Post-intubation tracheal injury during esophagectomy

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Abstract

Post-intubation tracheal injuries are rare complications with serious consequences. Several factors increase the risk of tracheal injuries which may be attributed to patient, or procedure related. Majority of the tracheal injuries are managed surgically, however, role of less invasive and conservative treatment are also emerging.

Case: we report a case of an elderly lady who underwent minimally invasive esophagectomy for esophageal carcinoma. She developed significant surgical emphysema within hours after surgery and massive air leak through underwater seal chest drainage tube. She was taken for emergency re-exploration. On table bronchoscopy confirmed 5 cm longitudinal tear of membranous part of cervical and upper thoracic trachea. Thoracoscopic repair along with transcervical-transtracheal repair of membranous wall of trachea and a tracheostomy was performed. She made significant recovery with few complications which were managed successfully.

Keywords: Trachea, Intubation, Tracheostomy.

Introduction

Tracheal injuries whether traumatic or iatrogenic are rare events with some serious life threatening consequences. There are no accurate reports on total incidences of tracheal injuries. A German study of 1033 tracheal injuries in 2009 revealed 604 (58.5%) iatrogenic injuries, among which 372 were associated with endotracheal intubation/mechanical ventilation. The study estimated risk of tracheal lacerations, due to single lumen intubation to be around 1:75,000(0.000013%) cases.[1] Other studies noted increased risk of tracheal injuries with the use of double lumen tube and tracheostomy, up to 0.5% and 1%, respectively.[2] Treatment of post-intubation tracheal injuries (PiTI) mainly consist of surgical intervention but some studies also provide insight for expectant or minimally invasive management of small injuries.[2] Here, we present a case of PiTI in a patient who underwent Video-assisted Thoracoscopic Surgery (VATS) 3 phase esophagectomy and technique of surgical repair.

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Case Presentation

A 57 years old woman, with a history of progressive dysphagia for about 1 year was referred to our department. She had history of laparoscopic cholecystectomy done 3 years back. She had no history of smoking or alcohol consumption. Physical examination revealed no specific findings. All the baseline blood investigations were done to evaluated the general condition of the patient. Then upper gastrointestinal endoscopy (OGD) was performed which showed ulcero-proliferative growth in the esophagus extending from 25 cm to 31 cm from the upper central incisors. Biopsy taken from the growth concluded to be Squamous cell carcinoma (Keratinizing variant). The contrast enhanced CT scan showed circumferential thickening with heterogenous enhancement in thoracic esophagus from T4 to T7 level for the length of 9 cm and with maximum thickness of 16 mm, causing severe luminal narrowing. There were enlarged mediastinal lymphnodes according to the CT scan report (Figure 1). There was no other evidence of distant metastasis upon further evaluation. She received neoadjuvant chemo-radiotherapy (NACTRT) with Paclitaxel and carboplatin as per CROSS protocol.[3] After neoadjuvant treatment, she was re-evaluated for possible surgical intervention. Post NACTRT CT scan showed decrease in the extent of disease with partial response.

Six weeks after completion of NACTRT, she underwent VATS 3 phase esophagectomy. Mobilization of the esophagus was done with VATS followed by midline laparotomy and left sided cervicotomy. Stomach was mobilized and pulled up through the bed of esophagus and stapled gastroesophageal anastomosis was done in neck.

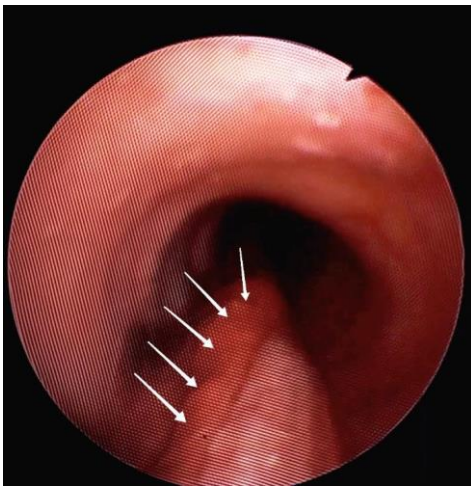
Figure 1. CECT of the chest and abdomen showing the circumferential esophageal mass. a. Axial view b. Coronal view

For the procedure, she was intubated with a conventional single lumen endotracheal tube. The surgery was completed with no intraoperative issues and patient was extubated and shifted to ICU postoperatively. It was noted that surgical emphysema developed progressively on the chest and neck area of the patient within few hours and there was significant gush of air in the intercostal chest drain indicating air leak from major airways.

The patient was immediately shifted to Operating room (OR) and first evaluated

with Flexible Bronchoscopy, which showed the site of airway injury (Figure 2a) in the membranous wall of trachea. Then the patient was anesthetized and intubated with a single lumen endotracheal tube and positioned for VATS evaluation. The site of injury was found high up in the cervical region which was about 5 cm with distal end just below thoracic inlet (Figure 2b).

a.



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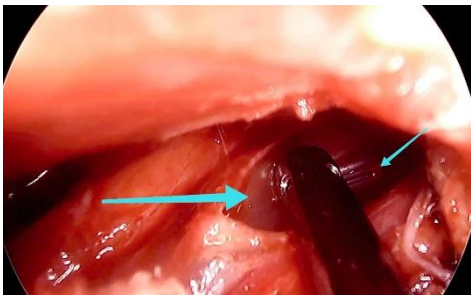
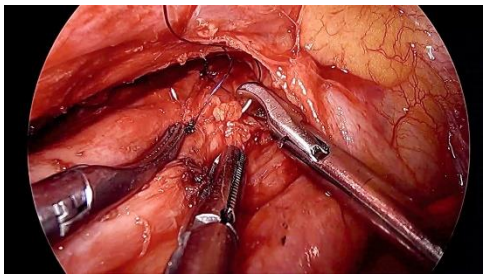


Figure 2. a, Bronchoscopic image of the lacerated posterior wall of trachea shown by white arrows; b, lacerated posterior wall seen during re-VATS exploration, shown by blue arrow.

Interrupted absorbable 4-0 monofilament suture (Monosyn) was used to suture about 3 cm of distal lacerated area with VATS (Figure 3a). Air leak check showed the laceration was not completely sutured (Figure 3b). With no space to suture the remaining part of laceration by VATS, it was planned to approach the lacerated area transcervically. As it would be difficult

a.



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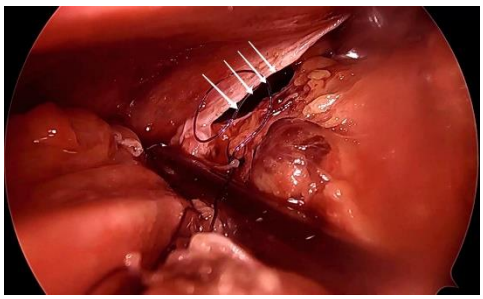


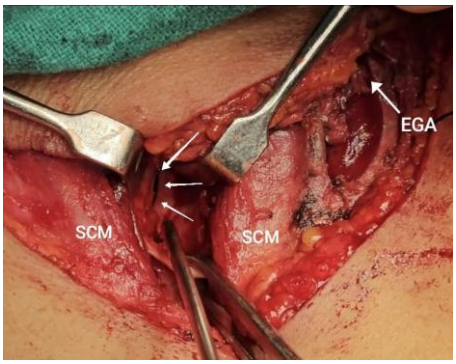
Figure 3. a, Repair of the trachea laceration by VATS; b, Remaining part of the laceration which could not be repaired by VATS.

to repair the laceration just by lifting the trachea since the laceration was on the posterior wall and the gastroesophageal anastomosis was in vicinity to it. Thus, it was decided to approach transcervically and transtracheally (Figure 4a). A bronchoscope was introduced through the endotracheal tube (the latter was withdrawn over the bronchoscope temporarily) and the location of the remaining laceration was located using a 22 Gauze syringe needle inserted from outside the trachea. The trachea was opened transversely at this site. A U-flap of the cartilaginous part of the trachea at the incision site was made and through the opening the lacerated part of the trachea was sutured in interrupted fashion using 4-0 Monosyn (Figure 4b). Patient was ventilated intermittently during tracheal repair (cross field ventilation). A tracheostomy was created. She was kept

sedated and under mechanical ventilation postoperatively. She was weaned off ventilator support to T-piece ventilation on the 2nd postoperative day and was started feeding via a Feeding jejunostomy tube placed during esophagectomy. She was shifted to ward on 4th postoperative day. The tracheostomy tube was removed after 2 weeks.

Patient developed the esophago-gastric anastomosis leakage in the cervical region. This was managed conservatively and the patient gradually improved. She was then discharged on the 29th postoperative day(POD).

a



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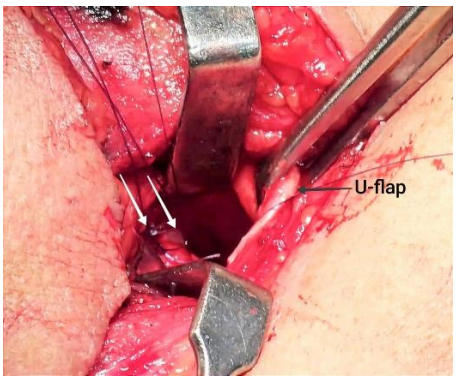

Figure 4. a, Transcervical-transtracheal exposure of the laceration. indicated by arrows, SCM sternocleidomastoid muscle, EGA esophago-gastric anastomosis; b, Interrupted sutures taken.

Discussion

Several risk factors for tracheal injury associated with the patient and procedure, have been identified such as short body height, female sex, old age, chronic obstructive pulmonary disease, steroid use, congenital tracheal abnormalities, weakness of the pars membranosa of the trachea, diseases that alter the position of the trachea (mediastinal collections, lymph nodes, or tumors), emergency intubation, a lack of procedural experience, inappropriate use of stylets and large tube sizes, and cuff over-inflations.[4–10]

The most common clinical signs are subcutaneous emphysema, which is followed by pneumomediastinum, pneumothorax, dyspnea/respiratory distress, and hemoptysis. Other less common symptoms included pneumoperitoneum, pneumopericardium, angina, hypotension, and shock.[5,7,10] Acute respiratory failure can also occur, but the diagnosis could be difficult in patients with preexisting respiratory failure.[7] A systematic review by Miñambres et al, with 50 studies including 182 cases of postintubation tracheal rupture, showed overall mortality to be 22%.[5] Krämer et al, found in 15-year period (2004–2018) with 54 patients, all-cause mortality was 50%, while the adjusted mortality was 13% in 90 days follow up.[4]

Clinical suspicion is the first and the most important step for the diagnosis. An emergency bronchoscopy, chest X-ray, and thorax computed tomography (CT) scan are necessary and helpful to diagnose and determine the type and the extension of the laceration. Bronchoscopy remains the “gold standard” for the diagnosis of tracheal injury. Bronchoscopy not only helps in identifying the exact location and size of the injury but may also help in

treatment of the injury.[11] CT scan helps in detecting pneumothorax, subcutaneous emphysema, pneumomediastinum, endotracheal tube displacement, and mediastinitis. The direct site of injury may or may not be visible as a tracheal wall defect or deformity, which is usually present in the posterior membrane of the proximal intrathoracic trachea in a craniocaudal direction.[12]

The management of iatrogenic tracheobronchial injury mainly consist of surgical repair, but depending upon the extent and grade of injury PiTL can be managed conservatively as well.[9,13,14] Cardillo et al, proposed a morphological grading of tracheal injury, depending upon the depth of the tracheal wall involvement from level I to IV. [9,13]

Majority of PiTI is managed surgically either with thoracotomy, exploration through neck or minimally invasive technique.[11] Surgery is recommended for highly symptomatic patients with large level IIIA and above or any lesion presenting with mediastinitis.[2,15,16] As described by Angelillo-Mackinlay, cervical tracheal injury can be repaired using a mediastinoscopy incision. The posterior wall of the trachea is exposed with a vertical incision on the anterior wall of the trachea.[17] While a more distal tracheal injury require a right thoracomtomy.[16]

In our case, we realized several challenges: tracheal injury crossing across the neck and upper thorax, major surgery (esophagectomy), preoperative use of chemoradiation and location of gastroesophageal anastomosis near the site of tracheal injury. In such difficult scenario, re-VATS should be recommended as suturing the site of injury through open thoracotomy would have been extremely difficult. Bronchoscopy as we performed in our case is extremely helpful in diagnosis and location of injury. We approached the patient with the previous right VATS incisions. The posterior wall of trachea was well exposed and it was sutured thoracoscopically with interrupted delayed absorbable monofilament suture, in contrast to literature which suggests continuous suture of posterior wall. This was done in the view of the tissue being fragile due to previously received radiotherapy by the patient. The cervical portion of the trachea was approached with a transcervical incision by extending the left cervical incision used for gastroesophageal anastomosis. After exposure of the trachea, we used bronchoscope to visualize the site of injury and used a needle externally to locate the same site from outside. The anterior tracheal wall was opened transversely with a U- flap in our case, which was sutured to the subcutaneous tissue in lower part of the incision, and the remaining part of the laceration was sutured with interrupted suture using the same material. Patient was intermittently ventilated during the suture through the tracheostomy U- flap site (intermittent cross field ventilation). This was different from the technique described by Angelillo-Mackinlay, in which the endotracheal tube is retracted laterally and repair is done through the vertical incision in the trachea.[17]

Mussi et al describes the use of endoscopy with traditional surgery favoring a less invasive approach.[16] Conservative approach is widely suggested in asymptomatic patients with small partial-thickness laceration (level I), hemodynamic and respiratory stability, without

mediastinal involvement.[9,18] However, indications to conservative management are now spreading to larger (up to 9 cm) or even deeper (up to level IIIA) tears.[11,19] Several cases of patients with endoscopically managed PiTIs have been reported in literature with encouraging results.[19] Rigid bronchoscopy and stenting or even definitive endoscopic repair can ensure lower morbidity-mortality rates especially in high-risk surgical candidates.[2]

Conclusion

This case report is probably a first case to be reported from Nepal regarding post-intubation tracheal injury which was managed with Thoracoscopic and transcervical approach. Although a rare complication, tracheal injury can be fatal if not identified and treated in time. High index of suspicion is required in at-risk cases. Surgical intervention is the preferred method of management with better results.

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