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# Anesthesiologist's Horror Case: Postintubation Tracheal Rupture

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# *Bir Anesteziyoloğun Korkulu Rüyası: Entübasyon Sonrası Trakea Rüptürü*

**ABSTRACT**

*Endotracheal intubation is a relatively easy procedure, however, complications may occur due to this easy procedure. Practitioners should be ready for unexpected difficult intubation and treat in the lights of guidelines. We herein describe a 48 years old female tracheal rupture case which was diagnosed intraoperatively and treated immediately after diagnosis. Although tracheal rupture after intubation is very rare; respiratory insufficiency, emphysema, even death may happen as a result. Clinical suspicion is the first and the most important step at the diagnosis of the ruptures. An emergency bronchoscopy, chest X-ray and computerized tomography of thorax are necessary for diagnosis of the type and the extention of the laseration. In the literature conservative and surgical therapies are both appropriate for treatment of membranous tracheal rupture. In this case report, the causes of tracheal rupture after unexpected difficult intubation and its treatment approach are explained.*

***Keywords:*** *Endotracheal intubation, complication, rupture*

**ÖZ**

*Endotrakeal entübasyon nispeten kolay bir işlemdir, ancak bu kolay işlem nedeniyle komplikasyonlar ortaya çıkabilir. Uygulayıcıların beklenmeyen zor entübasyon için hazır olmaları gerekir ve kılavuzlar ışığında müdahale edilmelidir. Bu yazıda intraoperatif olarak tanı konulan ve tanıdan hemen sonra tedavi edilen 48 yaşında bir kadın hastada trakeal rüptür olgusu tanımlanmıştır. Entübasyon sonrası trakeal rüptür çok nadir olmasına rağmen; sonuç olarak solunum yetmezliği, amfizem, hatta ölüm görülebilir. Klinik şüphe rüptür tanısında ilk ve en önemli adımdır. Acil bronkoskopi, akciğer röntgeni ve toraks tomografisi, laserasyonun tipinin ve uzunluğunun teşhisi için gereklidir. Literatürde hem konservatif hem de cerrahi tedaviler membranöz trakeal rüptürün tedavisi için uygundur. Bu olgu sunumunda, beklenmeyen zor entübasyon sonrası gelişen trakeal rüptür nedenleri ve tedavi yaklaşımı anlatılmaktadır.*

***Anahtar kelimeler:*** *Endotrakeal entübasyon, komplikasyon, rüptür*

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## INTRODUCTION

Tracheal rupture is most commonly seen after blunt trauma, however, it is also observed after intubation and sometimes extubation [1]. It is a serious complication that every clinician may encounter. Although endotracheal intubation is a relatively easy procedure, it may result in complications. Tracheal rupture after intubation is very rare. Respiratory insufficiency, emphysema, and even death may be observed as a result. So, early diagnosis and treatment are very critical. Also, it is important to manage the airway before and after the treatment. The approach according to airway guidelines will reduce potential damage to the airway. In this case report, the causes of tracheal rupture after unexpected difficult intubation and its treatment approach are explained.

## CASE REPORT

A 48-year-old female patient (height: 151 cm, weight: 69 kg, BMI: 30.6 kg $m^{-2}$) who was scheduled for laparoscopic hysterectomy was evaluated preoperatively. The patient's preoperative Mallampati score was III and the American Society of Anesthesiologists' physical status classification was II. She was taking medications for diabetes. All standard laboratory test results were within the normal range. Following

the standard anesthesia monitorization (pulse rate: 78 $min^{-1}$, blood pressure: 124/75 mmHg, oxygen saturation: 99%), the patient was induced with midazolam (Zolamid, Defarma, Turkey) 2 mg (0.03 mg $kg^{-1}$), fentanyl (Talinat, Vem Drug, Turkey) 150 µg (2 µg $kg^{-1}$), lidocaine (Aritmal 2%, Osel Drug, Turkey) 70 mg (1 mg $kg^{-1}$), propofol (Propofol 2%, Fresenius Kabi, Turkey) 150 mg (2 mg $kg^{-1}$) and rocuronium (Muscuron, Kocak Pharma, Turkey) 45 mg (0.6 mg $kg^{-1}$). After ventilation for three minutes with 100% oxygen, obtaining an appropriate depth of anesthesia, the patient was hardly intubated in several attempts with a tube which was previously controlled (Star Enterprise 7.0 mm ID, 9.4 mm OD, low pressure high volumetric cuff structure, Zhanjiang, PRC) with stylet and Sellick maneuvering accompaniment. The patient had a Cormack Lehane score of IV. The cuff was inflated with 10 mL of air. An air leak was noticed after intubation and the tube cuff was conventionally checked. The cuff did not break. The tube placement was confirmed by laryngoscopy, and the cuff was further inflated with 5 mL of air to minimize leaks. We could not measure the cuff pressure. A persistent air leak continued. Bilateral breathing sounds were confirmed with auscultation. There was no subcutaneous emphysema on physical examination. Shortly after air leak, arterial blood gases were studied, and the values were in normal ranges, because of this decided to start the operation. And we also continued to measure arterial blood gases during the surgery and the postoperative period. All the measurements were in the normal ranges. The leak attempted to be reduced by putting sponges into the mouth of the patient whose saturation was not decreased. She was ventilated with volume control 450 mL 12 $min^{-1}$ $FiO_2$ 50% + %50 air. Anesthesia was maintained with sevoflurane and remifentanil infusion. Subsequently we thought that we might have damaged the airway because of the continuous leak and an emergency flexible fiberoptic bronchoscopy was applied during surgery to asses any damage to the airway, but a clear view could not be obtained. Flexible fiberoptic bronchoscopy, which was repeated after the hysterectomy of the patient, revealed a suspicious lesion on the proximal carina at the posterior wall of the main trachea. The patient was scheduled for neck and thorax computerized tomography (CT) because a clear image could not be obtained. The CT scan showed an approximately 2.5 cm linear full rupture, 1.5 cm proximal away from the carina, in the right posterior membranous main tracheal wall (Figure 1). The results were discussed with the thoracic surgeons, urgent thoracic surgery was planned. The patient was operated on using the right posterolateral thoracic approach. During surgery the laceration was seen directly and primer suturized with 4.0 polyglactin 910 (Vicryl, Ethicon, Belgium) then used oxidized cellulose (Surgicel Nu-Knit, Ethicon, Somerville, USA) for hemostasis and fibrin glue (Tisseel, Baxter, California) as tissue adhesive. No air leak was seen again. Also, flexible fiberoptic broncoscopy revealed no foreign body in the airway. When the surgery completed, all anesthetic agents were discontinued and the neuromuscular blockade was reversed using 140 mg (2 mg $kg^{-1}$) sugammadex (Bridion, Merck-Sharp-Dohme, Germany). The patient breathed spontaneously and was extubated gently. She was taken to the postoperative intensive care unit and oxygenated with a face mask (2 L $min^{-1}$). The patient was observed closely with an electrocardiograph and pulse oximetry. She showed no specific signs or symptoms and the oxygen saturation was 99-100% without oxygen support after 24 hours from the surgery. Postoperative chest X-ray and CT were used for evaluation. The patient's laboratory and radiological results were within the normal range. Esophagoscopy was performed on the 2nd postoperative day and was also normal. The patient was discharged on the 7th postoperative day. After two weeks, the control

**Figure 1. CT scan showed that an approximately 2.5 cm linear full rupture in the right posterior membranous main tracheal wall, and overinflated cuff**

fiberoptic flexible bronchoscopy showed improvement of granulation tissue. Written informed consent was obtained from the patient for a case report.

## DISCUSSION

A tracheal rupture after intubation is a rare complication. However, it is a very critical state when diagnosis and treatment are late. The incidence ranges between 1:20000 and 1:75000 for intubation with a single lumen endotracheal tube [2]. Double lumen endotracheal tubes have a larger diameter and intubation with these tubes causes tracheal rupture more frequently (0.05-0.19%) [2].

There are risk factors for tracheal rupture sourcing from the patient, surgeon, devices, technique, and anesthetic management [3]. Risk factors include inexperienced personnel, repetitive attempts, inappropriate use of the stylet, an over-expanded cuff, inappropriate tube size, double-lumen tube use, and abnormal location of the tube [3]. Additionally, factors sourcing from the patient such as short stature, sudden movement, obesity, being more than 50 years old, percutaneous tracheostomy, steroid or radiation therapy, chronic obstructive pulmonary disease, and tracheomalacia increase the risk of perforation and rupture of trachea [4]. Also, tracheal rupture is observed more often in females [4]. In our case, we had many risk factors such as unsuccessful airway management, repetitive attempts, inexperienced clinician, short stature, obesity and gender. Moreover, because of the air leak, we had to over inflate the cuff (15 mL).

Difficult airway management requires knowledge and skills. Guidelines containing the steps to be followed in such difficult situations are published. In 2015 Difficult Airway Society published one of these for management of unanticipated difficult intubation in adults [5]. According to this guideline; first, *Plan A* consists of face mask ventilation and tracheal intubation. If it is not successful on the first attempt, the guideline gives you the fortune to try two more times, a total of three attempts then indicates a call for help. In our case, the patient was hardly intubated in several attempts. We should have counted how many times we tried until the intubation and behave kindly. One of our mistakes was not to call for help [5].
If the patient can not be intubated, the use of supraglottic airway devices (SAD) is recommended. This is *Plan B*. If the SAD insertion is successful, here is the stop and think stage; for waking the patient up or intubating the trachea via the SAD or proceeding without intubation or tracheostomy or cricothyrotomy. When the SAD insertion is not successful at a total of three attempts, skilled staff can try one more time. In this case, SAD could be used after the failure of intubation instead of several attempts [5].

If there is no success in this either, *Plan C* is face mask ventilation. If it is sustainable, the target should be to wake the patient up. If it is not successful, this situation is named CICO (can not oxygenate and can not intubate). *Plan D* is an emergency in front of neck access; cricothyrotomy [5]. Our patient was intubated without the need for these steps.

Although tracheal ruptures are very rare, they can be life-threatening. The clinical manifestations of tracheal injury are subcutaneous emphysema, pneumothorax, hemoptysis, and respiratory failure [3]. Usually, tracheal rupture appears at the perioperative period but sometimes it may not show any symptoms after surgery for many hours [3]. Clinical suspicion is the first and the most important step for the diagnosis of the ruptures. An emergency bronchoscopy, chest X-ray, and thorax CT are necessary and helpful to diagnose and determine the type and the extension of the laceration [3]. There was no subcutaneous emphysema on physical examination in our case but we suspected tracheal rupture due to an air leak.

Tracheal ruptures may be treated surgically or non-surgically. Although there is a trend toward the non-surgical treatment, there is no consensus and clear guideline yet [2].

Iatrogenic tracheobronchial rupture usually presents as longitudinal lacerations of the posterior tracheal wall, either centrally or laterally located, such that the membranous wall is avulsed from its cartilaginous insertion [1]. Due to the anatomic structure with the esophagus supporting the membranous trachea on the left side, tracheal ruptures are localized more frequently on the right side. Tracheal lacerations

seldomly spread out into the bronchi [2]. In our case, the patient had a rupture in the right posterior membranous main tracheal wall as a longitudinal laceration. Rigid tracheobronchoscopy is needed to confirm a tracheal mucosa laceration and plan the optimal treatment [1]. In our case, the lesion was not identified by flexible fiberoptic bronchoscopy, but a posterolateral wall laceration of the main trachea was indicated by CT. No pneumothorax was observed. After an operation for a tracheal rupture, early extubation is recommended under spontaneous ventilation considering the possibility of damage to the mucous layer of the trachea due to the movement of the endotracheal tube and the pressure of the cuff [4]. Although there is no consensus on the ventilation mode, high-pressure ventilation should be avoided. Intubated patients should be extubated as soon as possible. We extubated the patient as soon as rupture surgery was finished.

## CONCLUSION

Intubation may not always be easy. Practitioners should be ready for unexpected difficult intubation. Intubation related tracheal injuries can be minimized but not eliminated. In this case, there were many risk factors like comorbidity, inexperienced anesthesiologists, several attempts of intubation, and an overinflated cuff. Multiple attempts should not be made in cases of unsuccessful intubation. In presence of any problems in airway management, intervention should be made in the light of airway guidelines. Inexperienced clinicians must intervene in patients only under the surveillance of experienced staff. The cuff pressure must be measured in routine and should not be overinflated. Surgery should be avoided in case of clinical suspicion about the rupture and if the surgery has begun, it should be terminated. A detailed examination including bronchoscopy, chest X-ray, thorax CT, and emergent therapy procedures should be applied. It should be kept in mind that tracheal rupture can occur without classical rupture findings.

Patients must be evaluated carefully to detect the presence of difficult airway preoperatively. Patients with history or high suspicion of difficult airway or unanticipated difficult airway must be managed current difficult airway guidelines. Clinicians managing airway must know and able to apply it. For patients safety, steps should be taken in accordance with current guidelines.

**Conflict of Interest:** None
**Informed Consent:** Written informed consent was obtained from the patient

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