



# Visual Diagnosis in Emergency Medicine

## BLUNT LARYNGEAL INJURY IN A TEENAGE HOCKEY PLAYER

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### CASE DISCUSSION

A 13-year-old boy presented to the Emergency Department (ED) after sustaining blunt neck trauma while playing hockey. He reported falling forward with his neck landing directly on the edge of the boards. Immediately after the injury, he began coughing, with a single episode of hemoptysis, but no difficulties breathing. On arrival to the ED, he endorsed mild pain in his anterior neck. He was cooperative, smiling, and in no distress. His voice was hoarse. Vital signs were: temperature 37.2°C, heart rate 95 beats/min, blood pressure 133/72 mm Hg, respiratory rate 18 breaths/min, and oxygen saturation 100% on room air. A small abrasion was noted on his neck (Figure 1). Crepitus was palpable from the submandibular region to the clavicles bilaterally. He had no stridor. There was no cervical spine tenderness. Computed tomography (CT) of the neck showed extensive subcutaneous emphysema from the nasopharynx to the mediastinum (Figure 2), and significant narrowing of the larynx at the level of the left pyriform sinus. No laryngeal fracture was identified. A flexible nasolaryngoscopic examination performed at the bedside showed limited movement of the left arytenoid and vocal fold. The

patient was taken to the operating room for diagnostic laryngoscopy and bronchoscopy, which confirmed hypomobility of the left arytenoid without dislocation, and identified a left infraglottic hematoma with surrounding echymosis (Video 1, available online). A small abrasion was noted in the proximal esophagus.

The patient was admitted to the intensive care unit for observation. No surgical intervention was performed. Over the following 2 days, the subcutaneous air in his neck resolved and his phonation slowly improved. Repeat bedside flexible endoscopy revealed approximation of the posterior vocal folds had largely corrected, although the mobility of the left vocal cord remained limited. He was discharged on a soft diet and partial vocal rest. At follow-up 1 month later, he had a normal voice, with full mobility of both vocal cords noted on flexible nasolaryngoscopy.

### DISCUSSION

Laryngotracheal injuries are rare in pediatric patients, comprising < 0.5% of pediatric trauma admissions (1,2). Although uncommon, such trauma to the airway may lead to significant morbidity and mortality in children. Therefore, a high clinical suspicion and careful evaluation are required to avoid missing these injuries.

There are a number of anatomic features that affect injury patterns in children as compared with adults.

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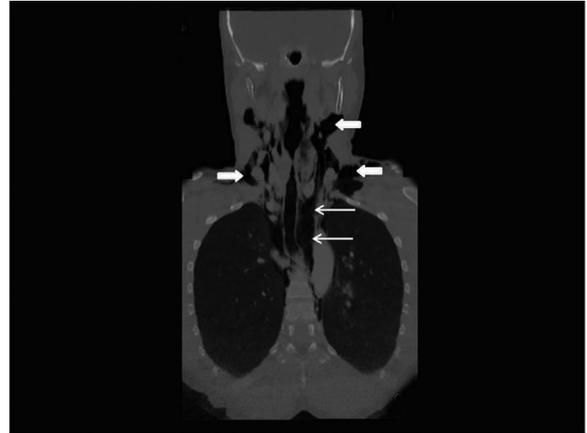


**Figure 1.** Small abrasion over the anterior neck.

Many of these features are protective. The larynx is more cephalad within the neck in infants and young children, so the mandible may shield the laryngeal structures from blunt forces in some cases (3). In addition, the less ossified laryngeal cartilages are more pliable in children and, therefore, less likely to fracture (1,3). However, the mucosal tissue of the larynx is loosely attached and can easily separate from the perichondrium in children after even mild blunt trauma. Such disruption leads to laryngeal edema or hematoma that can impede vocal cord function or rapidly occlude the airway, and may not be easily identified on radiographic imaging (1,2).

Patients with blunt laryngotracheal injury often present with nonspecific complaints that may include: cough, stridor, voice changes (hoarseness or aphonia), hemoptysis, or respiratory distress. Findings on physical examination may include: local abrasions or ecchymosis, swelling or tenderness of the neck, crepitus, loss of laryngotracheal landmarks, or appreciable stepoffs of the laryngeal cartilages. Importantly, the severity of signs and symptoms may not correlate with the extent or type of injury (2,3). Therefore, a systematic approach to evaluation should be utilized.

Radiographs of the neck and chest should be obtained in all pediatric patients with blunt neck trauma. In addition to identifying cervical spine injuries, these films provide an initial evaluation of airway injury. Although laryngeal fractures are rarely identified on plain radiographs, other findings suggestive of injury include soft tissue edema, airway narrowing, or air leak (subcutane-



**Figure 2.** Single coronal slice from the computed tomography scan showing subcutaneous emphysema extending from the nasopharynx throughout the neck (thick arrows) and into the mediastinum (thin arrows).

ous emphysema, pneumomediastinum, or pneumothorax) that may not have been appreciated on physical examination. Such air leak may indicate a violation of the laryngotracheal complex or the proximal esophagus (1,2). CT is more sensitive for diagnosing fractures and other laryngeal injuries, although it may be negative in some cases with significant airway injury, given the poor mineralization of the laryngeal skeleton in young children (4,5). This risk of false-negative studies as well as the exposure to ionizing radiation should be weighed against the potential benefit of improved radiologic information by CT, particularly in children who may not tolerate endoscopic examination well (1,3,4).

There is debate about the role of flexible nasolaryngoscopy in the evaluation of stable children with possible laryngotracheal injury. Those who suggest it should be standard of care note that it is safe, often well tolerated, and can be performed without general anesthesia. In addition, it provides direct visualization of the airway, including identification of mucosal trauma (echymosis and edema), cartilage injury, and arytenoid/vocal cord mobility that may not be detected radiographically (1,5). Advocates suggest that findings may direct further management (1,2). Others argue that providers who are comfortable performing this procedure in children are not always readily available, and there is a potential for complications when nasal endoscopy is attempted in uncooperative children. In addition, it is posited that many of these patients will ultimately require definitive evaluation of the entire airway, including additional assessment below the vocal cords, and operative diagnostic laryngoscopy and bronchoscopy should not be delayed (4).

A wide variety of injuries may be found on flexible or direct laryngoscopy, including: mucosal edema and

ecchymosis, submucosal hematoma, lacerations of the trachea (most commonly the posterior wall) or proximal esophagus, laryngeal fractures, or laryngotracheal separation (2). Inflammation or disruption of the arytenoids or vocal cords (subluxation, dislocation, immobility, or avulsion) may be identified as the etiology of hoarseness or difficulties with phonation (Video 1) (5–9).

Operative vs. conservative management of blunt laryngeal trauma patients will depend on findings from radiologic studies and visualization by bedside flexible nasolaryngoscopy or diagnostic laryngoscopy/bronchoscopy. For those patients who do not require operative intervention, admission to a closely monitored setting with serial endoscopy evaluation to monitor for worsening airway compromise is warranted (2). There are limited data regarding the role of steroids when airway edema is present and therefore, practice patterns vary. Injuries with airleak are often treated with prophylactic antibiotics to prevent infections in the deep neck or mediastinum. Soft diet and voice rest is recommended when vocal anatomy is involved. Lacerations, fractures, and dislocations of laryngotracheal structures typically require surgical repair (1,5).

In children with respiratory compromise, concern for progressive airway obstruction, or those requiring transport, endotracheal intubation must be considered. However, the optimal approach to invasive airway management is highly controversial, and will vary based on patient acuity as well as the availability of airway experts and an operating room that can accommodate pediatric patients (3). The benefits of securing the airway outside the operating room should be weighed against the possibility of causing greater harm by aggravating an existing injury or causing full transection of the trachea, creating an imminent life threat (1). This risk is likely higher when an endotracheal tube is inserted blindly past the vocal cords into the trachea. Therefore, whenever possible, operative laryngotracheoscopy with

a rigid bronchoscope is thought to be the safest and most reliable means to establish the airway in pediatric patients with blunt laryngeal trauma. If clinical circumstances mandate immediate intervention in the ED, the provider with the most airway management experience should perform the intubation procedure to optimize the opportunity for success on the initial attempt. Age-appropriate surgical airway equipment should be immediately available as back-up (1,3).

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## SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.jemermed.2019.05.033>.

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