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WILEY
Endoscopically Assisted Transstomal Primary Repair of an Acquired Tracheoesophageal Fistula

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INTRODUCTION

Acquired tracheoesophageal fistula (TEF) is a recognized complication of prolonged tracheostomy usage in the adult population.1,2 Ill-fitting airway appliances place pressure on the posterior tracheal wall, eroding through the posterior tracheal wall and trachealis, creating a fistula into the esophagus.2,3 This mechanism has not been reported in the pediatric population; pediatric acquired TEFs are more commonly secondary to caustic ingestion, foreign body ingestion (specifically button batteries), and trauma.2

In patients with TEF, principles of management focus on prevention of aspiration and repair or healing of the fistula. In the case of acquired fistulas, removal of the inciting cause is also a crucial component.4 Cases caused by caustic or foreign body ingestion often result in small fistula that can be managed conservatively. In the case of larger fistulas, surgical repair may be necessary.

For larger TEFs, open repair techniques are the mainstay of management. Open repairs are typically performed via a thoracotomy, with local tissue interposed between the trachea and esophagus at the site of the fistula to bolster the repair. These techniques are associated with injury to chest wall musculature and nerves, 3% mortality rate, and a 20% recurrence rate.2 In smaller fistulas, endoscopic repair has been reported where the lumen of the tract is denuded of mucosa, and often occluded with tissue glue or a similar substance, resulting in obliteration of the fistula tract.5,6 In this case we developed an endoscopically assisted transstomal technique to repair a wide, short, acquired fistula of the midtrachea.

CASE REPORT

A 12-year-old male with a history of prune belly syndrome, stroke resulting in right hemiplegia, bilateral lower extremity paraplegia, epilepsy, hypertension, G-tube dependence, and chronic tracheostomy dependence was referred for management of acquired tracheoesophageal fistula caused by erosion of the posterior tracheal wall by a longstanding tracheostomy tube. His tracheostomy had been placed at 3 months of age for persistent mechanical ventilation requirement due to his poorly developed abdominal musculature. Notably, there were no laryngotracheal abnormalities. Despite having been weaned from mechanical ventilation during early childhood and tolerating a Passy-Muir valve during waking hours for years, he had never undergone a capping trial or been evaluated for decannulation.

The patient initially presented to his local otolaryngologist with symptoms of severe coughing episodes, especially associated with oral intake, and expectoration of frank tube feed through his tracheostomy tube. An in-office flexible fiberoptic exam through his tracheostoma showed posterior tracheal wall erosion with concern for a TEF. His cuffless tracheostomy tube was exchanged for a cuff size 5 flexible Bivona tracheostomy in hopes of reducing pressure on the compromised area of the posterior tracheal wall with the longer tube and protecting the airway from aspiration. He also underwent a gastrostomy tube conversion to a gastrojejunostomy tube to reduce esophageal reflux, and the patient was made strict nothing by mouth (NPO). Despite 3 weeks of these conservative interventions, the patient continued to aspirate and expectorate tube feeds. A repeat examination demonstrated enlargement of the TEF, and he was transferred to our facility for further care.

Upon presentation, the patient was stable and not toxic appearing. Labs on admission did not initially show leukocytosis or other metabolic derangements. Day 1 post-admission he was taken to the operating room for evaluation. Direct laryngoscopy/bronchoscopy and flexible esophagoscopy identified an 8-mm ulceration of the posterior tracheal wall 3 cm above the carina. The TEF was confirmed by passing a flexible 6-French suction catheter through the erosion in the posterior tracheal wall and identifying it in the cervical esophagus (Figs. 1 and 2).
The orientation of the tract was determined by measuring from the maxillary incisors to the level of the fistula in both the trachea and esophagus. The distances were equal, demonstrating that the fistula through the party wall was short and transversely orientated.

Once the fistula had been evaluated, in consultation with our pediatric surgery colleagues and the patient’s parents, we decided to attempt primary repair of the fistula using an endoscopically assisted transtomal approach. The large caliber and short length of the fistula precluded simply denuding and occluding the tract. A small vertical releasing incision was made at the inferior aspect of the stoma to improve access to the posterior tracheal wall. The fistula was easily identified several centimeters below the stoma using a 3-mm, 0° endoscopic telescope. An esophageal bougie was passed transorally to protect the posterior esophageal wall during the repair procedure and was identified at the distal end of the fistula using the telescope. Under transtomal endoscopic guidance, the fistula tract was de-epithelialized using a Bugbee flexible monopolar electrode set on 8 W of power. The telescope was then removed from the stoma and passed transorally into the proximal trachea using a Parson’s laryngoscope. Primary repair was then completed under endoscopic guidance using 4-0 Vicryl interrupted sutures on a Castro needle driver passed into the trachea through the enlarged stoma. Closure was confirmed by probing the fistula site with a flexible suction catheter (Fig. 3). The patient was recannulated using a size 5 cuffed Bivona tracheotomy tube. The cuff was inflated and positioned to apply gentle pressure to the repair site. Throughout the procedure the patient was allowed to ventilate spontaneously with supplemental oxygen delivered through a 3.0 uncuffed endotracheal tube via the left nostril into the oropharynx. Three short episodes of desaturation were managed with transtomal intubation of the distal airway with a 4.5 cuffed endotracheal tube and ventilatory support; the endotracheal tube was removed to allow further surgery once the patient was adequately reoxygenated.

Following repair, the patient was admitted to the pediatric intensive care unit for postoperative observation on pulse oximetry. No mechanical ventilation was required following surgery, and he maintained saturations on a high-humidity tracheostomy collar. On postoperative day 2, he developed fever and leukocytosis, and a chest x-ray demonstrated pulmonary atelectasis. His fever and leukocytosis defervesced after several days of empiric treatment with Bactrim and use of an incentive spirometer. He was discharged home, NPO, on postoperative day 5 with the

Fig. 1. Acquired tracheoesophageal fistula cannulated with a 10-French suction catheter.

Fig. 2. Tracheoesophageal fistula held open on tension prior to denuding with a Bugbee electrode.

Fig. 3. Primarily repaired tracheoesophageal fistula.
tracheotomy in place with plans for future decannulation following confirmation of successful fistula repair.

The patient returned to St. Louis Children’s Hospital 5 weeks following repair, where diagnostic laryngoscopy and bronchoscopy demonstrated an intact posterior tracheal wall. A barium esophagram demonstrated no signs of contrast leakage from the esophagus into the airway. Diet by mouth was restarted and well tolerated. After a 24-hour capping trial, the patient was successfully decannulated.

DISCUSSION

This case highlights the importance of regular surveillance and re-evaluation of patients with long-term tracheostomies and reports a novel primary repair technique. Although development of an acquired TEF secondary to a longstanding tracheostomy has not been reported in pediatric patients, it is a well-recognized complication in adults; the risk correlates with duration of tracheostomy use.\(^1,4\) In this case, the patient had not been evaluated for possible decannulation despite being successfully capped for many years. Following repair of his TEF, he was successfully decannulated without incident. Regular patient re-evaluation regarding continued need for tracheostomy is essential to reduce the risk of such complications.

Due to the favorable location of the fistula, which was accessible via the patient’s stoma, it was successfully closed primarily using a minimally invasive, endoscopically assisted transstomal approach. Its large caliber precluded the usual endoscopic technique of demucosalization and occlusion with tissue glue, but the additional access provided by extension of the tracheostoma allowed the placement of sutures to close the fistula primarily. The patient ventilated spontaneously throughout much of the procedure, requiring brief transstomal intubation for ventilatory support on only three occasions. This state is more easily achieved in the pediatric population. In adult patients, the use of jet ventilation, or an intermittent apnea technique with distal intubation when needed, may be necessary.

CONCLUSION

In suitable cases, our technique minimizes morbidity by avoiding the thoracotomy and mediastinal dissection associated with traditional open approaches to repair,\(^5,6\) while still creating a watertight repair, maximizing the likelihood of healing.

BIBLIOGRAPHY