

## Tracheal Tear Post Appendectomy

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### Abstract

Post-appendectomy tracheal tear or rupture is quite rare. In most cases, a lesion is observed on the posterior or anterior tracheal wall along with postoperative subcutaneous and emphysema or dyspnea that can be considered as the first clinical indication of any rupture or tear. The tracheal tear is iatrogenic, localized, low-impact injuries having longitudinal tears.

On the other hand, traumatic tracheobronchial ruptures are high-velocity injuries with horizontal transections. In cases with progressive subcutaneous or mediastinal emphysema or dyspnea, treatment is done with tracheotomy while bypassing the lesion with a tracheotomy tube to ignore or abrupt enhanced air leakage into the mediastinum. The effect is generally diagnosed and followed up by clinical and endoscopic findings along with the use of chest computed tomography-CT scans.

In most cases, mediastinitis does not occur under broad-spectrum antibiotic therapy, and patients endure without sequelae. By observing several cases with spontaneous breathing and no mediastinitis, it was concluded that a conservative method for treating post appendectomy tracheal tear is the safest method and delivers lower mortality rates than surgical procedures.

We report a case of post appendectomy tracheal tear in a 17 years old patient at Jazan General Hospital; Jazan; Kingdom of Saudi Arabia.

**Keywords:** Tracheal Tear; Appendectomy; Pneumomediastinum

### Introduction

Post-appendectomy tracheal tear or rupture is quite rare.

### Case Report

A 17yr old male patient presented to the ER on 21/1/22 complaining of right lower abdominal pain associated with nausea and vomiting for 2 days. The patient had no past medical history according to the patient's history.

Clinically the patient was conscious, cooperative and oriented. No cyanosis or pallor, temperature was 36.7°C, PR = 92 bpm, BP = 130/80 mmHg, SPO<sub>2</sub> = 97% on room air. There was significant tenderness in the right iliac fossa with rebound tenderness. WBC = 6.51, HGB = 14.4 g/dL, platelets = 310, Urea = 4.94, creat = 74.91, Na = 139, K = 3.7, Cl = 106, Glu = 5.7. Abdominopelvic USS reported a blind ending non compressible tubular structure with diameter of 8 mm.

According to clinical and investigation results, the patient was diagnosed as having acute appendicitis. The need for operation, operation details and possible complications were discussed clearly with the patient and his mother. Consent was obtained from the mother as the father was absent. Decision was taken for appendectomy to be done under general anaesthesia. The patient was seen by the anaesthesia consultant.

Operation notes: Under general anesthesia and after sterilization, a Mc Burney incision was made and the appendix was suppuratively inflamed with the omentum masking the field and high caecum. Appendectomy was done which was straightforward with no perioperative complications.

On 22/1/22, the patient had no abdominal complaints and his abdomen was soft and lax. His complaint was cough for which medical consultation was done with a specialist review and advice for atrovent + pulmicort nebulizer as the patient gave them a history of bronchial asthma (patient denied at admission any history of chronic medical illness) and said he was on medication for a long time and stopped medication since one year.

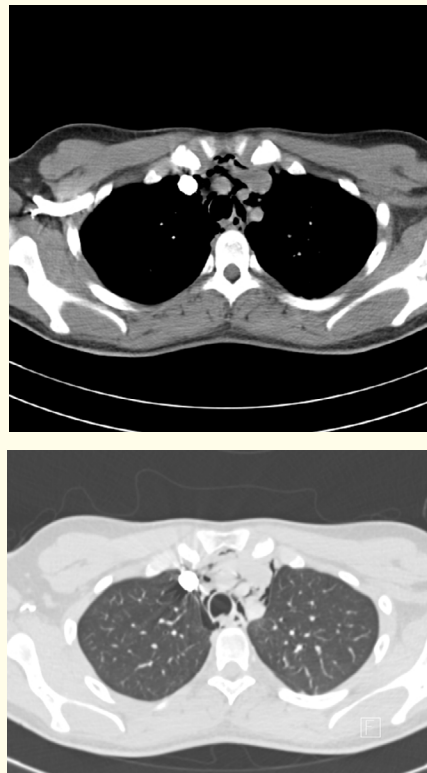
On 23/1/22, the patient was complaining of dyspnea and tachypnea. Oxygen saturation was 89% on room air and 95% on 5L oxygen. The patient was reviewed by the medical specialist who started investigations and management of the case. The patient was shifted to the ICU where the patient improved on medication with SPO<sub>2</sub> = 98% on 8L of oxygen, RR = 22 cpm, PR = 79 bpm, BP = 120/70 mmHg, T = 37°C. Swab for COVID was taken by the medical specialist and it proved negative.

On 24/1/22 the patient was reviewed in the ICU where he improved regarding dyspnoea and oxygen saturation. His vitals were SPO<sub>2</sub> = 97% on 5L oxygen, BP = 130/80 mm/Hg, RR = 24 cpm, T = 36.7°C. His abdomen was soft, lax wound clean and he was tolerating liquid diet. The patient was very uncooperative and was insisting to be discharged home from ICU and refused to continue medications. The patient discharged from ICU on the same day at night to the ward. The patient was on follow up and management by medical consultant and specialist.

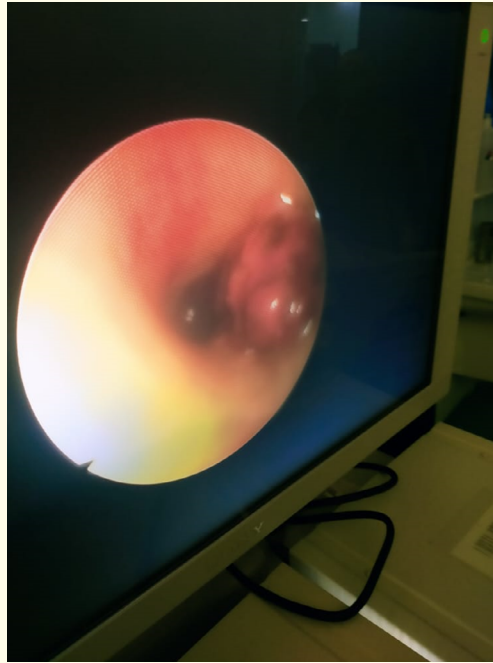
On 25/1/22, the patient was referred by the medical consultant to pulmonology in Prince Mohammed Bin Nasir Hospital for further investigations and management. Patient was admitted and CT scan of chest was done (Figure 1 and 2) which revealed extensive pneumomediastinum outlining the trachea and major vessels and lower posterior tracheal wall focal irregularity worrisome for tiny tracheal tear. Fibrotic bronchoscopy (Figure 3) was done and revealed a longitudinal tracheal tear of posterior part with total length 7 cm around 3 cm above the carina which was almost completely healed as well as collapse of bilateral lower lobes which was opened by suctioning of large amount of mucous plug. Patient improved and was discharged. Follow up at OPD revealed no complaint.



**Figure 1:** Coronal A and axial B lung window at the level of superior mediastinum demonstrate extensive pneumomediastinum outlining the trachea and major vessels.



**Figure 2:** Axial CT scan lung window A and mediastinal window B demonstrate lower posterior tracheal wall focal irregularity worrisome for tiny tracheal tear.



**Figure 3:** Bronchoscopy revealed a longitudinal tracheal of posterior part with total length 7 cm around 3 cm above the carina which was almost completely healed.

## Discussion

Post appendectomy tracheal tear is a relatively uncommon and life-threatening event. As per the records and observations of various case studies published in the peer-reviewed journals, a specific incidence for such type of tears necessitating interventions includes 1:200 for chest tube caused ones and 1:20,000 for intubation related tears [1]. For all the cases, repair of tracheal tear is performed. The tracheal tear can be traumatic or iatrogenic in origin. These two distinct types of lesions involve different mechanisms and morphological appearance leading to distinct therapeutic options.

Traumatic tears or injuries involve high velocity, high downshift, higher impact and complete horizontal transections of the trachea, rarely associated with oesophageal distortion. In the bifurcation region, multiple irregular trauma lines are observed. Whereas iatrogenic manipulations are low impact injuries that are locally limited, engendered either by intubation guides, by blunt on the inflation of the cuff, forming lacerations.

All-time longitudinal tears at the border between the membranous and cartilaginous part of the trachea rarely with elongation to the main bronchi on the right side are faced.

In the case of post appendectomy tracheal tear, several cases and reports published in the journals have observed two distinct appearances: one highlighting an immediately originated and marked mediastinal and subcutaneous emphysema, acknowledged without delay. Another one without emphysema, characterized with extended delay from days to weeks, even with typical radiologic signs [2].

The current research has emphasized the treatment of post appendectomy tracheal tear using the conservative method; this has proved beneficial and safe compared to the surgical procedure. The research of the literature is based on the databases and literature published in the peer-reviewed journals using the search strings “tracheal tear”, “iatrogenic tracheal rupture”, “intubation”, “post-appendectomy tracheal tear”.

In most cases, on the intra-operative diagnosis of tracheal tear, the patients are transferred to the ICU right after the appendectomy surgery. In the appendectomies patient or laryngectomies patient, the tracheal tube is positioned with cuff faraway to the tear to prevent air leakage further through the injury site [1]. For this method, the intact portion of the trachea above the anatomical structure is the prerequisite. The tear can be bridged with the tube, allowing the rapid stabilization of the crucial signs. The patient was considered a high-risk patient for any surgery, so the conservative method was chosen advantageously.

As per the test results, the patient displayed a favourable outcome without closures of the tracheal tear [1]. The healed trachea was observed three weeks after the injury. Another case was reported by Mullen, *et al.* [3] demonstrating the tracheal tear post appendectomy. Mullen, *et al.* [3] has reported the first symptom of mucosal tear as subcutaneous emphysema with a delay of 3 to 15 hours. On diagnosis of tracheal tear, the patient was monitored constantly for vital signs and symptoms.

To prevent mediastinitis, doctors administered experimental broad-spectrum antibiotic therapy to the patient. As the patient displayed progressive subcutaneous and mediastinal emphysema or dyspnea, the doctors performed a tracheostomy to safely sustain the airways and decrease intra-tracheal pressure and leakage of air. When the symptoms were observed post-appendectomy, the requirement for secure airways evolved at regular intervals.

Sometimes, the delayed progression appears after a week post-injury. Thus, this illustrates support towards a rapid settling of subcutaneous emphysema and pneumomediastinum post tracheotomy. The reports demonstrated that the repeated ex- and intubations resulted in tracheal tear. In another case, inhalation corticoid treatment might have enhanced the tracheal mucosa’s susceptibility. Most of the cases report negligible risk factors for the injury.

When the patient is discovered with subcutaneous or surgical emphysema post appendectomy, the mucosal injury should be examined, and prospective linked pneumo-mediastinum or pneumothorax should be kept out or diagnosed [4]. Emphysema is not considered specific to tracheal tear. Diffuse air entrapment in the soft neck tissues, head, and chest might obstruct the tear localization, and the expanses of emphysema do not display the extremity of the injury.

In most publications and literature, a combination of chest computed tomography (CT scans) and tracheoscopy are suggested to discover a suspected tracheal injury [5]. Computed tomography (CT scans) indicates the leakage of air into the mediastinum and at the same time, discover a pneumothorax. There is only 85% sensitivity for detecting tracheal tear by the CT scans [6]. Thus, endoscopic examination of the upper aero-digestive tract is the foundation of the diagnosis of tracheal tear.

Emphysema is caused by surgical trauma of the mucosa. Enhanced and uplifted intrathoracic pressure involving forced blowing, physical strain, ventilation with positive pressure, coughing when the vent for expiration is closed, diseases of lung-like bronchial asthma, lung perforation can lead to subcutaneous emphysema. Iatrogenic or post appendectomy tracheal tear is quite rare. Incidences range between 1:20,000 and 1:75,000 for intubation with a single-lumen endotracheal tube [7].

Double lumen endotracheal tubes include wider diameter and intubation with these tubes causing tracheal rupture more rapidly. Generally, these tears are longitudinal lesions of the posterior wall of the trachea known as paries membranaceus [8]. Tracheal tears are more frequently localized on the right side because of anatomic conditions with the oesophagus associated with membranous trachea

on the left side. The meta-analysis of 182 cases illustrated that immediate intubation (emergency) is a risk factor for tracheal tears [1]. Tracheal tear takes place primarily in women. Females have narrower airways due to thinner diameter and short trachea that are less resistant [5,8].

The primary cause for the post appendectomy is, however, still unclear. It might occur during the passage of the endotracheal tube, when the tip of the tube injures the mucosa, even without troublesome intubation [9]. Tracheal tear also results from utilising stylet as a guide for the tube [10]. Most predominantly, the tracheal tear occurs due to overinflation of the endotracheal tube cuff [10]. Due to the introduction of high volume low-pressure cuffs, the complication appears less promptly, but the problem has not been eliminated. The most apparent explanation involves accidental cuff overinflation.

In contrast, relative overinflation occurs when the cuff is filled just higher than the anatomical structure where the trachea has a wider diameter. The tube drifted back to its actual place [11]. To prevent mucosal tear, repositioning the tube without cuff deflation should be ignored. Intra-operative repositioning of the head of the patient or body can also de-locate the endotracheal tube and enhance tracheal injury [12].

When a patient develops a tracheal tear, an individualized therapy schedule must be set up while consulting with anaesthetics and surgeons. Prolonged clinical presentation of subcutaneous emphysema delays the diagnosis and therapeutic interventions. When the delay is lengthy, it distorts clinical situations involving mediastinitis and pneumothorax. Some researchers have concluded that the diagnosis time hardly influences mortality [1].

Generally, tracheal tears are treated using surgical methods. For instance, tears occurred during open surgical procedures are treated immediately. Any delay in the surgical repair of the tear enhances the mortality rate in the patients with post appendectomy tracheal tear than patients with the simultaneous repair. The surgical method in patients involving open chest surgery has higher mortality rates, up to 71% [12]. The increase in such evidence has suggested adopting conservative treatment of tracheal tear as a realistic and viable option [1].

Nowadays, there is a swift trend towards non-surgical or traditional methods, although clear guidelines are still lacking and there is no consensus reached yet.

Recent studies have suggested that conservative management of tracheal tear with post appendectomy patients is beneficial in symptoms including subcutaneous emphysema, no leakage of air, no respiration difficulty, no injury in oesophageal and spontaneous breathing or when extubation is reached within 24 hours [1,8,13]. Some researchers have focused on the length of the tear as a significant factor and suggested the conservative treatment in clinically stable patients who have tracheal tear less than 2 cm [14].

Tracheal tears over 2 cm in length are considered to be treated with surgical methods. However, some of the researchers and therapists suggest conservative therapy or treatment for tracheal tears up to 4 cm. Tiny tracheal tears localized in the upper third of the trachea are treated conservatively in those without respiratory stress. However, conservative treatment is also suitable for the lesions or tears of the upper two-thirds of the trachea that do not involve tracheal layers. Immediate surgical treatment is recommended for cases having oesophageal injury or mediastinitis. All other injuries and tears of the trachea and its wall involving fully penetrating incisions are treated with a conservative method with the help of fibrin glue [15,16].

Tracheal stenting of post appendectomy tracheal tears is a novel therapeutic approach [17]. An alternative to surgical treatment includes expandable tracheal stents in patients with a high risk of mortality due to surgery. Tracheotomy is another alternative to surgical treatment as it minimizes the intratracheal pressure and leakage of air through the tear, hence healing the tear rapidly.

### Conclusion

Post appendectomy tracheal tear is quite rarely found. The tracheal tear can be iatrogenic or traumatic. Both of these originative mechanisms include distinct methods. Traumatic tears or injuries involve high velocity, high downshift, higher impact and complete horizontal transections of the trachea, rarely associated with oesophageal distortion. In the case of post appendectomy tracheal tear, several cases and reports published in the journals have observed two distinct appearances: the first one highlighting an immediately originated and marked mediastinal and subcutaneous, acknowledged without any delay. In the above-represented cases (from peer-reviewed journals), conservative management involving tracheotomy and experimental broad-spectrum antibiotic treatment of post appendectomy tracheal tear is adopted.

It is proved to be a safe and effective mechanism for treatment. The researchers have concluded that all the patients were recovered from tracheal tears without sequelae. Also, the mortality rate was negligible. Thus, from all of the above review points and observations from several cases, it is concluded that the conservative method for treatment of post appendectomy tracheal tear is the safest method and yields negligible mortality rates compared to surgical treatment.

### Consent

Written informed consent was obtained from the patient's next-of-kin for publication of this case.

### Conflict of Interest

The author(s) reported no conflict of interest.

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