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Iatrogenic tracheal rupture following elective endotracheal intubation in the emergency department

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Abstract

Iatrogenic tracheal rupture following endotracheal intubation is a rare but serious complication. This condition may be associated with widespread subcutaneous emphysema, pneumothorax, respiratory failure, and even mortality. Therefore, early diagnosis and treatment play a crucial role. In this report, we provide a case study of a 49-year-old male patient who experienced an iatrogenic tracheal rupture subsequent to elective endotracheal intubation. The patient managed to survive the rupture through timely identification and conservative medical intervention.

Keywords: Iatrogenic tracheal rupture; Endotracheal intubation; Emergency department.

Abbreviations: ED: Emergency Department; CT: Computed Tomography; MRI: Magnetic Resonance Imaging; ETT: Endotracheal Tube; CRP: C-Reactive Protein; CPR: Cardiopulmonary Resuscitation; CXR: Chest X-Ray; ENT: Otorhinolaryngology.

Introduction

A blunt trauma to the neck or thorax typically causes tracheal rupture, a rare condition [1]. Iatrogenic tracheal rupture, even more rare, may be associated with various situations, including intubation, tracheostomy, bronchoscopy, stent placement, esophagectomy, and others; endotracheal intubation is the most common cause among all of them. The importance of this condition comes from its high morbidity and mortality rates. When comparing elective intubation with emergency intubation, emergency intubation is a significant risk factor that triples the mortality rate of tracheal rupture [2]. This case presentation discusses the causes and treatment approaches of iatrogenic tracheal rupture following elective endotracheal intubation.

Case presentation

A 49-year-old 75 kg male patient admitted to the Emergency Department (ED) because of progressive shortness of breath for three days, decreased oral intake, a 2-minute episode of generalized muscle spasms, and foaming at his mouth. The medical history was not remarkable. Vital signs on admission of ED were; blood pressure 100/70 mmHg, pulse 124/min, respiratory rate 18/min, temperature 37.1°C, and SpO_2 was 89%. At physical exemination, patient was confused, heart sounds were rhythmic and tachycardic, both hemithoraces exhibit equal respiratory effort, and there was prolonged expiration and bilaterally reduced lung sounds. There was no neurologic deficit. For the preliminary diagnosis of epilepsy and COVID-19, a non-contrast Computed Tomography (CT) scan of the brain and chest were performed. There was no acute pathology in the CT scan of the

brain, and the non-contrast CT scan of the chest revealed suspicious ground-glass opacities in both lungs, which cannot be clearly distinguished from sequelae atelectasis. According to arterial blood gas results: pH 7.18 (N:7.35-7.45), $PaCO_2$ 48 mmHg (N:35-45), PaO_2 60 mmHg (N:80-100), lactate 12.5 mmol (N:0.5-1.6), and HCO_3 15 mmol/L (N:22-26). Other laboratory results were unremarkable except for glucose 148 mg/dL (N:74-106), and C-Reactive Protein (CRP) 21 mg/L (N:0-5). In the ED loading dose of levetiracetam (15 mg/kg), intravenous infusion of 20 ml/kg of normal saline and oxygen started. While the patient's medical treatment continued, an endotracheal intubation decision was made due to hypoxia and to protect the airway. After 2.5 mg midazolam and 45 mg rocuronium IV administration the patient intubated at the first attempt. For intubation a size 3 Macintosh laryngoscope with a number 8 cuffed/balloon single lumen Endotracheal Tube (ETT) and an 8 mm tube-style guide used. An Magnetic Resonance İmaging (MRI) scan of the brain was planned to exclude central ischemia. While the patient was heading for cranial MRI Imaging, he was taken back to the emergency resuscitation room approximately 3-5 minutes later due to balloon-like swelling of his entire body and the development of cyanosis in the facial region. During this time, sudden cardiac arrest occurred with pulseless electrical activity. Cardiopulmonary Resuscitation (CPR) was performed for 3 minutes, and 1 mg of adrenaline was administered intravenously. For the management of tension pneumothorax, a needle decompression thoracostomy procedure was performed bilaterally at two points along each anterior axillary line at the 5th intercostal space. In response to the development of significant abdominal distension, to facilitate air passage, approximately 5 x 1 cm sized longitudinal skin and subcutaneous incisions were made bilaterally to the pelvic region (Figure 1). Bilateral small-diameter pleural drainage catheterswere rapidly inserted. Spontaneous cardiac output and oxygenation returned to normal, and widespread subcutaneous emphysema decreased. In the bedside Chest X-Ray (CXR) taken in the emergency resuscitation room using a mobile X-ray machine, more prominent infiltrations in the right perihilar region, along with widespread subcutaneous emphysema extending up to the neck and a bilateral small-diameter pleural drainage catheters were observed (Figure 2). Following stabilization of the patient's general condition, a contrast-enhanced neck and chest CT scan was performed to confirm the preliminary diagnosis of tracheal rupture. Widespread subcutaneous emphysema, suspicious loss of integrity in the posterior aspect of the trachea with surrounding air densities, pneumomediastinum, and bilateral pleural effusions were identified in the CT scan of the chest (Figure 3A), and a CT scan of the neck revealed widespread subcutaneous emphysema (Figure 3C). Contrast-enhanced abdominal and pelvic CT scans were performed with the preliminary diagnosis of abdominal compartment syndrome. In the CT scan of the abdomen, widespread subcutaneous emphysema and free air, which are more prominent in the anterior part of the abdomen (Pneumoperitoneum), were observed (Figure 3B). The pelvic CT scan showed widespread subcutaneous emphysema (Figure 3D). Consultations for the patient were requested from the departments of otorhinolaryngology (ENT), general surgery, thoracic surgery, chest medicine, anesthesiology and reanimation. During the transoral and transnasal flexible endoscopy procedures conducted by the otorhinolaryngology department, no pathology was identified within the endotracheal tube lumen or as far as visible beyond the carina, and evaluation of the trachea and larynx could not be performed due to secretion. The general surgery department did not suspect any abdominal pathology requiring emergency surgical intervention. Similarly, the thoracic surgery department did not consider emergency surgical intervention necessary. The chest medicine department was unable to perform bronchoscopy due to the unavailability of the bronchoscopy unit. The patient was admitted to the anesthesiology and reanimation unit with a preliminary diagnosis of iatrogenic tracheal rupture. Endotracheal intubation was reattempted successfully, taking care to keep the potential tracheal injury proximal. The patient was monitored with a mechanical ventilator in the intensive care unit, antibiotic treatment (meropenem 3 x 1 gr IV) for mediastinitis prophylaxis was initiated, and he was extubated on the 11th day. Subsequently, the patient was then transferred to the internal medicine service and discharged with full recovery on the 7th day. The patient was recommended to follow up with chest medicine department in 2 weeks.

Figure 1: Widespread subcutaneous emphysema causing balloon-like swelling throughout the body and cyanosis in the facial region, a 5 x 1 cm longitudinal cutaneous incision in the lateral area of the left pelvic (red arrow), and two entries for the needle decompression thoracostomy at the 5th intercostal space along the left anterior axillary line (blue arrow).

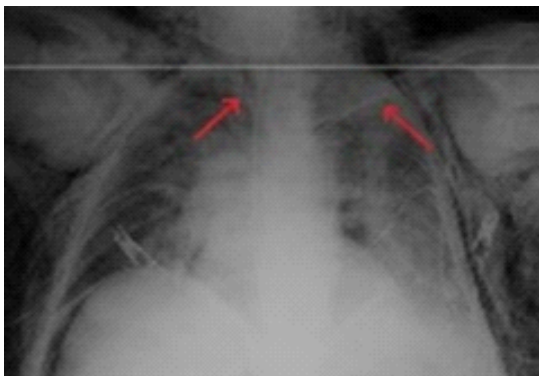

Figure 2: The bedside chest X-ray (CXR) is showing that bilateral small-diameter pleural drainage catheters (red arrows) and widespread subcutaneous emphysema.

Discussion

Tracheal rupture is a rare but life-threatening complication that most commonly occurs in blunt or penetrating trauma to the neck and chest and sometimes due to iatrogenic causes. The most common iatrogenic cause is intubation [3]. The reported incidence of tracheal rupture after endotracheal intubation

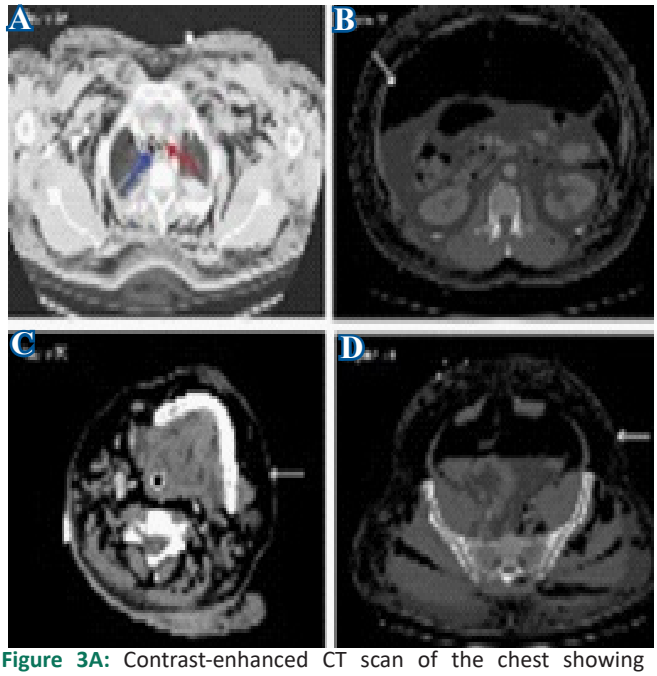

Figure 3A: Contrast-enhanced CT scan of the chest showing suspected loss of integrity in the posterior trachea near the endotracheal tube with surrounding air densities (blue arrow), widespread air densities in the mediastinum (pneumomediastinum) (red arrow), widespread air densities in the subcutaneous tissue (subcutaneous emphysema), and fluid densities in both pleural spaces (pleural effusions).

Figure 3B: Contrast-enhanced CT scan of the abdomen showing intra-abdominal free air (pneumoperitoneum) (white arrow) and widespread subcutaneous emphysema.

Figure 3C: Contrast-enhanced CT scan of the neck showing widespread subcutaneous emphysema (white arrow).

Figure 3D: Contrast-enhanced pelvic CT scan showing widespread subcutaneous emphysema (white arrow).

is approximately 0.005% [1]. Various factors play a role in the formation of tracheal rupture. These include procedural errors (multiple attempts, inexperienced practitioners), equipment selection (inappropriate stylet use, overinflation of the endotracheal cuff, malpositioning of the tube, inappropriate tube size), patient-related factors (excessive coughing, sudden movements), and anatomical factors (weakened membrane due to steroids, COPD, tracheomalacia) [4]. In the case of this patient, intubation was relatively easy and was successfully performed on the first attempt, and no apparent cause of tracheal rupture was identified. While tracheal laceration and rupture are commonly seen in the cervical region in penetrating injuries, they are more frequently seen in the distal trachea and main bronchi after intubation. Rupture typically occurs at the junction of membranous and cartilaginous portions and is linear. There was no identified rupture in our patient. The membranous portion of the trachea is less resistant in females and children compared to males. In the literature, it has been found that the risk of rupture is significantly higher in females and particularly in cases with short necks [3]. However, our patient was male and did not have a short neck. The most common clinical findings in tracheal rupture are respiratory failure, subcutaneous emphysema in the head and neck, pneumothorax, and hemoptysis. Other clinical findings are dysphonia, cough, hemoptysis, pneumoperitoneum, and cyanosis [2]. Our patient exhibited these symptoms except for hemoptysis, dysphonia, and cough. It has been reported that it may take a few minutes to several days for the symptoms and signs of tracheal rupture to become evident. In our patient, symptoms began to manifest within minutes after elective endotracheal intubation. Clinical suspicion is the first and most crucial step in the diagnosis of tracheal rupture. The diagnosis is made based on clinical symptoms and chest X-ray, and a CT scan of the thorax in some cases. Although pneumothorax and pneumomediastinum are observed radiologically, subcutaneous emphysema is almost always present in all cases of tracheal laceration. In our patient, in addition to these radiological findings, pneumoperitoneum was also present. In acute cases, up to 10% of patients may not present with any radiological findings. A CT scan may help with the diagnosis of patients with an appropriate clinical presentation. The definitive diagnosis of tracheal ruptures is made by bronchoscopy. Both rigid and flexible bronchoscopy can be used. Bronchoscopy should be performed as soon as possible and should include the area below the endotracheal tube. Studies have shown that up to 50% of lesions may be missed during the initial bronchoscopic examination. Therefore, if suspicion persists, the procedure can be repeated even if the initial bronchoscopic findings are normal [5]. In our case, due to the unavailability of the bronchoscopy unit in our hospital, attempts to identify the rupture were made with flexible fiberoptic endoscopy. However, a contrast-enhanced chest CT scan revealed a suspicious defect near the endotracheal tube, in the posterior part of the trachea, and air gaps in the para-tracheal soft tissue were observed. Tracheal ruptures can be treated either surgically or conservatively. Despite the trend towards non-surgical treatment, there is still no consensus or clear guideline yet [6]. Conservative treatment can be applied to patients with small ruptures less than 2 cm [7]. In conservative treatment, intubation with the tip of the endotracheal tube below the rupture and appropriate antibiotic therapy are the fundamental steps. Our patient was successfully and safely treated with conservative methods. Although there is no consensus on ventilation mode, high-pressure ventilation should be avoided and intubated patients should be extubated as soon as possible.

Conclusion

Iatrogenic tracheal rupture as a result of elective endotracheal intubation is a rarely seen complication with a high mortality. Clinical suspicion is the first and the most important step at the diagnosis of the tracheal rupture. Practitioners should suspect tracheal rupture when subcutaneous emphysema, mediastinal emphysema, or pneumothorax is observed in intubated patients. Timely diagnosis and treatment can be life-saving.

Declarations

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Informed consent: The patient's consent was obtained prior to the publication of the case report.

Author's contribution: Emin Uysal, Suleyman Solak, and Umit Yilmaz: analysis of data and writing the manuscript. Abuzer Ozkan, Burak Demirci, and Abuzer Coskun: review of manuscript.

Data availability: All data were obtained during the patient's hospitalization. Any inquiries regarding the additional information should be directed to the corresponding author.

References

1. Lim H, Kim JH, Kim D, Lee J, Son JS, et al. Tracheal rupture after endotracheal intubation-A report of three cases. Korean J Anesthesiol. 2012; 62(3): 277-80.

2. Miñambres E, Burón J, Ballesteros MA, Llorca J, Muñoz P, et al. Tracheal rupture after endotracheal intubation: A literature systematic review. Eur J Cardiothorac Surg. 2009; 35(6): 1056-62.

3. Kekeçoğlu A, Özdemir C, Karasulu L, Koşar AF, Dalar L. Tracheal laceration due to elective intubationand its treatment with endotracheal stenting. Eurasian J Pulmonol. 2015; 17: 119-21.

4. Chen EH, Logman ZM, Glass PS, Bilfinger TV. A case of tracheal injury after emergent endotracheal intubation: A review of the literature and causalities. Anesth Analg. 2001; 93: 1270-1.

5. Conti M, Pougeoise M, Wurtz A, Porte H, Fourrier F, et al. Management of postintubation tracheobronchial ruptures. Chest. 2006; 130(2): 412-8.

6. Sarıtaş TB, Bezen BA, Sıvacı RG. Anesthesiologist's horror case: postintubation tracheal rupture. JARSS. 2021; 29(2): 140-3.

7. Paraschiv M. Iatrogenic tracheobronchial rupture. J Med Life. 2014; 7(3): 343-8.