

# Surgical management of tracheoesophageal fistula

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## Clinical vignette

The patient is a 54-year-old female who suffered smoke inhalational injury during a house fire. She required prolonged intubation and mechanical ventilation and eventually underwent open tracheostomy tube placement. In the setting of recurrent pneumonia, she was diagnosed with a tracheoesophageal fistula (TEF). An attempt at TEF closure with esophageal clips was unsuccessful. A transcervical TEF repair was performed at an outside institution with a limited tracheal resection.

The patient unfortunately developed a recurrent TEF. She did not tolerate capping of the tracheostomy tube and could not be decannulated. Intermittently, bilious contents were noted in the airway. She was surprisingly able to tolerate oral intake. She did require multiple courses of antibiotics to treat tracheobronchitis and pneumonia. CT imaging revealed tracheal stenosis, bronchial wall thickening and central lobular emphysema. Bronchoscopy revealed a slit-like fistula immediately caudal to the cricoid cartilage as well as moderate to severe tracheobronchomalacia. The remaining trachea measured ~90 mm in length. A re-do repair of her TEF via a cervical approach was performed.

## Surgical technique

### Preparation

The patient did not have an active pneumonia and was considered nutritionally replete. Patients are almost always weaned from mechanical ventilation before TEF repair, and there is a low threshold to perform gastrostomy and jejunostomy to minimize airway soilage and improve nutritional status.

For all but the most distal TEFs, the operation is performed

through an anterior cervical approach. The patient is in the supine position, with the neck slightly extended, the head supported with a gel pad and the arms at the side. When the patient has an existing tracheal stoma, the indwelling tracheostomy tube is replaced with a sterile armored endotracheal tube. Sterile ventilator circuit tubing is brought onto the surgical field to facilitate cross-field ventilation. A nasogastric tube is placed to facilitate esophageal dissection.

### Exposition

The preferred technique for repair of acquired benign TEF is via an anterior cervical approach with division of the trachea. Very distal TEFs that are adjacent to the carina may be best approached through a right thoracotomy (1). The fistula is defined and the esophageal defect is closed, with interposition of a pedicled muscle flap between the esophagus and trachea. Often, the tracheal segment containing the fistula is stenotic and is resected before re-anastomosing the airway. When the length of tracheal stenosis (greater than 4 cm) or other patient factors preclude safe tracheal resection, repair of the trachea over a T-tube may be the best option. Our patient's prior tracheal resection, morbid obesity, short neck, and tracheobronchomalacia were felt to be contraindications to further tracheal resection and T-tube reconstruction was felt to be the best option.

### Operation

The operation is performed through a low cervical collar incision encompassing the prior stoma. An upper sternal split is occasionally required for exposure of a TEF that is located in the mid to distal trachea. Subplatysmal flaps are created, the sternohyoid and sternothyroid muscles are

mobilized, and the thyroid isthmus is divided. Dissection is carried in the pre-tracheal plane down to the carina. The trachea is dissected laterally and circumferentially only at the level of the fistula, to avoid devascularizing the trachea. The level of the fistula is confirmed bronchoscopically and marked before commencing with this dissection. Dissection is strictly performed by staying in the plane directly on the wall of the trachea to avoid injury to the recurrent nerve; there is no attempt to visualize the nerve.

Following tracheal division, the fistula is easily visualized, allowing for dissection of the plane between the esophagus and the membranous tracheal wall. The abnormal trachea is resected along with the fistula, limiting the resection length to less than 4–5 cm or even shorter if excessive anastomotic tension is anticipated. A laryngeal release is performed if there is any concern for anastomotic tension. Laryngeal release is associated with swallowing dysfunction and aspiration risk (2).

The esophageal defect is completely dissected and then closed in two layers. The mucosa is closed in interrupted fashion with inverting 4-0 absorbable sutures whose knots are tied within the lumen. A second layer of interrupted 4-0 silk sutures are placed to re-approximate the muscle over the initial layer of sutures. The indwelling nasogastric tube ensures that the lumen is not overly narrowed with this repair. An adequately mobilized and pedicled strap muscle is meticulously sutured in place over the esophageal repair to exclude it from the tracheal repair.

Tracheal reconstruction is performed with placement of paired lateral 2-0 vicryl stay sutures and additional interrupted 4-0 vicryl sutures whose knots are tied on the outside. Sutures are placed in systematic fashion and tied in reverse order of placement to complete the posterior aspect of the anastomosis. The anastomosis is then completed by tying the anterior sutures. If the tracheal stenosis cannot be resected, the airway may be re-anastomosed after inserting an appropriately sized T-tube. If a T-tube is placed, ventilation may continue by passing a small endotracheal tube down the side port. The tracheal anastomosis is tested by submerging the anastomosis under saline solution and applying positive pressure ventilation with the cuff of the endotracheal tube deflated. The anterior tracheal suture line is further buttressed with another pedicled strap muscle or thyroid. This is especially important to preclude trachea-innominate fistula.

### Completion

A flat surgical drain is placed beneath the platysma prior

to closure of the incision, and maintained on bulb suction. To minimize tension on the tracheal anastomosis, a chin or “guardian” stitch is loosely placed from the submental crease to the skin overlying the sternum.

## Comments

### Clinical results

The reported rate of successful fistula closure at our center is 94% with postoperative mortality occurring in less than 4% of patients. Over 80% of patients resume oral intake and over 70% breathe without a tracheal appliance. Similar results have been reported by other centers, with rates of successful fistula closure ranging from 91% to 95% and low operative mortality between 4.0% and 5.7% (3-5).

### Advantages

Although there are reports of endoscopic approaches to manage acquired benign TEF, open TEF repair remains the only definitive solution to this difficult problem. Endoscopic management generally delays treatment and on occasion extends the esophageal and tracheal injury.

### Caveats

In patients with prior radiation, esophageal or laryngeal surgery, or in the redo setting, there is considerable risk of fistula recurrence and airway compromise. Careful operative technique and interposition of a robust muscle flap between the trachea and esophagus are the most important safeguards (6).

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None.

## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

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