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## Tracheal rupture after endotracheal intubation: a rare case report

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### ABSTRACT

Tracheal rupture is a rare iatrogenic complication of endotracheal intubation that occurs only in 1/20,000-75,000 patients. This condition requires prompt diagnosis and treatment because of high morbidity and mortality. We present a case report of a 81-year-old woman that presented with subcutaneous emphysema just after modified radical mastectomy.

**Keywords:** tracheal rupture, endotracheal intubation, pneumothorax, pneumomediastinum, subcutaneous emphysema

## INTRODUCTION

Tracheal rupture is not a very common but life threatening condition. It can be caused by severe trauma or by iatrogenic causes such as endotracheal intubation (1). Tracheal rupture is a very rare complication of elective endotracheal intubation with the incidence of 1/20,000-75,000 patients and a higher incidence of 15% in emergently performed endotracheal intubations (2, 3). This condition is associated with high morbidity and mortality, for this reason prompt diagnosis is vital for the survival of the patients. However the delay of diagnosis ranges from 3 to 72 hours because the symptoms of tracheal rupture are not specific (2, 4). Despite a lack of specificity, the clinical signs can be highly suggestive, so it is important to be aware of causes, clinical manifestations, diagnosis and treatment.

We report a clinical case of tracheal rupture after endotracheal intubation in a patient who had modified radical mastectomy and presented with subcutaneous emphysema just after the surgery. The aim of our report is to raise awareness of this rare but life threatening complication which can be successfully treated if clinical manifestations and radiological signs are detected early.

## CASE REPORT

A 81-year-old woman diagnosed with a left invasive lobular carcinoma of the left breast was hospitalized at our hospital for modified radical mastectomy. After extubation subcutaneous emphysema was seen in the face, neck and upper chest. Chest radiography was performed – there were signs of subcutaneous emphysema and

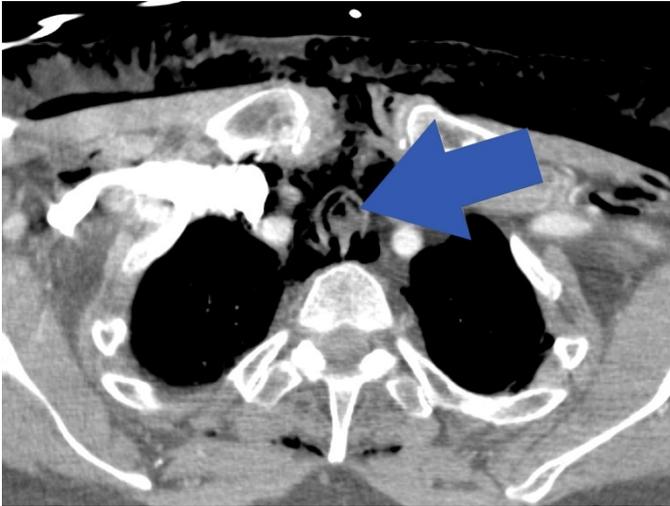
pneumomediastinum. Urgent computed tomography (CT) scan with and without contrast revealed subcutaneous emphysema, right side pneumothorax, which wasn't visible in plain film, pneumomediastinum and tracheal deformation just above the manubrium of sternum level. There was a 3 cm long defect in the posterior wall of the trachea, esophagus wall was prolapsing inside the lumen of the trachea, the lumen was narrowed – only 0,2 cm in width – consistent with a rupture of the trachea (Figures – 1-3). Bronchoscopy confirmed the defect of the membranous wall of trachea (Figure 4) and pathological movement while breathing. In laboratory tests – hemoglobin level 132 g/l, white blood cell count (WBC)  $7.67 \cdot 10^9/l$ , platelet count  $217 \cdot 10^9/l$ , prothrombin time 12.6 seconds, international normalized ratio (INR) 1.03, creatinine 198  $\mu\text{mol/l}$ , urea 18.64 mmol/l, C-reactive protein (CRP) 6 mg/l. Electrolytes were normal.

Concerning the management, the right pleural cavity was drained and to ensure oxygenation the patient was intubated by a smaller size endotracheal tube. The distal end was 1 cm above the carina and the tracheal defect was partially covered with the cuff. In order to provide adequate lung ventilation, the mechanical ventilator was used. The patient received infusion therapy, analgetics and antibiotic therapy.

During the hospitalization, the chest radiography was performed every day due to better pneumothorax and subcutaneous emphysema control. The second day there were no signs of pneumothorax and pneumomediastinum, pleural drain was removed, subcutaneous emphysema was reducing and the patient was extubated.

Repeated laboratory tests remained normal. Due to the improving condition the patient was discharged from the hospital and continued

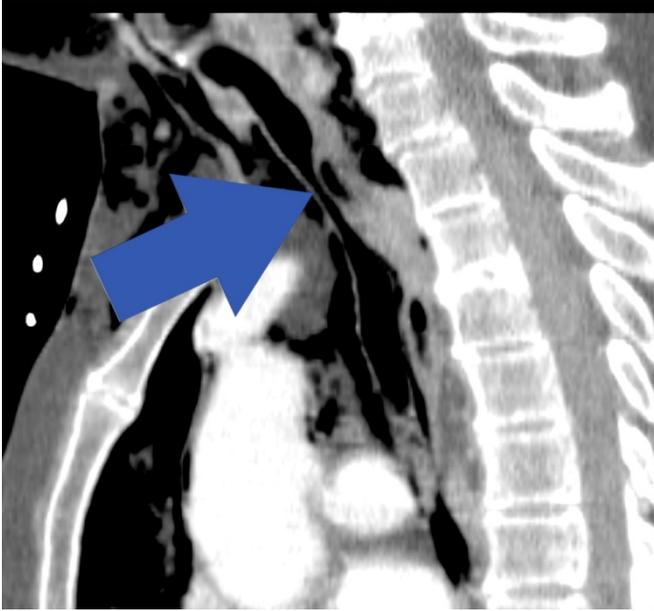
treatment at home with a general practitioner's supervision.



*Figure 1. Contrast-enhanced CT axial view – tracheal rupture, prolapse of esophageal wall in the lumen of trachea.*



*Figure 2. Contrast-enhanced CT axial view, lung window – prolapse of esophagus in the lumen of trachea, narrowing of the lumen of trachea, subcutaneous emphysema.*



*Figure 3. Contrast-enhanced CT sagittal view – narrowing of tracheal lumen.*



*Figure 4. Bronchoscopy, endotracheal view – tracheal rupture, prolapse of esophageal wall in the lumen of trachea.*

There are several risk factors contributing to tracheal rupture after endotracheal intubation which can be divided into mechanical and anatomical. Anatomical factors contribute to the weakening of esophageal wall while mechanical factors act as a traumatic force. Mechanical factors include emergency, sudden movement of the tube without deflating the cuff, several forced attempts at intubation, endotracheal tube stylets protruding beyond the tip of the tube, unsuitable size of the tube, overinflation of the cuff, repositioning the patient while intubated, vigorous coughing and a lack of experience in intubation. Anatomical factors include female gender, age above 50 as in our case, short stature, elevated body mass index, chronic use of corticosteroids, congenital tracheal malformations, chronic obstructive pulmonary disease and other inflammatory diseases (4-7). The exact mechanism of the tracheal laceration following endotracheal intubation remains uncertain, our patient had risk factors such as age and gender predisposition. We suspect that the cause could be overinflation of the cuff, which is thought to be the most common cause of tracheal rupture. The incidence of this complication has reduced since the introduction of “high-volume-low-pressure” cuffs although has not completely eliminated. Relative overinflation can occur if the cuff is inflated above carina where the trachea is of the largest diameter and then is positioned to its correct place (8). The laceration is usually longitudinal and located in the posterior part of the trachea which is not supported by cartilaginous rings (4).

The clinical signs of tracheal disruption include subcutaneous emphysema, pneumomediastinum,

pneumothorax, respiratory failure, dyspnea, dysphagia, hemoptysis and pneumoperitoneum (4, 5, 7). Usually these signs appear during surgery, immediately or as in our case soon after extubation, though sometimes they can take several days to develop (4, 5). Subcutaneous emphysema is the most common sign of tracheal rupture as well as a protective factor. Its appearance leads to suspicion of a tracheal disruption resulting in acceleration of diagnostic procedures and early treatment (4).

Clinical suspicion must be followed by diagnostic confirmation, which is achieved by radiological investigations and bronchoscopy. Chest radiographs show radiolucent areas in soft tissue, that consistent with subcutaneous emphysema, sometimes striated pattern expected from a pectoralis major muscle which is called ginkgo leaf sign may be seen (9). Pneumomediastinum is a common finding that is seen as a thin vertical line located parallel to mediastinal border (10). Pneumothorax 40% of cases can be revealed only by CT scan (1). In our case right pneumothorax wasn't seen in the plain film.

Extrapulmonary air is an indirect sign of tracheal rupture that is seen in CT scans. The direct signs are either discontinuity of tracheal wall, or deformation of its length (1). CT multiplanar reconstructions are very useful for measuring the exact length of laceration. Bronchoscopy still remains the gold standard for the detection of tracheal rupture because of direct visualization (4, 7). Bronchoscopy helps to detect not only the exact location of the lesion, extension (length and depth), but also herniation of the esophageal wall into tracheal lumen as well as provide options of

endoscopic or endoscopic-assisted treatment (1). In our case the herniation was well seen in CT. It is important to observe if subcutaneous emphysema is increasing and to measure the length of laceration because it determines the therapeutic approach (1).

The treatment options depend on the location and size of the injury, its clinical manifestations and the condition of the patient. Conservative treatment is selected if the patient is clinically stable and the laceration is less than 4 cm located in the upper part of trachea and not involving all tracheal layers (8). Surgical treatment is preferred with a transmural laceration larger than 2 cm and the presence of esophageal herniation into the tracheal lumen. The progression of subcutaneous emphysema and pneumomediastinum, early signs of mediastinitis and detection of the rupture during surgery are also indications for surgical treatment (1, 8). In our case the patient was older, the lesion was 3cm and she was improving fast, so conservative treatment was chosen. In every case healing should be evaluated by tracheal fibroendoscopy one month after the injury (6).

## CONCLUSION

Tracheal rupture is a rare but life threatening iatrogenic complication after endotracheal intubation. Our case report is a reminder that radiological signs have an important value diagnosing this pathology and may help to determine the therapeutic approach.

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