

# Acute Airway Obstruction and Tracheal Laceration during Gastrostomy Placement in an Infant with Tracheoesophageal Fistula

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**A**IRWAY control is one of the most important tenets of anesthetic practice. Asphyxia and tracheal laceration in infants are extremely rare, but life-threatening complications. Despite many reviews in the literature regarding tracheoesophageal fistula (TEF) and esophageal atresia,<sup>1–4</sup> no case of tracheal injury following the aberrant passage of a gastrostomy catheter has been reported. The present case describes an unusual case of iatrogenic airway obstruction and tracheal laceration following placement of a gastrostomy catheter in an infant with esophageal atresia. In addition, we discuss a method to prevent this rare iatrogenic injury.

## CASE REPORTS

A 2,410-g male infant was delivered vaginally at 37 weeks of gestation. Upon attempted passage of a feeding tube, it was noted that the tube was unable to be placed into the stomach through the esophagus. A diagnosis of esophageal atresia (Gross type C) was made by chest and abdominal radiographs, which demonstrated that the tube was coiled in the upper esophagus in association with air in the intestine distal to the stomach. No other anomalies were present. The 1-day-old infant was scheduled for TEF repair.

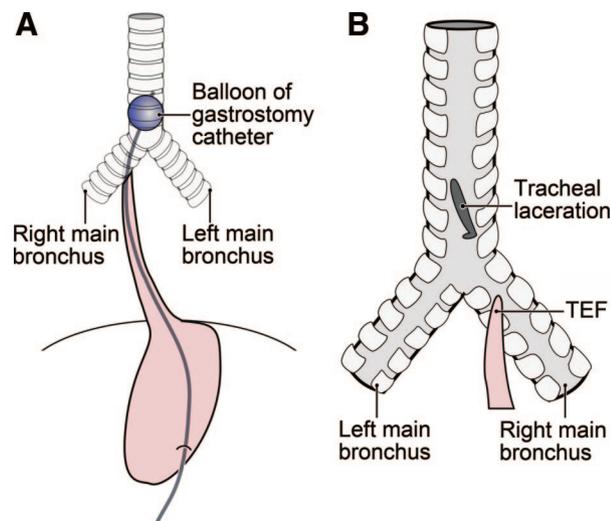
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General anesthesia was induced with sevoflurane and oxygen without muscle relaxant. The trachea was easily intubated (3.0 mm endotracheal tube). Fentanyl 0.001 mg/kg was administered intravenously for perioperative anesthesia. The anesthesia strategy was to maintain anesthesia with sevoflurane and an air-oxygen mixture under spontaneous ventilation. The operation commenced with the passage of a gastrostomy catheter (6-French Phycon catheter; Fuji Systems Corporation, Tokyo, Japan) inserted into the stomach. The catheter was smoothly inserted to a depth of 25 cm through the abdominal and gastric walls. After the guide wire was removed, the balloon was inflated to anchor the tube. Shortly thereafter, no end-tidal carbon dioxide was detected, the oxygen saturation decreased below 70%, and the infant became bradycardiac. Cardiopulmonary resuscitation was initiated promptly. Atropine 0.02 mg/kg and epinephrine 0.01 mg/kg were administered intravenously. Assisted ventilation with 100% oxygen was ineffective, and auscultation revealed absent breath sounds. We considered the following possibilities, using mnemonic DOPE: displacement or obstruction of the endotracheal tube, pneumothorax, and equipment failure.<sup>5</sup> Displacement was unlikely, because the endotracheal tube was passed to the correct depth. The ability to easily pass the tube suggested no obstruction. Trial extubation showed the lumen of the tube was not obstructed. Finally, all equipment was performing correctly. Mask ventilation, however, was also ineffective. An attempt was made to place a new endotracheal tube, but it could not pass into the distal portion of the trachea. Pneumothorax was therefore suspected. A gastrostomy balloon was deflated as the first step to address a pneumothorax. This immediately facilitated ventilation and allowed the trachea to be easily intubated. We concluded that the catheter had been erroneously passed through the TEF and asphyxia was caused by airway obstruction following inflation of balloon in the trachea (fig. 1A). The period of apnea requiring cardiopulmonary resuscitation lasted 13 min and was associated with bradycardia without asystole. Following hemodynamic stabilization, the infant was placed on pressure-controlled ventilation. Arterial blood gas analysis revealed neither hypoxia nor hypercarbia. The infant was then positioned for a right thoracotomy. As the tracheal secretions were blood-tinged and the oxygen saturation had gradually decreased,



**Fig. 1.** Views of the gastrostomy catheter and tracheoesophageal fistula (TEF). (A) An anterior view of the gastrostomy catheter, which had been erroneously passed through the TEF, with the balloon inflating in the trachea. (B) Posterior view of the TEF, located in the right main bronchus. The tracheal laceration was approximately 10 mm in length and located in the membranous portion 10 mm above the carina.

bronchoscopy was performed through the 3.0-mm endotracheal tube. Insertion of the OD 2.2-mm flexible bronchoscope (Olympus LF-P; Olympus Optical Company, Tokyo, Japan) revealed a small amount of clot in the trachea. Dissection of the connective tissue surrounding the trachea decreased minute ventilation, and packing this area with absorbent gauze reduced air leakage. It was confirmed that the gastrostomy balloon caused not only an airway obstruction, but also a tracheal laceration. This laceration was located in the membranous portion of the trachea 10 mm above the carina, and was approximately 10 mm in length (fig. 1B). The laceration was successfully closed with sutures. The peritracheal tissue sealed the laceration and prevented the development of a pneumomediastinum. The fistula, which communicated between the distal esophagus and the right main bronchus, was then repaired.

The infant was transferred to the neonatal intensive care unit. The postoperative chest radiograph demonstrated no subcutaneous emphysema or pneumomediastinum. Positive pressure ventilation was tolerated well and no air-leak from the repaired tracheal laceration was observed. A major anastomotic leak of the esophagus occurred on postoperative day 3 and presented tension pneumothorax, requiring bilateral chest tube placement. The chest tubes were removed at the bedside on postoperative day 9. The infant was extubated successfully on postoperative day 11. An esophagram on postoperative day 26 showed a severe esophageal cicatricial stricture and an underdeveloped angle of His. The angle of His is almost nonexistent in many infants, and the esophagus tends to form a straight line with the stomach.<sup>6,7</sup> Consequently, the underdeveloped angle might have contributed to the passage of the gastrostomy catheter into the trachea. Several operations were performed to balloon-dilate the esophageal stricture under general anesthesia with no perioperative complications, as has been previ-

ously reported.<sup>8</sup> The infant was discharged from the hospital with intact neurologic status.

## Discussion

While gastrostomy for the prevention of gastric distension is not commonly employed in TEF repair,<sup>1-3</sup> the surgeons at our facility perform this as a safeguard against gastric distention, which may occur due to failure to perform gentle manual ventilation.<sup>9</sup> To our knowledge, this is the first report of an acute airway obstruction and tracheal laceration during the placement of a gastrostomy catheter. In this case not only did the dilation of the misplaced gastrostomy balloon cause cardio-respiratory arrest, it also resulted in a significant tracheal laceration. While the majority of tracheal lacerations heal with conservative management,<sup>10,11</sup> they may be lethal if the airway is obstructed by a clot or if a pneumomediastinum develops due to a progressive air leak.<sup>12,13</sup> In these rare cases, surgical repair is required.<sup>14</sup>

This case would suggest that some procedure should be followed to ensure correct placement of the gastrostomy catheter. Correct positioning of the balloon has been reported to be ensured by performing the procedure under fluoroscopy. However, this results in exposure to radiation.<sup>15</sup> Bronchoscopy could also be used to ensure the balloon is not in the trachea or major bronchi, but though several authors have demonstrated that intraoperative bronchoscopy is useful for rapid confirmation of correct placement of endotracheal tube and to avoid accidental intubation of the TEF,<sup>16,17</sup> bronchoscopy in infants is technically complicated and involves essentially high-risk procedures that can result in serious complications such as hypoxia, bronchospasm, bleeding, pneumothorax, and arrhythmia.<sup>18,19</sup> Therefore, given the disadvantages of the latter two diagnostic approaches, the awareness of the possibility of airway obstruction appears to be the most important factor in prevention of this complication.

In conclusion, in the rare situation when airway obstruction and tracheal laceration occurs in the setting of TEF treatment, knowledge of the possibility of this iatrogenic injury should aid in the prompt diagnosis and subsequent successful treatment of the injury.

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