

# External airway injury resulting in insidious life-threatening complications

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## Sessizce gelişip yaşamsal komplikasyonlara yol açan eksternal hava yolu travması

Akut eksternal larengotrakeal travma, baş boyun bölgesinde karşılaşılabilecek olası hayati komplikasyonların önlenmesi bakımından mutlaka hızlı karar ve uygulamanın gerektiği en acil durumlardan birisidir. Pediyatrik hastalarda üst hava yollarının anatomik yapısı, özellikle yaşamsal komplikasyonların erişkinlere göre daha kolaylıkla gelişebilmesine yol açmaktadır. Bu makalede, boyun anterior kompartman künt travması sonucu tiroid ve krikoid kıkırdaklarda kırılma, trakea yırtılması ve buna bağlı ilerleyici tarzda retrofarengeal amfizem ve pnömomediasten gelişen 7 yaşında bir erkek çocuk olgusu bildirildi. Acil trakeotomiyle hava yolu güvene alındı ve takiben elektif cerrahi koşullarda hasarlı larenks rekonstrükte edildi. Retrofarengeal amfizem ve pnömomediasten benzeri beklenmedik ciddi komplikasyonların gelişimi, olgunun pediyatrik dönem açısından sıra dışı olmasına sebep olmaktadır.

**Anahtar Sözcükler:** Larengotrakeal travma, pediyatri, retrofarengeal amfizem, pnömomediasten.

## Abstract

Acute external laryngotracheal injuries constitute one of the most urgent conditions of the field of otolaryngology. In such cases, immediate decision-making and intervention are imperative to prevent possible detrimental consequences. The situation is even more serious if the wounded is of the pediatric age group. In this report, we present a 7-year old boy with a blunt trauma to the anterior neck, which resulted in fractures of the thyroid and cricoid cartilages and dissection of the trachea with insidious onset of retropharyngeal air trapping and pneumomediastinum. After securing the airway by emergent tracheotomy, appropriate reconstruction of the injured larynx was performed under elective conditions. Unexpected serious complications like acute retropharyngeal emphysema and pneumomediastinum in a patient of pediatric age group makes our case extraordinary.

**Key Words:** Laryngotracheal injury, pediatric, retropharyngeal emphysema, pneumomediastinum.

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## Introduction

Acute airway trauma is a medical emergency. As opposed to the translumenally originating trauma, which are usually iatrogenic, these injuries frequently occur as a result of external blow to the upper airway region.<sup>1,2</sup> The susceptibility of the pediatric laryngotracheal complex makes such external injuries even more dangerous in this age group.<sup>3</sup>

In such a case, the foremost priority is to secure the airway with the vital signs under close observation.<sup>4</sup>

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Immediate decision making with a careful presentiment is lifesaving. Other systemic disabilities resulting from the incident are handled only after the airway is secured.

Although appearing indolent at first, the damage associated with the trauma may not be limited only to the upper airway complex. The insidious onset of a cascade of events may give rise to pathologies, which may be life threatening. For this reason, a careful and circumspect approach to such a patient is mandatory. In this report, we present a patient with an acute airway injury who was relatively stable at presentation. However, rapid deterioration commenced and the evaluation revealed fractures of the thyroid and cricoid cartilages, tracheal dissection and perforation of the posterior hypopharyngeal wall. Air trapping through the perforation had resulted in retropharyngeal emphysema and relevant pneumomediastinum.

## Case Report

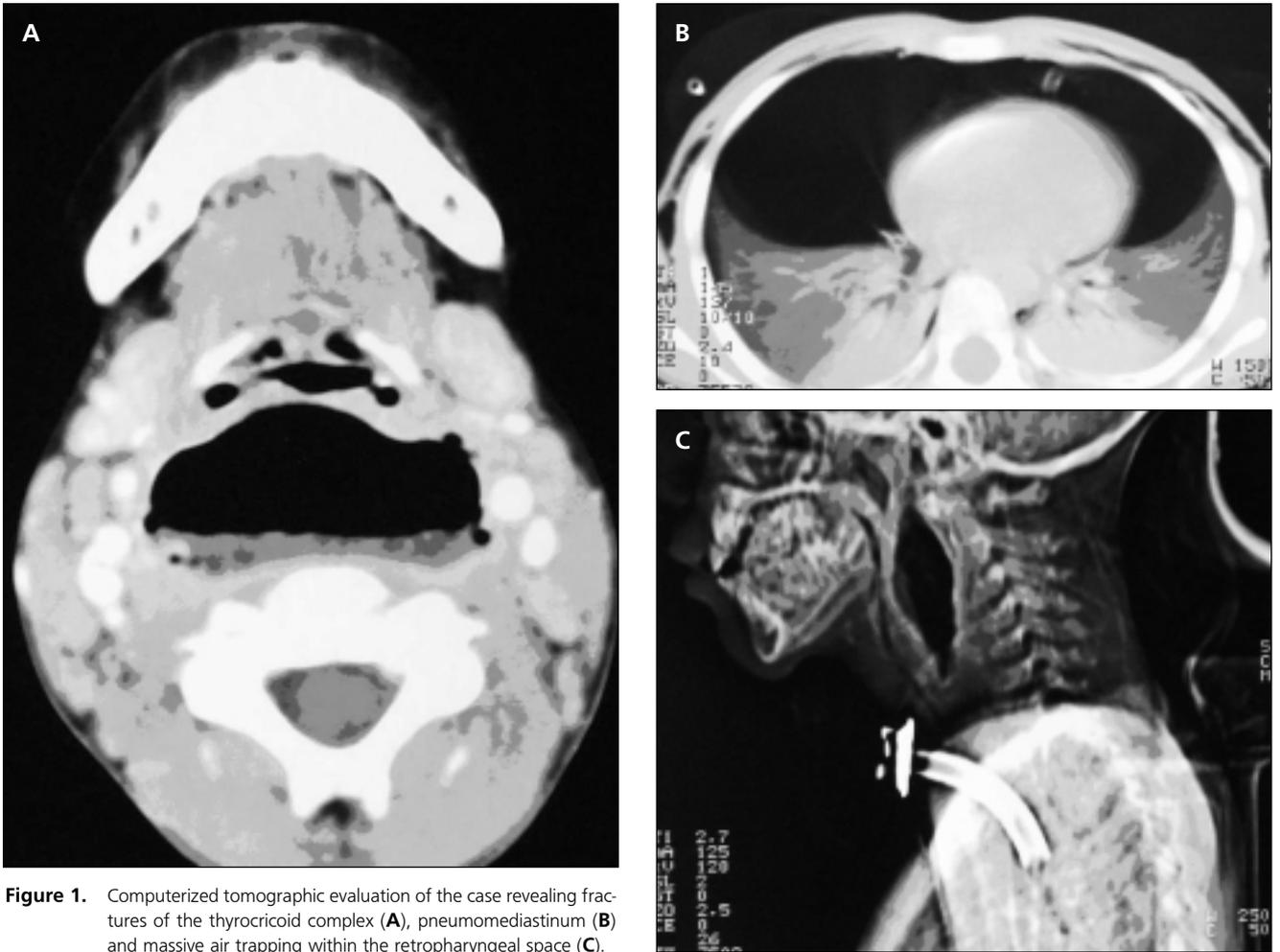
A 7-year old boy was brought to the emergency room (ER) of Istanbul University Faculty of Medicine, with a history of falling on a timber with his neck exposed anteriorly. No respiratory distress was evident initially and the neck was immobilized with a collar as a precaution for a possible cervical spine injury. A slight distension and noticeable abrasions were evident on the anterior cervical region and palpation revealed widespread subcutaneous emphysema. The plain radiograms did not show any significant injury of the bony cervical spine. During the preliminary examination, when a diagnosis of acute laryngotracheal airway injury was established, a sudden onset of respiratory distress compelled the otolaryngology team to perform an emergency tracheotomy to secure the airway.

Due to worsening of the respiratory distress and appearance of cyanosis, all procedures were abandoned and the patient was tracheotomized urgently. Although the respiratory distress and cyanosis were relieved, partial oxygen saturation could not be raised to satisfactory levels. Meanwhile, left pulmonary hypoventilation with overinflation of the ipsilateral hemithorax appeared insidiously. Emergent computerized tomography revealed fractures of the thyrocricoid

complex (Figure 1A), pneumomediastinum (Figure 1B) and massive air trapping within the retropharyngeal space (Figure 1C). Immediate active drainage was provided by insertion of bilateral thoracostomy tubes. Rapid deterioration of the general status of the patient did not permit any additional procedures.

Thoracostomy tubes were withdrawn two days later when the lungs expanded and begun to ventilate. Endoscopic evaluation was performed under general anesthesia and a massive distension on the posterior pharyngeal wall blocking the airway was encountered. Drainage of this region revealed excessive amount of purulent material and laryngeal inlet could finally be reached by virtue of this decompressive maneuver. There was a shortening of the anterior-posterior diameter of the larynx due to multiple fracture sites at thyroid and cricoid cartilages such that the anterior commissure collapsed over the posterior cricoid lamina. Normal anterior-posterior diameter could only be achieved by elevating the anterior commissure region off the cricoid lamina with a probe. The patient's true vocal cords were short, flask and thick. Despite no fractured cartilage segments were apparent; a mucosal laceration on the right posterior hypopharyngeal wall was evident. This site was assumed to be lacerated by the fractured cartilage and evaluated as the site of origin of air leak to the retropharyngeal space, which led to the initiation of the cascade of life threatening complications. Further rigid esophagoscopy examination revealed no additional pathology.

According to the classification system defined by Schaeffer,<sup>5</sup> the case was graded as "group 4 laryngotracheal injury". The patient was given ko-amoksilav for seven days. On disappearance of the infectious criteria, an open laryngotracheal reconstruction was decided to be performed. Under general anesthesia, exposure of the endolarynx was executed along the existing vertical paramedian thyroid fracture line. The fracture line started from the thyroid notch and extended downward in a paramedian fashion. The cricoid cartilage was avulsed about 7 mm in the midline (Figure 2). Non-vital and avulsed cartilage was removed from the cricoid, and minor endolaryngeal mucosal lacerations were repaired with 5/0 fast-absorbable catgut sutures. Montgomery laryngeal stent (Boston Medical Products,



**Figure 1.** Computerized tomographic evaluation of the case revealing fractures of the thyrocricoid complex (A), pneumomediastinum (B) and massive air trapping within the retropharyngeal space (C).

child stent) was placed through the paramedian fracture line and was fixed with transventricular-transdermal 3/0 polypropylene sutures. The defective area over the cricoid cartilage was repaired with conchal cartilage (Figure 3). Cartilage sutures were performed with 3/0 poliglactin 910 (Ethicon vicryl).

The stent was withdrawn 4 weeks later under general anesthesia. In order to test the tolerability of decannulation, the silver tracheostomy cannula was replaced with a speaking canulla (Tracoe Co, speech ventile canulla). After 3 weeks, the patient was decannulated with normal airway and speech.

In indirect laryngoscopic evaluation of the patient on postoperative 5<sup>th</sup> month, no serious endolaryngeal pathology was encountered except a minor synechia

on the anterior commissure and a slight edema on the right arytenoid. Anterior-posterior dimension was satisfactory to provide sufficient airway (Figure 4). Meanwhile, unexpectedly high quality of voice attracted attention.

## Discussion

Laryngotracheal injuries occur rather infrequently and the occurrence of this event in pediatric population is even more uncommon.<sup>1,2,4,5</sup> There was only one pediatric case in the series of 139 patients of Schaeffer,<sup>4</sup> which reflected his 27 years of experience. Limited experience with this type of injury precludes the establishment of universally accepted protocols for both evaluation and management.



**Figure 2.** Open surgical exploration revealing a vertical thyroid fracture line starting from the thyroid notch and extending downward in a paramedian fashion. The cricoid cartilage is also shown to be avulsed about 7 mm in the midline.



**Figure 3.** Reconstruction of the defective area over the cricoid cartilage with conchal cartilage graft. The stent is already in place and fixed with transdermal sutures.

When compared with adults, laryngeal injuries are rather rare in the patients of pediatric age group due to the "intrinsic invulnerability" of the pediatric larynx. However, once effected, the pediatric airway injury is serious due to "intrinsic susceptibility". More superior location of the pediatric larynx benefits from mandibular protection and greater flexibility due to non-calcified cartilaginous structures, which provide additional protection against external trauma.<sup>2,3</sup> However, the relatively small cross-sectional area of the pediatric larynx and the high possibility of soft tissue damage may result in a rather serious course of events in the pediatric age group.<sup>3,4</sup> Surgery is recommended within the first 24-hours of the incident as stated by Schaeffer<sup>4</sup> and others<sup>2,6</sup> because of the fact that one of the most important determinants of the final outcome in terms of voice quality and airway patency is the timing of surgery. The earlier the intervention, the less severe the scar forma-

tion. In our case, dissection of the deep cervical fascia leading to pneumomediastinum resulted in deterioration of the general health status. Despite our intention to reconstruct as soon as possible, the poor condition of our case prevented further intervention and we had to perform a delayed reconstruction 9 days after the initial event.

The use of endolaryngeal stents is a controversial issue. Relevant mucosal damage is the most significant point used in opposition.<sup>5</sup> However, we were compelled to use an endolaryngeal stent because the injury was so extensive that it consisted of multiple fractures of more than one laryngeal cartilage at more than one site. Cartilaginous framework collapse was so pervasive that we could not dare to remove the stent within 10-14 days, as advised by some authors.<sup>3,5</sup> We waited for 4 weeks for removal.



**Figure 4.** Indirect laryngoscopic view on 5<sup>th</sup> postoperative month.

Conchal cartilage from the auricle was used to reconstruct the defect in the anterior cricoid ring. Despite the reported use of the sternohyoid muscle with its overlying fascia for the reconstruction of anterior cricoid defects, we could not find any healthy strap muscle for this purpose due to the preoperative tracheotomy and infective complications such as acute retropharyngeal abscess.<sup>3,5</sup> For this reason, we had to use conchal cartilage for reconstruction.

Despite the initial indolent appearance, serious life threatening complications developed within a very short period of time. This proves the insidious course of the pediatric airway injuries. Even in multicenter trials, no case of primary laryngotracheal injury was shown to lead to such extensive complications to affect organs outside the laryngotracheal tree.<sup>2,7</sup> As stated by the works of other authors, this case report clearly indicates that no evident relationship exists between any sign and symptom of external laryngeal trauma and the actual underlying life threatening events.<sup>2,8,9</sup>

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