

■ Case Report

## Iatrogenic post-intubation tracheal rupture treated surgically with cardiopulmonary bypass support

### *İyatrojenik post-entübasyon trakea rüptürünün kardiyopulmoner bypass desteği ile cerrahi tedavisi*

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#### ABSTRACT

Iatrogenic tracheobronchial injuries are severe complications of airway access techniques such as endotracheal intubation. The reported incidence is approximately 0.005% for orotracheal intubations. Although conservative methods may also be used, surgical intervention is the treatment of choice for most cases. Herein, we present a 78-year old patient with a post-intubation huge membranous tracheal rupture, which was eventually repaired surgically with cardiopulmonary bypass support.

**Keywords:** endotracheal intubation, trachea rupture, cardiopulmonary bypass

#### ÖZ

İatrojenik trakeobronşiyal yaralanmaları, endotrakeal entübasyon gibi hava yolu erişimi tekniklerinin ciddi komplikasyonlarından. Orotrakeal entübasyon sonrası görülme sıklığı yaklaşık % 0.005'dir. Zaman zaman koruyucu methodlarla tedavi edilseler de çoğu vaka cerrahi yöntemlerle tedavi edilir. Bu olgu sunumunda, 78 yaşındaki bir hastada, entübasyon sonrası meydana gelen geniş membranöz trakea rüptürünün kardiyopulmoner bypass yardımı ile cerrahi tedavisini sunuyoruz.

**Anahtar kelimeler:** endotrakeal entübasyon, trakea rupture, kardiyopulmoner bypass

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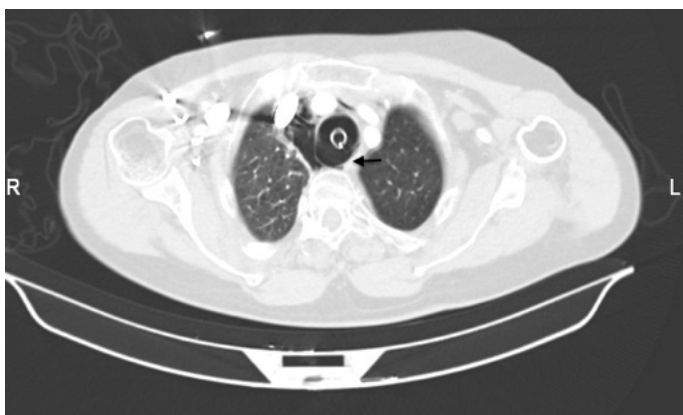
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## Introduction

Tracheobronchial injuries are rare but potentially life-threatening complications of endotracheal intubations. The reported incidence is approximately 0.005% for orotracheal intubations [1,2]. The most likely causes of the trachea injury are massive overinflation of the endotracheal tube cuff, the preexisting tracheal wall weakness, steroids, chronic diseases and use of introducer [3]. In most cases surgical cardiopulmonary bypass (CPB) intervention is the treatment of choice, yet conservative methods may also be used [4]. We present a 78-year old patient with post-intubation membranous tracheal rupture, which was eventually repaired surgically with support.

## Case report

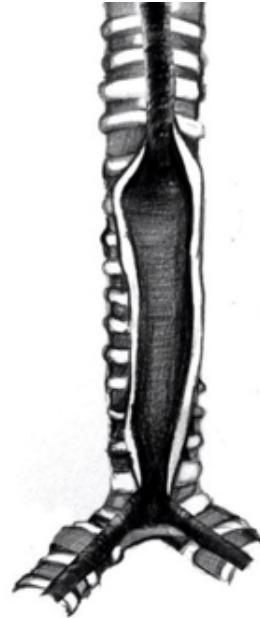
A 78-year old female was found at home unresponsive with no heartbeats or respiration for almost 10 minutes. Orotracheal intubation was performed by an emergency service member. Cardiopulmonary resuscitation (CPR) was immediately instituted. After 5 minutes of CPR, her rhythm had restored to sinus rhythm and advanced cardiac life support measures were initiated. At arrival in the emergency department (ED) hemodynamic stabilization was established. The Glasgow Coma Scale score was 3, and the pupils were noted to be anisocoric, which gradually became isocoric. Further examination revealed massive subcutaneous emphysema over the neck and the chest wall. Computed tomography (CT) of the chest revealed small volume pneumomediastinum, pneumothorax on the right chest, bilateral non-displaced rib fractures and a large posterior tracheal rupture in the pars membranosa (Figure 1). Cranial CT was reported to be normal. Thus the patient promptly proceeded to surgical repair.



**Figure 1.** Chest CT scan; CT of the chest showed small volume pneumomediastinum, and a large posterior tracheal rupture in the pars membranosa (black arrow points the large rupture).

Expecting the difficulties of lateral decubitus position for this considerably obese patient and considering the long length

of laceration median sternotomy was performed. CPB was initiated with ascending aorta and right atrial cannulation. Large posterior tracheal rupture located in the pars membranosa was confirmed. The lesion was measured nearly 8 cm long and it extended from 1 cm below the level of cricoid cartilage to the carina (Figure 2).



**Figure 2.** Schematic illustration of the tracheal rupture; A 8 cm long posterior tracheal rupture extends from 1 cm below the level of cricoid cartilage up to the carina.

Endotracheal tube (ETT) was removed. The trachea was transected from the upper level of the rupture allowing clear exposure. The defect was repaired continuously with 5-0 polydioxanone (PDS®) suture up to the level of transection. End to end anastomosis of the transected trachea was performed with 5-0 polydioxanone (PDS®). ETT was inserted, positioned at the level of the carina and the cuff was left deflated. The suture lines were controlled with fiberoptic bronchoscopy. Lung ventilation was then re-instituted and the patient was weaned from CPB. Chest tubes were placed and the incision was closed. During the follow-up in the intensive care unit (ICU) the patient was declared to be hemodynamically stabilised. Sedation was subsequently discontinued. However, there was no response to deep pain stimulation. Pupillary and corneal reflexes were also absent. Neurological consultation revealed probable brain death according to the neurologic criteria. Subcutaneous emphysema and pneumomediastinum resolved and the thoracal drains were removed on the post-operative 2nd day. In the follow-up, the patient's general state deteriorated gradually. On the post-operative 5th day the patient had cardiac arrest followed by asystole and cardiopulmonary resuscitation was performed; however, despite all efforts the patient was considered exitus.

## Discussion

Iatrogenic tracheobronchial injuries, which occur rarely, are severe complications of airway access techniques such as endotracheal intubation and tracheostomy. The risk of injury seems to increase with difficult or emergency intubations and with multiple vigorous attempts of inexperienced medical staff especially in stressful situations. Obesity, female gender, advanced age, poor medical condition, short stature, chronic obstructive pulmonary disease (COPD), and tracheomalacia are considered to be important risk factors [2,5,6]. Injuries are usually linear and involve the membranous portion of the lower third of the trachea (60-80%). Involvement of the middle trachea is rare [2,7,8]. In this case, we present a 78-year old female who had obesity and history of COPD with a large laceration involving nearly the whole length of trachea.

Persistent air leak around the endotracheal tube, subcutaneous emphysema over the neck and chest, mediastinal emphysema, cyanosis, hemoptysis, and clinical signs of pneumothorax are typical findings [9,10].

Computed tomography (CT) of the thorax is preferred to evaluate mediastinal emphysema and pneumothorax and also allows direct visualization of the tracheal injury in 70% of the cases. Bronchoscopy is considered to be the most effective method for confirming the diagnosis and for determining the exact location and extent of the injury [4,11,12].

The management of iatrogenic tracheobronchial injuries is controversial. Treatment strategy depends on several factors such as clinical presentation and overall condition of the patient, location and extent of the lesion, and the patient's pre-existing risk factors.

Iatrogenic tracheobronchial injuries can be treated conservatively in selected cases. The criteria for conservative treatment are considered to be stable vital signs, spontaneous breathing or no difficulty in ventilation while intubated or no respiratory distress after extubation, no evidence of esophageal injury, nonprogressive pneumomediastinum or subcutaneous emphysema and no signs of sepsis [5,13,14]. Carbognani and colleagues chose nonsurgical therapy in small, uncomplicated tears (<2 cm) in stable patients [13]. Gomez-Caro and colleagues also recommended conservative management for patients with no associated esophageal injuries, no rapidly progressive subcutaneous or mediastinal emphysema, and no mediastinitis [15]. Schneider and colleagues advocate conservative treatment in stable patients with a delayed (>24 hours) diagnosis of the tracheobronchial injury [1].

Endoscopic stenting is another therapeutic option. However,

few reports exist about acute stenting of tracheal injuries. Madden and colleagues reported two cases of a longitudinal posterior wall perforation after percutaneous tracheostomy treated by tracheal stenting [16]. Shimizu and colleagues successfully inserted a T-silicon stent through a tracheostomy over a laceration [17]. Alternatively, bronchoscopic application of fibrin sealant onto the lesion may ensure tissue regeneration particularly in small tears [18,19]. Aydemir and colleagues reported two patients which were successfully managed with fibrin sealant [20].

The traditional method preferred by most authors for the management of iatrogenic tracheobronchial injury is primary repair. The criteria for surgical repair include the following: lesions >2 cm in length, perforation into the pleural cavity, progressive subcutaneous or mediastinal emphysema and insufficient mechanical ventilation [1,5,14]. In our case the decision was to repair the defect surgically due to the extent and location of the laceration, high possibility of both mediastinitis and expansion of the pneumothorax.

When primary repair is indicated, it is traditionally performed through a right lateral thoracotomy. However, for surgical repair of patients with a laceration of the upper or middle thirds of the trachea transcervical approach can be preferred [21,22]. Considering the length and location of the defect we decided to repair it under CPB support with median sternotomy which would also provide a better exposure for the whole length of the trachea. In our opinion, CPB support contributes to the exposure of the trachea and provides a safer repair in the surgical management of patients with extended post-intubational tracheal injury.

## Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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## References

1. Schneider T, Storz K, Dienemann H, Hoffman H: Management of iatrogenic tracheobronchial injuries: A retrospective analysis of 29 cases. *Ann Thorac Surg* 2007; 83: 1960-4.
2. Massard G, Rouge C, Dabbagh A, et al. Tracheobronchial lacerations after intubation and tracheostomy. *Ann Thorac Surg* 1996; 61: 1483-7.
3. Sahin M, Anglade D, Buchberger M, Jankowski A, Albaladejo P, Ferretti G: Case reports: Iatrogenic bronchial rupture following the use of endotracheal tube introducers. *J Can Anesth* 2012; 59: 963-7.

4. Hofmann H, Rettig G, Radke J, Neef H, Silber RE. Iatrogenic ruptures of the tracheobronchial tree. *Eur J Cardiothorac Surg* 2002; 21: 649-52.
5. Minambres E, Gonzalez-Castro A, Buron J, Suberviola B, Ballesteros MA, Ortiz-Melon F. Management of postintubation tracheobronchial rupture: our experience and a review of the literature. *Eur J Emerg Med* 2007; 14: 177-9.
6. Marty-Ane CH, Picard E, Jonquet O, Mary H. Membranous tracheal rupture after endotracheal intubation. *Ann Thorac Surg* 1995; 60: 1367-71.
7. Satyadas T, Nasir N, Erel E, Mudan SS. Iatrogenic tracheal rupture: a novel approach to repair and a review of the literature. *J Trauma* 2003; 54: 369-71.
8. 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.
9. Freiburger J. An unusual presentation of an airway tear. *Anaesthesiology* 1984; 61: 204-6.
10. Gaukroger P, Anderson G. Tracheal rupture in an intubated critically ill patient. *Anaesth Intensive Care* 1986; 14: 199-201.
11. Stark P. Imaging of tracheobronchial injuries. *J Thorac Imaging* 1995; 10: 206-19.
12. Ramos Izquierdo R, Moya Amoros J, Morera Abad R, Pujol Rovira R, Perna V, Ferrer Recuero G. Iatrogenic tracheal rupture after endotracheal intubation. *Cir Esp* 2006; 80: 46-8.
13. P. Carbognani, A. Bobbio, L. Cattelani, E. Internullo, D. Caporale, et al. Management of Postintubation Membranous Tracheal Rupture. *Ann Thorac Surg* 2004; 77: 406-9.
14. Rossbach MM, Johnson SB, Gomez MA, Sako EY, et al. Management of Major Tracheobronchial Injuries: A 28-Year Experience. *Ann Thorac Surg* 1998 ;65: 182-6.
15. Gomez-Caro Andres A, Moradiellos Diez FJ, Ausin Herrero P, et al. Successful conservative management in iatrogenic tracheobronchial injury. *Ann Thorac Surg* 2005; 79: 1872-8.
16. Madden B, Datta S, Hussain I, McAnulty G. Tracheal stenting for rupture of the posterior wall of the trachea following percutaneous tracheostomy. *Monaldi Arch Chest Dis* 2001; 56: 320-1.
17. Shimizu J, Hirano Y, Ishida Y, Kinoshita T, Tatsuzawa Y, Kawaura Y. Use of a silicone T-tube for management of a tracheal injury in a patient with cervical blunt trauma. *Jpn J Thorac Cardiovasc Surg* 2003; 51: 541-4.
18. Wurtz A, Benhamed L, Hysi I, Conti M. Endoscopic or Conservative Management of Postintubation Tracheal Membrane Laceration. *Ann Thorac Surg* 2011; 91: 1654-5.
19. Sierra DH. Fibrin Sealant Adhesive Systems: A Review of Their Chemistry, Material Properties and Clinical Applications. *Journal of Biomaterials Application* 1993; 7: 309-52.
20. Aydemir B, Celik S, Uncu O, Tanrikulu H, Okay T. Iatrogenic Tracheal Ruptures: Review of the Literature and Personal Experience on 11 Cases. *Open Journal of Thoracic Surgery* 2013; 3: 130-4.
21. Ishibashi H, Ohta S, Hirose M, Akimoto T. Blunt Tracheal Transection and Long Tear in Posterior Membranous Trachea. *Eur J Cardiothorac Surg* 2006; 30: 945-7.
22. Borasio P, Ardisson F, Chiampo G. Post-Intubation Tracheal Rupture. A Report of Ten Cases. *Eur J Cardiothorac Surg* 1997;12: 98-100.