We report a case of a 59-year-old male who experienced tracheoesophageal fistula and grade IV subglottic stenosis after percutaneous dilation tracheotomy. Although percutaneous tracheotomy is considered a safe procedure that is often performed in the intensive care unit setting, it is not without complications. While subglottic stenosis and tracheoesophageal fistula are known complications of percutaneous tracheotomy, this report discusses a patient who experienced both complications simultaneously. The purpose of this report is to discuss potential serious complications of percutaneous tracheotomy and their management, and to review the literature on percutaneous tracheotomy complications.

Key Words: Percutaneous tracheotomy, subglottic stenosis, tracheoesophageal fistula, cricotracheal resection.

Level of Evidence: NA

INTRODUCTION

Percutaneous dilation tracheotomy (PDT) is a commonly performed surgical procedure that was first described by Ciaglia in 1985 as an alternate method to open surgical tracheotomy for managing the airway while avoiding the complications of translaryngeal endotracheal intubation.1 PDT is well tolerated and considered to be a safe procedure. Known complications of PDT include loss of airway, excessive bleeding, tracheotomy occlusion or dislodgement, posterior tracheal wall perforation, stomal infection, tracheal ring fractures, pneumothorax, subcutaneous and mediastinal emphysema, tracheoesophageal (TE) fistulae, and subglottic stenosis.2–4

TE fistulae are rare complications that result in a connection between the trachea and esophagus from damage to the posterior tracheal wall either during the procedure or afterward from excess cuff pressure. Definitive treatment of TE fistula is surgical repair or stenting of both the trachea and esophagus in nonoperative patients.5

Subglottic stenosis is another rare PDT complication that generally occurs late and results in abnormal narrowing of the tracheal lumen, commonly at the level of the stoma or the distal tip of the tracheostomy tube.6 Although TE fistula and subglottic stenosis are both known complications of PDT, there has been no previous report that discusses a patient who experienced both complications simultaneously. Here we present such a case and discuss its successful surgical management.

CASE REPORT

The otolaryngology–head and neck surgery (OHNS) service was consulted to evaluate a 59-year-old gentleman who had suffered polytrauma as a result of a high-speed motorcycle collision. He had been in the intensive care unit for 7 days and was failing to wean from the ventilator. He subsequently underwent bedside percutaneous dilation tracheotomy by the general surgery service. On postoperative day (POD) 11, he underwent modified barium swallow study to evaluate dysphagia. This study was concerning for TE fistula (Fig. 1).

The patient was taken to the operating room for rigid bronchoscopy and esophagoscopy. He was noted to have a very small TE fistula approximately 2 to 3 cm inferior to the glottis (Fig. 2). His endoscopic examination was also notable for diffuse subglottic edema and free floating cartilaginous components (Fig. 3), which were removed from the airway. Because of the active granulation tissue in the subglottis, the decision was made to allow the fistula to heal with strict nil per os status and enteral feeding for 3 weeks.

After 3 weeks, the patient was reassessed by the OHNS service. He notably could not tolerate capping of
tracheotomy, and expressed an inability to pass air into the lungs upon deep inspiration with tracheotomy occlusion. Subsequent bronchoscopy was performed revealing a persistent TE fistula and Cotton-Myer grade IV subglottic stenosis extending from 2 cm below the glottis to 1.5 cm above the tracheostoma.

Definitive repair was planned in collaboration with the thoracic surgery team. The patient underwent cricotracheal resection with primary anastomosis and infrahyoid release. Prior to the cricotracheal anastomosis, the tracheoesophageal fistula was closed primarily, and a sternohyoid interpositional muscle flap was placed between the airway and the repaired esophagus. Postoperative flexible fiberoptic nasopharyngolaryngoscopy showed normal recurrent laryngeal nerve function. On POD 4, he became stridulous and was noted to be in respiratory distress, and so emergent direct laryngoscopy and bronchoscopy were performed. Examination of the airway revealed supraglottic edema and an intact tracheal anastomosis. His stridor was attributed to a circumferential eschar at the site of anastomosis. The patient did well with a short course of intravenous dexamethasone. He had no further episodes of stridor. Grillo stitches were removed on POD 11. Repeat modified barium swallow study showed no evidence of TE fistula. He was subsequently discharged home without further incident on hospital day 100.

DISCUSSION
There is a paucity of literature studying complication rates of percutaneous dilation tracheotomy. Studies comparing PDT to open surgical tracheotomy show similar overall complication rates.6–8 There are no reported rates of TE fistula with PDT, but it is considered an extremely uncommon complication. Tracheal stenosis is also considered rare and may occur in up to 11% of cases, but these cases are typically mild and do not result in grade 4 stenosis.3 In the largest study to date of PDT cases, a cohort of 3,162 procedures was retrospectively reviewed. There were no cases of TE fistula and only five cases of tracheal stenosis requiring operative intervention.9

There are concerns that the modified Seldinger technique of PDT may lead to complications due to blind placement of the tracheotomy tube. A composite analysis comparing PDT with and without bronchoscopy showed that bronchoscopy significantly decreased the incidence of complications.10 In the present case, the primary team performed flexible bronchoscopy during the initial procedure, and placement of tracheotomy cannula into the airway was confirmed with direct visualization.

Airway complications following PDT range in severity from minor complications like adhesions and tissue

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**Fig. 1.** Barium swallow study with evidence of frank contrast extravasation into airway. Extravasation noted by arrowhead.

**Fig. 2.** Bronchoscopic view of tracheal party wall with tracheoesophageal fistula noted (F). Tracheal lumen visualized inferiorly (L). [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]

**Fig. 3.** Rigid bronchoscopy revealing diffuse subglottic edema with exposed tracheal cartilage. [Color figure can be viewed in the online issue, which is available at www.laryngoscope.com.]
changes resulting in dysphonia, to major complications such as airway loss, reintubation, conversion to open surgical tracheotomy, TE fistula, tracheal stenosis, and death. Dennis et al. reported a major airway complication rate of 0.38% and an overall mortality rate of 0.16% in their large analysis of PDT cases performed at the bedside without bronchoscopic guidance.9 The synchronous occurrence of TE fistula and tracheal stenosis, two major airway complications, is exceedingly rare and in fact has not previously been reported in the literature.

One possible contributing factor to this patient’s airway complications was placement of the tracheotomy in a more superior position than is ideal. Excess force utilized to pass the cannula could have resulted in fracture of the cricoid cartilage. Violation of the cricoid cartilage and the first tracheal ring could explain the subglottic stenosis and the cartilaginous components visualized on initial bronchoscopic examination. The fistula could have resulted from passage of the guide needle through the tracheal party wall or from the fractured cricoid fragments piercing through the wall. Diffuse edema and airway collapse from compromise of the cricoid may explain the resultant complete tracheal stenosis.

Although the overall and major complication rates of PDT discussed in the literature are low, suggesting that PDT is a safe procedure, the clinician must be vigilant for signs of complication such as dysphagia, increased secretions, or failure to tolerate tracheotomy capping. In the event of concern for complication, there must be a low threshold for examination of the airway under anesthesia to assess the severity and extent of injury as well as to direct further treatment modalities.

CONCLUSION
Percutaneous dilation tracheotomy is a commonly performed procedure with very low complication rates, but caution is needed because there is a potential for severe complications including loss of airway, excessive bleeding, tracheotomy dislodgement, posterior tracheal wall perforation, tracheoesophageal fistula, and subglottic stenosis. Diagnosis and management of these severe sequelae of PDT require careful surgical and medical management, including serial evaluation of the airway. A multidisciplinary approach should be considered when reconstruction of the airway is required.

BIBLIOGRAPHY
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