Tracheoesophageal Fistula following Endotracheal Intubation for Organophosphorus Poisoning

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Abstract
Tracheoesophageal fistula (TEF) is an abnormal communication between the trachea and esophagus. Iatrogenic TEF can be due to endotracheal intubation, rigid bronchoscopy or tracheostomy. Tracheostomy tube cuff volumes and pressures require constant monitoring to avoid tracheal injury. Acquired TEF which occurs after prolonged intubation, usually develops after 15-200 days of mechanical ventilation. We report a case of a large TEF secondary to endotracheal intubation for organophosphorus poison-induced respiratory failure. Patient presented with dysphagia and recurrent aspiration pneumonia after extubation. She underwent trachea-esophageal fistulectomy and closure with a sternocleidomastoid muscle flap.

Introduction
Acquired nonmalignant tracheoesophageal fistula is very rare disease and difficult to manage.¹,² High cuff pressure or direct mechanical trauma during mechanical ventilation are considered as the main causes of TEF.³ TEF is an abnormal communication between the trachea and esophagus. Esophageal malignancy is the most common cause of TEF in adults; other benign causes are induced by endotracheal tubes, tracheostomies and thoracic surgery. Ono’s sign⁴ i.e. cough while swallowing is an important clinical sign of TEF. Increase in tracheal secretions and aspiration during swallowing results in paroxysms of cough and recurrent pneumonia. Patients may have food particles in expectorated material.

The incidence of TEF following endotracheal intubation is < 1%. Usually TEF develops after prolonged mechanical ventilation, with a mean period of 42 days.⁵ In this case patient had underwent mechanical ventilation for 12 days, after extubation she developed dysphagia and further evaluation revealed large TEF.

Case Report
A 25 year old lady came with complaints of dysphagia, fever and cough. She had history of consumption of organophosphorus compound two months ago and had been on ventilator support for 12 days, with an endotracheal tube. The patient developed dysphagia and recurrent fever after extubation. She had cough every time during food intake, more so with liquids.

On initial evaluation, she was pale, cachexic, febrile, weighing 30 kg, with Pulse rate- 110/min, blood pressure – 100/70 mmHg, had bilateral crepitations, more in right base. Her hemoglobin was 8.5 gm%, TLC – 15000/ cum, platelet counts were normal, other routine biochemical investigations were normal.

The chest radiography revealed patchy heterogeneous opacities in both lung fields. Her CECT chest showed large TEF in upper esophagus (Figure 1). Esophagus was seen containing air and communicating with the trachea, with Ryle’s tube in situ (Figure 2). OGD-scopy also confirmed the presence of fistula.

As patient was nutritionally debilitated and had recurrent aspirations, a feeding jejunostomy was done and she was also put on partial parenteral nutrition for 4 weeks along...
with chest physiotherapy.

Intraoperative endoscopic localization of the fistula showed it to be 2 cm in diameter, 3 cm below cricopharynx. The esophagus is seen with Ryle’s tube in situ. (figure 3). Neck exploration was done with a L shaped anterolateral incision and the fistula was localized and divided. The edges were refreshed. The esophageal and tracheal defects were closed with interposition of sternocleidomastoid between the two closure lines. The patient was extubated uneventfully. The leak stopped after three weeks.

Discussion

Endotracheal tube cuff volumes and pressures require constant monitoring to avoid tracheal injury. Past literature recommended routine inflation and deflation of cuffs every few hours; but this has not been shown to reduce the risk of tracheal injury, it actually increases the risk for aspiration. Ischemic damage of the trachea depends on the balance between mucosal perfusion pressure and the pressure exerted by the cuff.

When the cuff pressure exceeds tracheal mucosal perfusion pressure, induction of ischemia and/or necrosis will just be question of time. Cuff pressures > 30 cm H₂O compress mucosal capillaries and impair blood flow, with total occlusion occurring at 50 cm H₂O, it is generally recommended that cuff pressures should not exceed 20 cm H₂O. However, monitoring cuff pressure alone is insufficient, because tracheal damage and increases in cuff volume can occur even when cuff pressures are maintained within the desired range. Cuff volumes should not exceed 6 to 8 ml.²

Predisposing factors for development of TEF include prolonged intubation ranging from 15-200 days (with mean of 42 days), traumatic intubation attempts, presence of a wide bore gastric tube and excessive motion of tracheal tube during dressing change. Local infection, anemia, shock, metabolic acidosis, diabetes and steroid therapy cause decrease in mucosal blood flow hence increase the likelihood of fistula formation.² Problems during endotracheal intubation may cause iatrogenic trauma to of the upper airways. The direct cause of rupture is difficult tracheal intubation particularly with a stylet inside the tube.³

In the study by Kalaud and colleagues, use of stylet in intubation in 4 of 12 TEF cases has been mentioned. The size of endotracheal tube and swelling of cuff may contribute to the trauma. Many researchers assert that prevalence of iatrogenic tracheal rupture is higher in females and this assertion leads to conclusion that the membranous trachea is less firm in women and children as compared to men.⁴

In the present case difficult/traumatic intubation seem to be the cause of iatrogenic TEF, as the total duration for which the patient was intubated i.e. 12 days, is not very long. The exact mechanism remains uncertain, but the most probable explanation is direct laceration from endotracheal tube tip caught in the fold of flaccid posterior tracheal membrane while advancing the tube.

A patient with acquired TEF should be preoperatively given good supportive therapy, measures should be taken to prevent aspiration and pulmonary infections should be aggressively managed. A spontaneously breathing and nutritionally fit patient is prerequisite for success of the therapy.

Conclusion

Proper selection of an appropriate size endotracheal tube, use of low pressure high volume cuffs with frequent cuff pressure monitoring (keeping cuff pressure < 20 mm of H₂O and cuff volume < 6-8 ml), minimal endotracheal tube movement during positioning/suctioning and using flexible nasogastric tube can prevent the occurrence of TEF. This case reinforces the need for a high index of clinical suspicion for an early diagnosis and treatment of a tracheoesophageal fistula.

References