, or there is a very large TOF as in *Figure 4*, surgical closure of a TOF becomes necessary. Repuncture with placement of a new tracheoesophageal prosthesis is possible

sometime after closure of the problematic fistula. Candidates for surgical closure should also be counseled about alternative methods of voice rehabilitation *e.g.* oesophageal speech and electrolarynx.

When planning closure of a TOF, *assess the size of the stoma* for the presence of stomal stenosis so that *stomoplasty* can be performed at the time of closure of the TOF.

TOFs are notoriously difficult to close, and the success rate is highly variable⁷ due to the poor blood supply of the irradiated and fibrotic tissue. Various methods of TOF closure have been reported:

- Layered closure
- Muscle rotation flaps (Sternocleidomastoid, [pectoralis major](#))
- Free or pedicled fasciocutaneous flaps ([radial forearm free flap](#)³, [deltopectoral](#)⁸, [supraclavicular](#) flaps)

However, use of flaps is limited by the bulkiness of the flaps.

The method described below is simple and does not require any flaps, unless closure of the oesophageal defect will result in oesophageal stenosis and requires reconstruction with a flap for that reason.

Surgical steps

- The procedure is performed under general anaesthesia with intermittent apnoea
- Intubate the patient via the tracheostoma with a small armoured endotracheal tube
- Insert a nasogastric tube
- Prepare and drape to leave the neck exposed from the mandible down to the upper chest
- Local anaesthetic with adrenaline is injected around edge of the tracheostoma
- Make a circumferential incision around the stoma with a 15 blade (*Figure 5*)

- Dissect 360 degrees along the wall of the trachea for a few centimeters, using electrocautery and dissecting scissors (*Figure 5*)

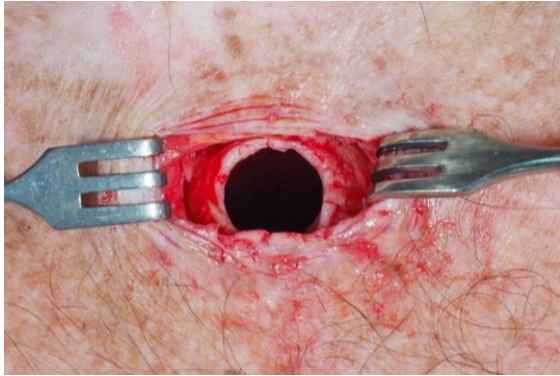


Figure 5: Tracheostoma incised circumferentially and for a few centimeters along the wall of the trachea

- Posteriorly, dissect carefully with scissors in a plane between the membranous part of the trachea and the anterior wall of the oesophagus (*Figure 6*)
- Avoid accidentally opening into the oesophagus
- Continue the dissection inferiorly beyond the TOF (*Figure 6*); dense fibrosis between the trachea and oesophagus can make identification of the TOF difficult

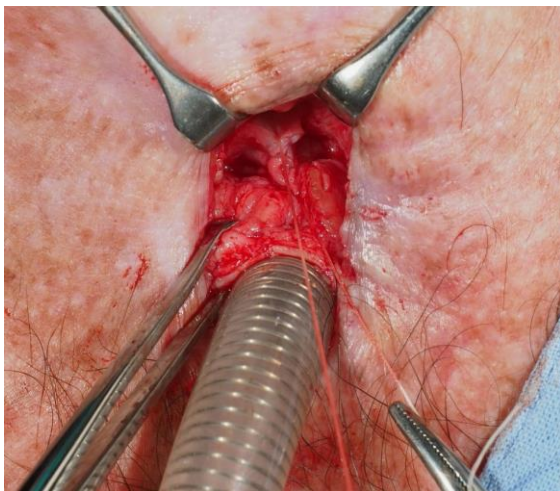


Figure 6: TOF identified and divided. The oesophageal defect is being closed with 3-0 Vicryl sutures

- With the fistula identified, it is divided. Leakage of saliva or mucus may be seen from the oesophageal side
- Oversew the oesophageal mucosa with interrupted 3-0 absorbable Vicryl
- Resect the proximal trachea beyond the TOF
- Mobilise the trachea so that it comfortably reaches the skin surface (*Figure 7*)
- Suture the trachea to the skin edge with 2-0 Vicryl or Nylon stitches using a modified mattress technique
- No drain is required

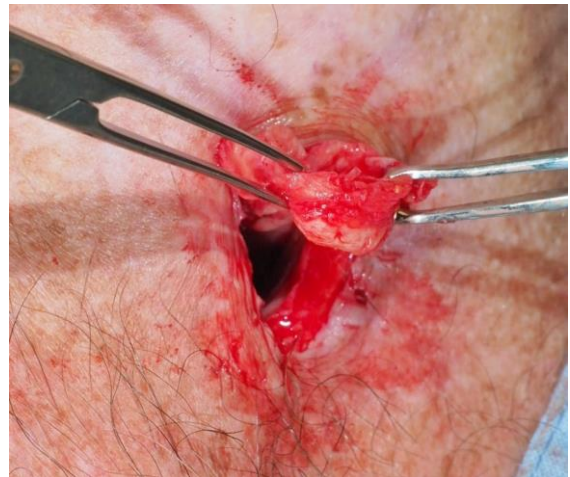


Figure 7: Trachea is mobilised and proximal tracheal rings are resected inferior to the level of the TOF



Figure 8: Tracheostoma is closed with 2-0 Vicryl or Nylon stitches using modified mattress sutures

Postoperative Care

- Patient is kept nil by mouth for 5-7 days, and fed via the NGT
- A secondary TOF can be made once the wounds have healed and matured, not sooner than a month after surgery
- Reinserting a prosthesis too soon may result in the prosthesis having to be replaced with a shorter length prosthesis as the scar matures

Case of exposed common carotid artery

This case illustrates the *proximity of the common carotid artery to the trachea*, and the need to maintain a dissection plane on the tracheal wall. The patient had a very large tracheoesophageal fistula that had developed spontaneously some years after surgery and radiation therapy (Figures 4, 6). During the dissection the common carotid artery was noted to be covered by only a thin layer of scar tissue in the left lateral wall of the tracheostoma with the tracheal rings having resorbed (Figure 7). The trachea was stuck down and fibrotic, and mobilizing the trachea was not possible.



Figure 6: Large tracheoesophageal fistula with nasogastric tube visible in the midline

The carotid artery was carefully exposed over a length of 3cms (Figure 7). The oesophageal fistula was repaired with 3-0 Vicryl.

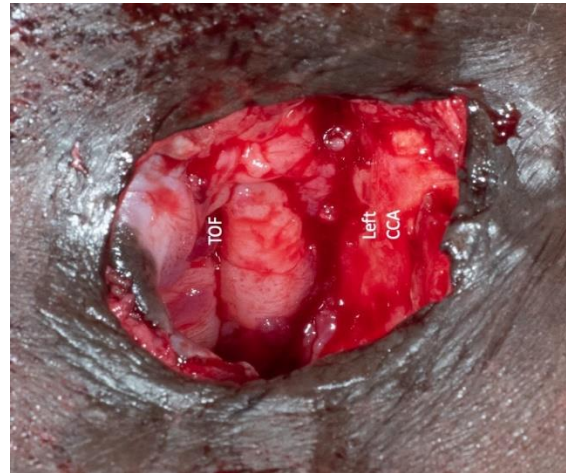


Figure 7: After dissecting the trachea around the stoma, we noted a medialized left common carotid artery (CCA) situated in the lateral wall of the tracheostoma

A [supraclavicular flap](#) was designed (Figures 8-10) and tunneled into the stoma to cover and isolate the carotid from the tracheostoma to avoid carotid artery blow-out in the future.



Figure 8: Supraclavicular flap design



Figure 9: Raised supraclavicular island flap

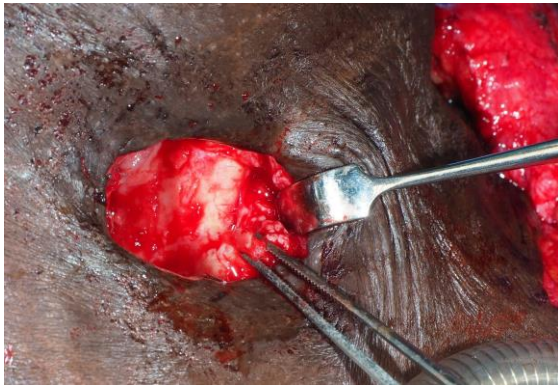


Figure 10: Exposed common carotid artery before flap inset



Figure 11: Supraclavicular flap inset to cover the exposed common carotid and overlay the oesophageal repair

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