

**Review-Derleme**

<http://dx.doi.org/10.7197/1305-0028.1390>

# Anaesthetic management of tracheal tear

## *Trakeal yırtıkta anestezi yönetimi*

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### **Abstract**

Tracheal tear is an uncommon but a serious injury that may be lethal because of the difficulties of accurate anatomical diagnosis and perioperative airway management. A high degree of suspicion is essential to identify these cases and early intervention is associated with better outcome. The anaesthesiologist managing such a case should be aware of the difficulties during securing the airway and during repair of trachea. Proper planning and keeping back up plans ready helps in successful management of these patients. The anaesthetic management needs to be modified during repair of the trachea by using total intravenous anaesthesia and insertion of an endotracheal tube in the trachea distal to the tear.

**Keywords:** Tracheal tear, anaesthetic management, airway

### **Özet**

Trakeal yırtık nadir ancak doğru anatomik tanımlama ve perioperatif havayolu yönetimindeki güçlükler nedeniyle ölümcül olabilecek kadar ciddi bir hasardır. Bu vakaların tanınmasında yüksek klinik şüphe gerekir ve erken müdahale ile tedavi sonuçları daha iyidir. Anestezist, havayolunun güvenliği ve trakeanın tamiri sırasındaki güçlüklerin farkında olarak bu tür hastaları tedavi etmelidir. Uygun planlama ve yedek planların oluşturulmasıyla bu tür hastalar başarılı bir şekilde tedavi edilebilirler. Trakeanın tamiri sırasında, total intravenöz anestezi uygulanıp yırtığın distalindeki trakeaya endotrakeal tüp yerleştirilirken anestezik tedavinin modifiye edilmesi gerekmektedir.

**Anahtar sözcükler:** Trakeal yırtık, anestezik tedavi, havayolu

**Geliş tarihi/Received:** February 20, 2012; **Kabul tarihi/Accepted:** April 24, 2012

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### **Introduction**

Tracheal tear is a rare but a serious injury usually related to blunt trauma that involves a partial or complete laceration or puncture of the tracheal or bronchial wall [1]. It can occur in the following ways:

1. Shearing forces between the fixed carina or proximal bronchus and the mobile distal bronchus as in a deceleration injury.
2. Rupture resulting from an abrupt increase in pressure against a closed glottis [2].
3. Blunt trauma to the cervical trachea or penetrating injury.
4. Necrosis resulting from compromised mucosal blood flow after overinflation of an endotracheal tube cuff.
5. Perforation by a stylet or endotracheal tube.

### ***Incidence***

Tracheal injuries are rare. The reported incidence is less than 1% [3]. Blunt trauma accounts for the preponderance of all tracheobronchial injuries. Tracheal injury from blunt trauma is 3 times more common in males. Women have a greater chance of iatrogenic injury from endotracheal tubes, because their trachea is smaller [4, 5]. As in women, children have a greater possibility of iatrogenic injury from endotracheal tubes, because their trachea is smaller. A higher incidence of serious chest trauma is seen in patients younger than 40 years; therefore tracheal tear is seen more often in younger patients overall. The stronger proximal cartilage framework tends to fix the trachea and proximal bronchi in place, while the distal bronchi and lungs are more mobile. Consequently, deceleration injury from blunt trauma typically occurs at the transition zone between the fixed and mobile bronchus, within 2.5 cm of carina [6].

### ***Signs and symptoms***

Common presenting signs include subcutaneous emphysema, dyspnoea, sternal tenderness and hemoptysis. The radiographical findings include pneumothorax or pneumomediastinum associated with either fracture of the clavicle or the first rib.

### ***Morbidity and cause of death***

The posterior membranous part of the trachea is the commonest site of rupture [7]. Anterior rupture of the trachea near the carina is not only rare but can be catastrophic. The air leak from the site of trauma can spread through the mediastinum and along the great vessels. It can cause cardiac tamponade by spreading into the pericardium. Death occurs in approximately 30% of patients with tracheal tears with 50% of fatalities occurring within the first hour. Mortality may be due to

- a) An inadequate airway
- b) Tension pneumothorax
- c) Occlusion of airway by protrusion of the oesophagus into the tear or accompanying injuries.

In two thirds of the survivors, diagnosis is delayed, occasionally for many years, resulting in complications such as airway stenosis, atelectasis, pneumonia, mediastinitis, sepsis and decreased pulmonary capacity [8].

### ***Diagnosis***

Chest radiography is the standard initial screening examination for evaluation of tracheobronchial injury. Computed tomography (CT) is preferred if tracheobronchial tear is suggested. In appropriate circumstances, multiplanar or virtual endoscopic reconstructions from the CT data can be performed to clarify questionable findings. Definite diagnosis of tracheal tear is made by bronchoscopy. If clinical or radiographic findings suggest airway injury, diagnostic bronchoscopy is recommended [1].

### ***Anaesthetic management***

Immediate treatment depends on the patient's condition and associated injuries. At a minimum, emergency bronchoscopic confirmation of the diagnosis and location is important if tracheobronchial tear is suspected. This may aid in placing the endotracheal tube cuff beyond the injury. Small tears may be treated conservatively. Surgical repair is indicated when a transmural tear longer than 1 cm causes a pneumothorax that is unrelieved by tube thoracostomy or in cases of mediastinal emphysema with hemodynamic instability [1]. Patients with tracheal rupture present a considerable challenge to the anaesthesiologist. The most important aspect in anaesthesiology in such cases is to maintain oxygenation and ventilation because of loss of ventilation to the atmosphere due to open airway [9]. The difficulties encountered in the anaesthetic management of these cases are during induction and securing the airway, maintenance of anaesthesia during tracheal reconstruction, prevention of aspiration as well as effective nutrition in the postoperative period [10]. The early diagnosis of tracheal disruption is

critical for minimizing mortality and choosing therapy. The most common presenting symptoms and findings are dyspnoea, subcutaneous emphysema, hemoptysis, sternal tenderness and pneumothorax. It is generally accepted that chest drainage should be performed in the presence of pneumothorax. But in cases of tracheal rupture, chest drainage may produce a massive continuous air leak and may fail to fully expand the lung [11]. Therefore suction through chest drainage should be applied gradually only after reconstruction of trachea. It is important to be prepared for every possible scenario that can take place. Anaesthesia providers should also become intimately familiar with emergency airway management algorithms. The American Society of Anaesthesiologists (ASA) modified trauma algorithm that pertains to airway disruptions, is an excellent source to follow for tracheal tears [12]. The algorithm emphasizes some key management points that need to be followed, such as maintaining spontaneous respirations, which is especially important until the level of tear has been determined by bronchoscopy [13]. For all major tears an awake fiberoptic intubation should be done. The type of preoperative medication is governed by the extent of airway obstruction. The obvious concern when faced with airway obstruction is the avoidance of oversedation and central respiratory depression. In patients in whom airway obstruction is severe, especially when there is obvious stridor and use of accessory respiratory muscles, the administration of atropine and other drying agents should be avoided. Anaesthesia is maintained with inhalation agent-oxygen or in cases in which normal pulmonary function exists and an adequate airway is present, with a combination of nitrous oxide and oxygen to supplement the inhalational agent. Relaxants are avoided and ventilation is generally accomplished by hand [14]. If a neuromuscular blocker is used, positive pressure ventilation before isolation of the tracheal disruption may further aggravate the mediastinal emphysema and air leak. Once the level of tear has been determined, the algorithm recommends placing the endotracheal tube below the tear to avoid increasing the pneumomediastinum and subcutaneous emphysema with positive pressure ventilation [15, 16]. If the tear is too low, close to the carina or involves one bronchus, a double lumen tube may be used. But intubation using a double lumen tube even under fiberoptic guidance carries the risk of extending the tracheal tear, because the Robertshaw double lumen tube has a relatively large external diameter and curves in two planes. Also, after placement of double lumen tube, the tracheal cuff would lie at the site of tracheal injury and positive pressure ventilation through the tracheal lumen can expose the defect to further damage [17]. Bilateral bronchial intubation is a rational approach for the management of tracheal rupture. The tubes are readily available and can be accurately placed provided that careful clinical assessment, fiberoptic bronchoscopy and regular chest radiography are employed. The tubes can migrate from their intended position and considerable attention must be paid to securing them in position. Bronchial rupture is a well recognized complication of overinflation of bronchial tube cuffs and care must be exercised in limiting cuff pressure to that which is necessary to establish a seal [18]. An alternate method using high frequency positive pressure ventilation has also been described for the management of tracheal resection [19] but this requires specialized equipment and expertise for safe implementation. If the tear involves a complete dissection of the trachea or requires a complicated surgical repair, cardiopulmonary bypass may be needed [20].

### **Monitoring**

The standard approach for monitoring the otherwise uncomplicated patient is the use of an electrocardiography (ECG), blood pressure cuff, pulse oximetry, capnography and radial artery catheter. The arterial catheter is not only useful for instantaneous monitoring of blood pressure during the intra and postoperative periods, but is of even greater benefit in facilitating sampling of arterial blood to follow the efficiency of gas exchange. The selection of the site of cannulation is governed not only by the availability of such vessels, but also by the fact that the right radial artery is often lost due to compression or deliberate sacrifice of the innominate artery, which crosses the trachea and hence the

operative field anteriorly from left to right. Thus, the left radial artery is preferred [14]. A central venous catheter is appropriate when it is anticipated that vasopressor support or other intravenous medications requiring such a route will be used during the intraoperative period. In general, the use of central venous pressure monitoring is dictated by a history of existing cardiopulmonary disease [14].

### **Postoperative care**

Postoperative patients are admitted to the intensive care unit (ICU) for a minimum of 24 hours. Patients are monitored by using ECG, arterial pressure and serial arterial blood gases. A radiography of the chest is obtained shortly following admission to ICU to ensure that a pneumothorax is not present. Sufficient oxygen is administered with a high flow humidified system via a facemask to provide adequate arterial oxygenation. Feeding in the postoperative period is done in the sitting position with the neck flexed to prevent aspiration. This method has been described in the literature as being vital to help prevent aspiration [21].

Potential complications include perforation of the anastomotic site and tracheal irritation with subsequent edema and airway obstruction which may induce vomiting and aspiration. In cases in which abundant secretions are a problem, frequent transoral flexible fiberoptic bronchoscopy can be used to provide pulmonary toilet.

It is also very important to document the injury very clearly and to take still pictures of the site for inclusion in the patient's chart. This will aid future airway management for these patients, as these injuries often result in scarring that may impede smooth passage of an endotracheal tube in the future. Tracheal tears as well as all severe airway damage, eventually lead to stenosis, stricture and scarring, so documentation may prevent further damage and allow the next team to take a different approach to intubation such as awake fiberoptic intubation after viewing the airway and assessing for any obstructions [22].

In conclusion, proper preparation has always been a hallmark of anaesthesia and familiarity with airway algorithms improves the anaesthesia provider's ability to manage tracheal tears and provide a safe anaesthesia for the patient. Also, there should be communication between the surgical and anaesthesia team members during perioperative management of tracheal tear.

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