Tracheal Rupture: Airway Catastrophe Associated with Intubation

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Abstract

Disruption of the trachea following intubation is an uncommon but potentially fatal condition. The incidence is difficult to establish because many tracheal lacerations may be undetected clinically. Some patients present acutely with subcutaneous emphysema or may develop it only after several hours. Signs of tracheobronchial injury such as hemorrhage, cyanosis, air leak or compliance changes may be absent in some patients. Interdisciplinary treatment requires precise documentation of the extent of the injuries, using advanced imaging techniques and bronchoscopy. Early repair may be necessary to prevent acute tension pneumothorax, airway obstruction, and chronic tracheal stenosis.

Introduction

Tracheal rupture after orotracheal intubation is an uncommon life-treating condition that is normally related to other settings like bronchoscopy or surgical airway complications. We report a case of this unusual condition in an emergency scenario; a difficult emergency endotracheal intubation by paramedic personnel outside the hospital setting.

Case report

A 38 year-old woman was found unresponsive by family members after allegedly ingesting several tablets of a long-acting benzodiazepine. The emergency medical response team (EMRT) arrived on scene and found the patient unresponsive to verbal and painful stimulation, with a systolic blood pressure of 80 torr, heart rate 110/min and a respiratory rate of 4/min. Emergency airway management and intravenous access was started by the EMRT. Three attempts at intubation were performed, an 8 French endotracheal tube ultimately placed and secured at 23 cm from the lips. Immediately after intubation, the patient was transported to the Emergency Department (ED) of a tertiary care facility.

On arrival to the ED, the patient was noted to have a systolic blood pressure of 110 torr, heart rate of 140/min and a spontaneous respiratory rate of 6/min. Lung examination revealed decreased breath sounds bilaterally. Heart sounds were distant. She was placed on assisted ventilation and intravenous fluids were given. Additional findings included, prominent subcutaneous emphysema in the chest and neck which were noted after assisted ventilation had begun and colorimetric change in ETCO₂. A chest radiograph (Figure 1) revealed right-main stem intubation with significant subcutaneous emphysema and pneumomediastinum.

As there was no significant history of chest or upper airway trauma given by the family, and on the basis of the significant subcutaneous emphysema, a decision was made to perform an emergent bronchoscopy. Bronchoscopic findings revealed a 0.8 cm tear in the anterior wall of the trachea (Figure 2). The patient was seen by the cardiothoracic surgery service who recommended observation rather than airway intervention. After 36 hours, the patient was successfully extubated and a repeat bronchoscopy showed closure of the tear. The patient was then transferred to an inpatient psychiatric facility for additional treatment. Three months after discharge she was seen on outpatient basis without any respiratory complaints.

Discussion

For over 100 years, clinicians have documented occasional cases of tracheal disruption related to air-
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The incidence of this condition is difficult to establish because many tracheal lacerations may be undetected clinically.

Of all causes of tracheal laceration and rupture, endotracheal intubation is the third most common cause following trauma and bronchoscopy [1]. Previous reports have related its occurrence to vigorous repeated attempts at intubation (particularly in children), tracheal abnormalities, the use of a stylette and overinflation or rupture of the endotracheal tube cuff [2]. Lobo-Sanchez and colleagues described two cases of tracheal rupture in 49,000 patients that underwent general anesthesia [3]. Of these patients, one had a previous history of pulmonary tuberculosis and chronic bronchitis and sustained a rupture produced by a double-lumen (Carlens) endotracheal tube. The second patient experienced severe bronchospasm during intubation. In a report by Velly et al. of 47 traumatic ruptures of the tracheobronchial tree, 30 involved the trachea, 11 a main bronchus and 6 an intermediate or lobar bronchus [4]. In only 4 cases, the lesions were discovered following tracheal intubation.

The pathogenesis of intubation-related tracheal rupture is not known, several theories have been proposed, such as the eccentric inflation of the cuff with a resultant ischemic damage [5]. In two case series, gender appeared to correlate with the incidence of tracheal lacerations. Women had a higher incidence of tracheal disruption after intubation, especially those over the age of 60 [6,7]. Some authors have been proposed that because women have shorter tracheas, the major risk factor for tracheal disruption is wrong tube selection [8]. Although a weaker trachea in women has also been suggested as the mechanism of injury, there is no data to support this theory [9].

On rare occasions, like in the case of our patient, large tracheal ruptures have been described [10]. Some cases may present acutely with subcutaneous emphysema or this may develop only after a delay [2,11]. Large tracheal tears have been reported during surgery or in the immediate postoperative period, with subcutaneous emphysema and respiratory distress as common signs [12]. Signs of tracheobronchial catastrophes such as hemorrhage, cyanosis, air leak or compliance changes may be absent in some patients [13].

In emergency settings, iatrogenic tracheal laceration should be suspected and early investigation and therapy started in patients with difficulty ventilating, with subcutaneous emphysema or abnormally positioned endotracheal tube on chest radiograph [6]. Interdisciplinary treatment requires precise documentation of the extent of the injuries, including advanced imaging techniques [14]. If tracheal rupture is suspected, it is essential to establish a diagnosis by bronchoscopy [5,15]. Some authors have suggested that bronchoscopy may aggravate the injury [16]. However, most clinicians accept bronchoscopy as the gold standard for diagnosis of trau-

Figure 1. Chest radiograph of the patient on arrival to the emergency department revealing right-main stem intubation.

Figure 2. Bronchoscopic finding of the patient showing the right (R) and left (L) main stems and the tracheal disruption.
matic rupture of the trachea [5,15]. Some authors have reported the use of computed tomography for the diagnosis of tracheal disruption [17].

The diagnosis of tracheal rupture may be difficult to establish. Spear suggests the assessment of the endotracheal tube cuff leak pressure in these patients [18]. Understanding that an air leak develops when the cuff on the endotracheal tube is not in the proper place, leak pressure can be determined by placing a stethoscope over the larynx and noting the aneroid manometric pressure at which the leak around the tracheal tube becomes audible after closure of the pressure relief valve. A decrease in more than 10 cm H₂O in properly measured leak pressure should alert the clinician to possible airway problems [19]. Clinicians must remember that removal of the endotracheal tube prior to accurate diagnosis can result in immediate airway obstruction.**

Typical clinical and radiological findings are pneumomediastinum, pneumothorax and subcutaneous emphysema [20]. Other more specific signs of tracheal rupture as described by Rollins and Tocino include: orientation of the distal portion of the endotracheal tube to the right, relative to the lumen of the trachea and the orientation of the distal portion of the endotracheal tube with respect to the right, relative to the lumen of the trachea and pneumothorax.

Conclusions

Tracheal disruption related to emergency airway management is uncommon, however it may be life-threatening. Clinicians working in these situations need to consider this possibility in intubated patients with subcutaneous emphysema. A multidisciplinary approach is recommended for the management of these patients.

References


