

Approach to the Patient with External Laryngeal Trauma: The Schaefer Classification

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Abstract

Although not a common presentation, laryngeal trauma can be a potentially life-threatening injury and therefore warrants close attention by relevant clinicians including general practitioners, emergency department practitioners and otolaryngologists. In our experience, since such cases are not frequently encountered, knowledge of optimal assessment and management is highly variable. In this article, we present a further case of laryngeal trauma, emphasizing the importance of a clear and structured management approach including the use of a classification system for injury severity. We hope that this will serve as a useful aide-mémoire to clinicians thus improving patient survival and long-term functional outcomes, specifically relating to breathing, speech and swallowing.

Introduction

Laryngeal trauma is an uncommon presentation to the otolaryngologist usually via the emergency department and rarely via a general practitioner. However, due to the potentially life-threatening nature of such injuries, it is crucial that relevant clinicians are aware of key principles surrounding initial assessment and management. Since such cases are infrequently encountered, confidence in managing these cases is variable. There is a wide range of presenting signs and symptoms, which may not correlate with severity of injury; hence severe injuries may be missed. Here we present a further case of laryngeal trauma which was successfully managed conservatively. We emphasise the importance of a structured management plan for the various types of laryngeal trauma, and the use of a classification system for severity of injury. Such measures have been shown to increase patient survival and improve long-term functional outcomes, pertaining to breathing, speech and swallowing.

Case Report

A 46 year old female presents to the emergency department having been held in a strangle hold by a prisoner for approximately ten minutes during her work as a prison nurse. On arrival, she complains of difficulty breathing, a hoarse voice and anterior neck discomfort. She is promptly assessed by emergency department clinicians who deem her airway to be stable as she has no stridor and is maintaining oxygen saturations of 96-98% on room air. She is then referred to the otolaryngology (ENT) team for further assessment. On examination by the ENT team, mild bruising is noted overlying the left side of the thyroid cartilage but the normal anatomical landmarks of the neck are preserved. Flexible endoscopic examination of the larynx revealed mild oedema and bruising of the vocal cords which were otherwise mobile; consistent with a Schaefer type 1 laryngeal injury. A Computerised Tomography (CT) scan was organised which ruled out laryngeal fracture and showed no mucosal disruption. The patient was then treated with intravenous dexamethasone (with proton pump inhibitor cover to prevent further laryngeal irritation), nebulised adrenaline and humidified oxygen as required, antibiotics and voice

rest. She was observed on the ward for 48 hours and clinically improved. She was then safely discharged and at 2 week follow up in the laryngology outpatient clinic, her voice and airway were found to be markedly improved with no swallowing difficulties.

Discussion

What are the broad types of external laryngeal trauma?

Two broad categories of external laryngeal trauma are recognised, namely penetrating or blunt injuries [1]. Common mechanisms resulting in blunt laryngeal trauma include motor vehicle accidents, physical assault (as in the reported case) or sports injuries. Penetrating laryngeal trauma may arise following knife, gunshot and blast injuries [2]. Laryngeal trauma is thought to account for less than 1% of all cases seen at major trauma centres and constitutes approximately 1 in 30'000 emergency department visits [3]. Schaefer SD reviewed cases of laryngeal trauma over a 27 year period and noted increasing rates of penetrating neck injuries, whilst blunt laryngeal injuries appear to be declining. This appeared to be a consistent finding throughout the literature [3,4].

Whilst this report primarily focuses on external laryngeal trauma, it is important to note that iatrogenic internal injury, in particular intubation trauma, is a significant aetiological factor not to be overlooked. Notably, the most common cause of arytenoid cartilage dislocation cited in the literature is intubation trauma, accounting for 80% of cases, followed by external trauma, implicated in 15% of cases [5].

How do patients present?

A key factor to note from the outset when assessing patients who have suffered laryngeal trauma is that no single symptom correlates well with injury severity. Indeed, laryngeal trauma may initially go unnoticed as patients may appear deceptively asymptomatic in the early hours after injury [6]. Common presenting symptoms include dysphonia, neck pain and/or bruising, dyspnoea, aphonia, haemoptysis

and odynophagia. Common signs of laryngeal injury include stridor, subcutaneous emphysema, loss of normal anatomical landmarks of the neck, neck tenderness or bruising, loss of laryngeal crepitus, vocal cord paralysis and airway obstruction [7-9].

It is worth noting that whilst laryngeal trauma is an uncommon presentation in adult patients, the incidence of paediatric laryngotracheal injuries is even lower. This is thought to be attributable to several factors. Firstly, children are less likely to be involved in violent altercations and road traffic accidents. Secondly, the paediatric larynx is more pliable and anatomically located higher in the neck, allowing more protection from the mandible in comparison to adults; thereby decreasing the likelihood of fracture. However, by virtue of its narrower lumen and looser mucosal attachments to underlying cartilage, the paediatric larynx is more predisposed to soft tissue injury, including oedema and haematoma formation, resulting in life-threatening airway obstruction [10]. This is an important concept to be aware of at initial presentation as it can be seen that the age of the patient can affect the likelihood of specific types of laryngeal injury. A high index of clinical suspicion is required for early diagnosis.

What are the priorities in initial assessment?

The Advanced Trauma Life Support (ATLS) protocol is indicated for any individual who is severely injured. In keeping with this protocol, the initial priority is to assess and secure the airway in any patient who has suffered laryngeal trauma [11]. Once deemed stable, the airway should be further evaluated using flexible fiberoptic laryngoscopy to assess the extent of laryngeal injury. This is a critical step in the initial assessment of patients who have experienced laryngeal trauma.

Additionally, cervical spine injuries must be excluded in all cases of laryngeal trauma [12]. Due to the likelihood of concurrent injuries, a complete trauma assessment must be performed in keeping with ATLS principles. In a large case series of 392 patients over a 5 year period, associated injuries included skull base or intracranial injury (13%), open neck injury (9%), cervical spine injury (8%) and oesophageal or pharyngeal injury (3%) [12].

When should patients be referred to ENT?

Emergency department clinicians and rarely general practitioners are usually the first to assess patients who have experienced laryngeal trauma. Such patients should be referred to an ENT specialist for

airway assessment and flexible fiberoptic laryngoscopic examination. In our experience, some clinicians felt that very minor cases of laryngeal trauma e.g., sports injuries could be discharged home without ENT input.

However, it is widely reported in the literature that although patients may sometimes appear asymptomatic, there may be a severe underlying laryngeal injury [6]. Atkins et al. suggest that up to a third of cases may initially present without symptoms in the first 24-48 hours post injury [13]. Hence, we would argue that some form of early ENT input would be prudent for all cases of laryngeal trauma.

What investigations are required?

If the airway stable, it is widely accepted that Computerised Tomography (CT) remains the gold standard for assessing the extent of laryngeal injury. CT imaging also helps to rule out cervical spine injuries. Most studies report high sensitivity and specificity, although stated absolute values were not found in the literature [14]. Hence, most patients with laryngeal injury undergo CT imaging as a first line imaging investigation.

However, in paediatric patients, where laryngeal cartilages are not ossified and consequently not well visualised on CT, MRI (Magnetic Resonance Imaging) is advisable as a suitable second line imaging investigation [15]. Indeed, Duda Jr et al. report that by virtue of its superior contrast resolution, MR imaging may be preferable in detecting epiglottic injuries, including avulsion in the subacute or chronic setting [16]. Furthermore, CT imaging may miss laryngeal fractures and cartilage avulsions. In cases, where there is clinical suspicion of laryngeal fracture but no definitive CT findings, MRI should be considered to aid in diagnosis.

Obviously, if the airway is not stable and cannot be managed safely, CT scanning is inadvisable. In these cases, it may be necessary to proceed directly to neck exploration as the risks to the patient outweigh the benefits of imaging [11].

Is there a classification system for severity of injury?

The Schaefer Classification System for categorising the severity of laryngeal injury is the most widely used [3]. Through this system, laryngeal injuries are divided into five categories of increasing severity, outlined in Table 1 below.

Groups	Severity of injury in ascending order
Group 1	Minor endolaryngeal hematomas or lacerations without detectable fractures
Group 2	More severe edema, hematoma, minor mucosal disruption without exposed cartilage, or nondisplaced fractures
Group 3	Massive edema, large mucosal lacerations, exposed cartilage, displaced fractures, or vocal cord immobility.
Group 4	Same as group 3, but more severe, with disruption of anterior larynx, unstable fractures, two or more fractures lines, or severe mucosa! Injuries.
Group 5	Complete laryngotracheal separation.

Table 1: Schaefer classification system [3].

Schaefer SD looked at a large case series of 139 consecutive patients with laryngeal trauma over a 27 year period. A particular emphasis was placed on patient management and the findings were used to devise a classification system for injury severity. Whilst each laryngeal

injury is unique and must be managed on its own merit, categorisation of injuries into an organised system assists clinicians in determining a structured management plan.

How are patients managed?

Patients are managed according to the severity of injury; hence the Schaefer classification system serves as a useful guide. Management ranges from adjunctive medical treatment for mild injuries e.g., humidification, steroids, antibiotics and anti-reflux agents to surgical treatments including direct laryngoscopy, pharyngo-oesophagoscopy, tracheotomy and open repair with or without stenting for progressively more severe injuries. Suggested management for each type of injury is best summarised in Table 2 below.

Type	Management
1	Observation, humidification, antibiotics, steroids, anti-reflux medications, voice rest
2	Tracheotomy/intubation, panendoscopy, antibiotics, steroids
3	Panendoscopy, open surgical repair with or without stenting and with or without tracheotomy
4	Panendoscopy, open surgical repair with stenting, with tracheotomy
5	Tracheotomy/intubation, panendoscopy, reconstruction, restoration, or resection with end-to-end anastomosis with or without stenting

Table 2: Suggested management for each type of laryngeal injury [17].

It is important to note that laryngeal trauma infrequently occurs as an isolated injury and there may be concomitant injuries. If there is associated facial trauma, this poses additional difficulties in securing the airway as there may be oedema, bleeding, secretions or loss of bony support, complicating face mask ventilation [18]. Once intubation is considered, the aim is to pass the endotracheal tube across the injured area without precipitating more injury.

Alternatively, tracheostomy aims to gain airway access distal to the site of injury. As in the reported case, Schaefer type 1 minor endolaryngeal injuries can be managed conservatively with antibiotics, steroids, voice rest and anti-reflux medications. However, for more severe Schaefer type 3-5 injuries, open surgical repair will be required to secure a definitive airway. Thus, a systematic classification and management approach is crucial in guiding early decision-making and improving patient outcomes.

Are there any long-term complications?

In studies involving both penetrating and blunt laryngeal trauma, complication rates with regard to chronic airway obstruction have been estimated to be as high as 15-17%, whilst voice compromise occurs in up to 21-25% of cases [12]. There is evidence to suggest that early treatment within 48 hours improves patient outcomes in terms of voice and airway function when compared to delayed treatment. In a reasonable size case series of 112 patients with laryngeal trauma, Butler et al. reported that 28% had good voice outcome with 73% having good airway function in the delayed treatment group. In comparison, significantly better outcomes were noted in the early treatment group, with 78% having good voice outcome and 93% having good airway function [14] and 99% of all patients reported normal swallowing after laryngeal injury.

Key Points

Very mild initial signs and symptoms may occasionally mask a very severe laryngeal injury, ultimately leading to airway compromise or obstruction.

The immediate priority in the treatment of laryngeal injuries is to establish and maintain a stable airway.

Airway evaluation should include flexible fiberoptic laryngoscopy and imaging to allow classification of injury severity; thus guiding treatment planning to improve patient outcomes.

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