Original Article

Laryngeal fractures: a 5-year experience from an Australian major trauma centre

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Background: Laryngeal fractures are uncommon but potentially life-threatening airway injuries. Management is controversial with limited evidence on large-scale outcomes. This retrospective study evaluates clinical presentations, management, and outcomes of laryngeal fractures at a major Australian trauma centre over a five-year period.

Methods: Retrospective single-centre cohort study at a major Australian trauma centre between 2019–2024. Data on demographics, mechanisms of injury, Schaefer classifications, clinical presentations, management, and outcomes [assessed via Voice Handicap Index-10 (VHI-10) scores] were analysed.

Results: Twenty-four patients (23 males, 1 female), with a mean age of 43±14.8 years were included. The most common symptoms were dysphonia (58%), odynophagia (29%), and dysphagia (20%), while 20% were asymptomatic. Motor-vehicle accidents (29%) and blunt force trauma (25%) were the most common mechanisms of injury. Only one patient required emergent intubation for impending airway obstruction. A Schaefer classification of III or IV corresponded highly with operative repair. Twenty fractures were managed conservatively. Three patients underwent open reduction with plate and/or suture fixation between days two to nine, and one underwent microlaryngoscopy and cricoarytenoid joint reduction to restore vocal fold mobility on day three. Outcomes were favourable, with no mortalities and VHI-10 scores ranging from 0 to 38. There was a negative correlation between time to repair and VHI-10 scores for Schaefer IV injuries, although this was not statistically significant (P=0.33).

Conclusions: Laryngeal fractures can be asymptomatic, but presence of odynophagia and dysphonia should prompt high clinical suspicion. All cases should undergo radiological computed tomography (CT) evaluation. This study supports conservative management for most laryngeal fractures whilst highlighting the importance of early surgical intervention for unstable injuries. Repair of unstable and displaced injuries can be challenging; however satisfactory reduction was seen with both polydioxanone and prolene suture repair and plate fixation, even up to nine days following injury. Early microlaryngoscopy and reduction of cricoarytenoid joint subluxation should be considered in vocal fold immobility. Long-term follow-up is essential to evaluate voice and airway patency and patients may require thyroplasty and speech rehabilitation.

Keywords: Laryngeal trauma; voice disorders; airway obstruction; cartilage injuries

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Introduction

Laryngeal fractures are rare but acutely life-threatening injuries that are often underdiagnosed. A recent United States (US) study showed flexible nasal endoscopy (FNE) was only performed in 1.9% of cases (1). Historically, these injuries are managed poorly negatively impacting voice, swallow, and respiratory function with mortality rate quoted as 17.9% (2). Clinical presentation can be variable, with up to a third being initially asymptomatic (3), which can delay diagnosis and management. It is estimated to occur anywhere from one per 5,000–140,000 emergency department visits (4), with a quarter experiencing long-term morbidity from sequelae such as stenosis, dysphonia, or aspiration. Due to their uncommon nature, there is limited evidence available and no best practice (5) with many clinicians lacking experience. Incidence is however increasing in line with motor vehicle accidents, domestic violence and self-inflicted harm (6).

Mechanisms are usually external from a blunt or penetrating trauma but can also arise internally from iatrogenic injury or forceful pressure such as that from a closed-airway sneeze or cough. Hoarseness (85%) and dysphagia (52%) are common symptoms (7). Signs include subcutaneous emphysema, stridor, or a palpable fracture. The Schaefer-Fuhrman classification system is widely used to assess injury severity and guide management (8,9). For stable injuries, typically Schaefer I and II, conservative management includes voice rest, head elevation, steroids, proton-pump inhibitors (PPIs), humidified air, continuous pulse oximetry monitoring, cautious dietary upgrade, and serial FNE. The use of steroids and PPIs are thought to reduce granulation tissue formation in the acute phase, with humidified air to reduce crusting and head elevation to improve oedema. For unstable injuries, i.e., Schaefer III and above, timing of surgical repair is controversial but early repair within 24–48 hours is advised (5). Delays in repair are considered higher risk for formation of granulation and scar tissue, and subsequent airway stenosis.

This retrospective study examines all laryngeal fractures managed by the Ear, Nose, and Throat (ENT) surgical department at a level one major trauma centre in Melbourne, Australia, over a five-year period intending to elucidate clinical presentation, management, and contemporary outcomes. The aim is to review and compare current practice with the literature to optimise recognition and treatment of laryngeal fractures.

Methods

A retrospective analysis of laryngeal fractures managed by the ENT department at The Alfred Hospital (Melbourne, Australia) was performed. All patients admitted with laryngeal trauma between 2019 and 2024 identified via coding in the hospital's trauma registry were included. Patients with incomplete medical records were excluded. Data on demographics, symptoms, mechanism of injury, clinical and radiological findings, and management were collected and analysed in Microsoft Excel. Descriptive statistics were summarised as means ± standard deviation for continuous variables and percentages for categorical variables. Correlation analyses were performed using Spearman's rank test, with significance set at $P<0.05$. Missing data was handled by excluding incomplete records from the analysis to ensure data integrity. Outcome measures were performed with patient-reported outcomes using the Voice Handicap Index-10 (VHI-10) and examination findings. The VHI-10 is a ten-item patient questionnaire assessing impact of voice on quality of life, with scores ranging from 0–40 with higher scores indicating greater perceived handicap (10). All fractures were confirmed radiologically with computed tomography (CT) scans and graded using the Schaefer-Fuhrman classification. The Schaefer-Fuhrman system ranges from grade I to V, with grade I representing oedema or haematoma without fracture and grade V indicating complete laryngotracheal separation (8,9). This review focuses on Schaefer grades II, III, and IV: undisplaced fractures, displaced fractures, and destabilisation of the laryngeal framework with two or more displaced fractures, respectively. Follow-up ranged from ten weeks to thirty-seven months. The study was conducted in compliance with the Declaration of Helsinki (as revised in 2013) and approved by The Alfred Hospital Ethics Committee (Code: EC00315; Project Number: 433/24). Patient confidentiality was maintained by anonymising data, and individual consent for this retrospective analysis was waived. The study is reported according to the STROBE reporting guidelines (available at https://www.theajo.com/article/view/10.21037/ajo-24-78/rc).

Results

A total of 24 laryngeal fractures were recorded during the five-year period (4.8 per year) and summarised in *Table 1*. Nearly all patients were male, with only one female. The

Table 1 Summary of demographics, clinical characteristics, and management of laryngeal fractures

Clinical characteristics	Data (n=24)
Age, years	43±14.75 [24–83]
Sex	
Male	23 (95.83)
Female	1 (4.17)
Mechanism	
Motor vehicle accident	7 (29.2)
Speed recorded (km/h)	91±33.7 [60–160]
Blunt force	6 (25)
Assault	5 (20.8)
Fall	3 (12.5)
Strangulation	1 (4.17)
Waterskiing	1 (4.17)
Snowboarding	1 (4.17)
Type	
Thyroid	16 (66.67)
Thyroid + cricoid	3 (12.5)
Thyroid + hyoid	2 (8.33)
Cricoid	1 (4.17)
Hyoid	2 (8.33)
Fracture lines	
One fracture line	15 (62.5)
Two or more fracture lines	9 (37.5)
Schaefer classification	
II	18 (75)
III	2 (8.33)
IV	4 (16.67)
Symptoms	
Dysphonia	14 (58.33)
Odynophagia	7 (29.17)
Dysphagia	5 (20.83)
Asymptomatic	5 (20.83)
Dyspnoea	1 (4.17)
Haemoptysis	1 (4.17)
Stridor	1 (4.17)
Subcutaneous emphysema	1 (4.17)
Flexible nasal endoscopy findings	
Oedema	5 (20.83)
Haematoma/ecchymosis	15 (62.5)
Vocal cord hypomobility	2 (16.67)
Displacement	1 (4.17)
Laceration	1 (4.17)
Normal	5 (20.83)
Not performed	2 (8.33)
Management	
Conservative	20 (83.33)
Open repair and internal fixation	3 (12.5)
Time to repair (days)	6±3.61 [2–9]
Microlaryngoscopy	1 (4.16)
Time to repair (days)	3
Steroids	11 (45.8)
No steroids	13 (54.2)
Length of hospital stay (days)	8±8.05 [0–27]
Airway	
Intubation	5 (20.83)
Tracheostomy	2 (8.33)
No airway intervention	17 (70.83)

Table summarising patient demographics, mechanisms of injury, fracture characteristics, symptoms, examination findings, and management approaches for 24 patients with laryngeal fractures treated at The Alfred Hospital over a five-year period. Data are presented as n (%) or mean ± standard deviation [range].

mean age was 43±14.8 years (range, 24–83 years).

Clinical characteristics

The most common mechanisms of injury were motor vehicle accident (31.8%), followed by blunt force (22.7%) and assault (18.2%). Blunt force mechanisms included being shouldered or elbowed during sport, falling downstairs, or projectile injury from a high velocity object.

The most common symptoms were dysphonia (58%), odynophagia (29%), and dysphagia (20.8%), with 20.8% being asymptomatic. Haematoma or ecchymosis (62.5%), followed by oedema (20.8%) and normal endoscopic

Table 2 Patient-reported outcomes using VHI-10 scores for all Schaefer III and IV injuries after six weeks post-injury

Schaefer	Management	Method of fixation	Days to fixation	VHI-10 score	Follow-up (months)
IV	Surgical	Combination plate and suture fixation (PDS)	2	38	37.6
IV	Surgical	Plate fixation	7	0	19
IV	Surgical	Suture fixation (prolene)	9	0	9.5
IV	Conservative	–	–	4	9.4
III	Conservative	–	–	2	2.3
III	Surgical	Microlaryngoscopy and reduction of cricoarytenoid joint subluxation	3	0	29

VHI-10 scoring is on a scale from 0–40 with higher scores indicating a greater degree of handicap. Management, method and timing of fixation and follow-up is included. PDS, polydioxanone suture; VHI-10, Voice Handicap Index-10.

appearance (20.8%) were the most frequent findings on FNE. Two patients had vocal fold immobility (8.3%). Two patients did not undergo FNE due to patient refusal. Only one patient had stridor and received emergent intubation.

Fracture characteristics

The thyroid cartilage was the most commonly fractured site (87.5%) with 62.5% of patients exhibiting only one fracture line. The majority were non- or minimally displaced.

Management

Rate of airway intervention was 12.5%. Five were orally intubated: only one was for impending airway obstruction, the remaining four were polytraumas with alternative reasons to secure the airway. Two tracheostomies were performed later for prolonged intubation.

Mean length of hospital stay was 8±8 days (range, 0–27 days). Twenty patients were managed conservatively, three underwent open reduction and internal fixation, and one underwent microlaryngoscopy and reduction of a partially dislocated cricoarytenoid joint. Eleven patients received steroids (46%) with many not receiving steroids (54%) as they were either intubated or referred to ENT more than 48 hours post-injury.

Conservative management was successful in 83.3% of cases, with surgical intervention reserved for Schaefer grade IV fractures. *Table 2* summarises management and outcomes for all Schaefer III and IV fractures. There were three Schaefer IV injuries managed operatively on days 2, 7, and 9 of injury. There was a negative correlation between time to fixation and patient-reported outcome measures using the VHI-10 scale however this was not statistically significant (Spearman $\rho=-0.87$, $P=0.33$). Surgical open repair and internal fixation was performed with either prolene or polydioxanone sutures (PDS), plates and screws, or a combination. Of those repaired, one Schaefer IV injury sustained bilateral displaced thyroid cartilage fractures. They had the anterior third of their vocal cords medialised on initial examination, underwent open reduction and internal fixation with rectangular plates and screws after seven days, and at the two-month follow up they felt their voice was restored but had a lower pitch. Another Schaefer IV had a displaced buckled left thyroid laminae fracture and presented with stridor requiring emergent intubation. This was repaired with a combination of 2/0 PDS and plates within 48 hours. At the five-month follow up they had persistent asthenia and fatiguability and had a significant glottic gap with lateralisation of the left vocal cord. They underwent left injection thyroplasty with hyaluronic acid filler with significant improvement in voice and patient satisfaction. This was repeated a further four times and then patient ceased treatment and avoided social contact. They considered their voice a significant handicap, impacting their employment, personal and social life, and their mental health, scoring 38/40 on their VHI-10 questionnaire. The third Schaefer IV repair sustained an identical fracture pattern and had repair on day nine using 4/0 and 2/0 prolene. They self-reported a deeper, lower-pitched voice at the two-month follow up with a VHI-10 score of zero.

The conservatively managed Schaefer IV had bilateral thyroid cartilage fractures with inward depression of the thyroid notch and a small supraglottic haematoma. They were too frail for operative intervention but underwent serial monitoring and did not require a definitive airway nor

complain of any long-term functional issues. One Schaefer III injury that was managed conservatively had a cricoid fracture with a subglottic haematoma that underwent serial examinations. They developed left vocal cord immobility after 24 hours and received high dose dexamethasone with a PPI. At the six-week follow up they had ongoing unilateral vocal cord immobility and complained of a deeper, croakier voice with difficulty in pitch variation, scoring two on their VHI-10. The second Schaefer III patient sustained a blunt injury from an elbow into their throat and had bilateral thyroid and left cricoid cartilage fractures. They initially had left vocal cord fixation on FNE with left arytenoid subluxation seen on CT and underwent microlaryngoscopy with reduction of the left arytenoid three days after their injury. At the two-week follow-up, they had no haematoma and good vocal cord mobility and reported no issues with their voice with a VHI-10 of zero after two years.

Discussion

Laryngeal fractures were most common in males in their third to fourth decades of life which is consistent with the literature. Our incidence (4.8 per year) is similar to a recent systematic review performed between 2005–2019 which found 5.3 per year, rising from 3.3 per year from 1995–2004 in Finland (6). Prior studies report 64 between 2000–2018 (3.55 per year) (11), 12 between 1998–2008 (1.2 per year) (12), 33 between 1995–2005 in Finland (3.3 per year) (13), 22 between 2000–2010 (2.2 per year) in South Korea (14). Recent US studies report 40–60 cases per 16–18-year study periods (6), suggesting we have a high case load. The largest review using a database of emergency departments in the US found 3,102 between 2009–2011 (1,034 per year) out of 388,904,009 ED visits (1). They proposed the majority of laryngeal fractures are actually incidentally found on radiological scans. In their review, emergent intubation or tracheostomy was rarely reported (2.6% and 0.1% of all cases respectively), with a 3.8% mortality.

Dysphonia and odynophagia were the most consistent symptoms however it is important to recognise that many can be initially asymptomatic and have normal FNE examinations. Examination of the neck should include palpation for tenderness over the larynx, loss of thyroid cartilage prominence, presence of subcutaneous emphysema or ecchymoses over the anterior neck, and voice assessment (15). Concurrent oesophageal injury has also been found in 4–6% of laryngeal fractures (15) and swallow studies should be considered before commencing oral intake.

The majority of fractures were undisplaced or minimally displaced Schaefer II injuries which is likely in part due to protection by the adjacent mandible and sternum and the elasticity of the cartilage (14). The thyroid cartilage was the most commonly injured (87.5%), followed by cricoid (16.67%) which is consistent with Buch's findings of 82% and 24% respectively (16). Cricoid cartilage fractures have been reported to have a mortality rate of up to 40% because of rapid airway obstruction given it is a complete ring (7). Our four patients with cricoid fractures had conservative management and did not require airway intervention. One refused nasal endoscopy and was lost to follow-up, one had a mildly rough, deep voice and delayed vocal cord immobility, and the other was satisfied with their voice long-term but experienced difficulty in raising their pitch. A deep voice and difficulty with pitch elevation was a commonly observed sequela; however, the majority reported minimal psychosocial impact or functional disruption as a result. Vocal fold immobility can be due to arytenoid subluxation and early closed reduction may be necessary to prevent fibrosed fixation (17), although voice therapy alone has also had successful outcomes (18).

Our rate of airway management was 12.5% and this ranges vastly in the literature from 8.2% (5) to 71.6% (11). Schaefer has outlined that orotracheal intubation should only be performed by an experienced anaesthetist when the larynx and trachea are intact and the glottis is visualised on nasal endoscopy (19). This is due to potential risk of cervical spine injuries, oedema, dislocation of fracture fragments, lacerations, creating a false lumen, and potentially destabilising the airway. Even minor disruptions can result in long-term effects on phonation, swallowing and airway patency (20). One patient who sustained a minimally displaced thyroid cartilage fracture with a haematoma extending from their right aryepiglottic fold to their right arytenoid, vestibular fold, and vocal fold, was intubated on scene for reduced consciousness and managed conservatively. At the two-week follow up, they reported worsening shortness of breath and a rough, husky voice. It remains unclear whether orotracheal intubation contributed to further laryngeal disruption, and the low incidence of airway intervention in this study makes this difficult to evaluate. Traditionally, tracheostomy has been favoured over oral intubation for airway procurement to prevent further potential damage (2,21). Tracheostomy within 24 hours has been recommended to secure the airway and reduce length of stay (21). The only two patients who had tracheostomies

in our hospital were for prolonged intubation and unrelated to airway stability.

The initial goal of management is airway protection and restoration of laryngeal structure and function, with long-term management goals centred on voice and respiratory function. Observation for all injuries is recommended for at least 24–48 hours with pulse oximetry to ensure airway stability (5). A recent systematic review proposed surgical intervention is necessary for Schaefer groups III–IV (5), however we found it only pertinent for Schaefer IV. Butler also suggested Schaefer III and above undergo surgical exploration and repair with stenting for 2–6 weeks (22), although stents have become unfavourable due to risks of infection, granulation, and necrosis (5). Early fixation for Schaefer III–IV injuries within 48 hours has previously shown to have significantly better outcomes for voice and airway function (58% with good voice and 87% with good airway function in those receiving operative repair within 48 hours, versus 22% and 55% respectively in the delayed treatment group) (22). Delaying timing of repair beyond 24–48 hours has concerns of increased granulation, risk of stenosis, dysphonia and aspiration (8,23). Microlaryngoscopy is recommended at the time of repair to allow for thorough evaluation, drainage of haematomas, repair of selected lacerations or dislocated cricoarytenoid joints, and stents to prevent adhesions. Our repairs were fixed on days 2, 7 and 9. There was no significant correlation between time to fixation and patient-reported outcome measures using the VHI-10 scale, with satisfactory results seen in repair delayed up to 9 days. Both plate and suture fixation yielded satisfactory results with VHI-10 scores of zero. We did not identify any complications such as scarring or stenosis in our patients who had repair delayed beyond 48 hours of injury. Reduction of a partially dislocated cricoarytenoid joint on day three resulted in restoration of vocal fold mobility with a VHI-10 score of zero after two years of follow-up.

Repairing cartilage can be technically challenging and typically only performed to reduce and stabilise displaced, unstable fractures. Miniplate fixation is theorised to be superior as it promotes cartilaginous union, whereas wire and suture fixation heal by fibrous union (24). A recent systematic review however shows a shift towards suture fixation (5). Alternative methods of fixation include resorbable plates, bioabsorbable or titanium plate fixation, epiglottectomy, laryngotracheal anastomosis, muscle flap, thyroid alar rim graft, debridement, and endolaryngeal stenting (5).

Our centre has the benefit of a high rate of trauma CT scans on presentation that can diagnose laryngeal fractures early. Overall, a Schaefer classification of IV corresponded highly with operative repair. The clinical presentation and degree of displacement radiologically determined airway instability and likelihood of undergoing fixation. The majority of laryngeal fractures were stable and managed conservatively with serial FNE over a 24-hour period, with a low threshold to administer high-dose steroids. Our mortality rate was zero. Only one required emergent intervention to secure their airway and it is unclear whether orotracheal intubation in fractures caused adverse sequelae. Our review is limited by being a retrospective, small, single-centre study, lacking on large-scale outcomes of surgically repaired injuries given the low incidence of unstable fractures. The VHI-10 is of the most validated and commonly used patient-reported outcome measures, however it is a subjective assessment that focuses on individual perspective on functionality and socioeconomic impact. It can be prone to polarisation of scoring and may not identify all voice impediments due to lack of specificity. A review evaluating long-term morbidity and strategies to optimise laryngeal function long-term is necessary considering these are usually younger patients of working age.

Conclusions

Laryngeal fractures can be asymptomatic, but presence of odynophagia and dysphonia should prompt high clinical suspicion. All should be evaluated radiologically with CT scans. Schaefer classification corresponded highly with instability and requirement for intervention. The majority of fractures were stable and managed conservatively without any airway intervention. Our recommendation is at least 24 hours of airway monitoring with serial FNE, high-dose steroids and PPIs. For unstable and displaced Schaefer IV injuries, repair can be challenging but satisfactory reduction was seen with both prolene and PDS suture repair and plate fixation up to nine days post-injury. Early microlaryngoscopy and reduction of cricoarytenoid joint subluxation should be considered in vocal fold immobility. All patients should be followed up to evaluate their voice and airway patency and may require thyroplasty and speech rehabilitation.

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Footnote

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References

1. Sethi RKV, Khatib D, Kligerman M, et al. Laryngeal fracture presentation and management in United States emergency rooms. Laryngoscope 2019;129:2341-6.
2. Schaefer N, Griffin A, Gerhardy B, et al. Early recognition and management of laryngeal fracture: a case report. Ochsner J 2014;14:264-5.
3. Back MR, Baumgartner FJ, Klein SR. Detection and evaluation of aerodigestive tract injuries caused by cervical and transmediastinal gunshot wounds. J Trauma 1997;42:680-6.
4. Jewett BS, Shockley WW, Rutledge R. External laryngeal trauma analysis of 392 patients. Arch Otolaryngol Head Neck Surg 1999;125:877-80.
5. Moroco AE, Patel VA, Saadi RA, et al. Systematic Review of Laryngeal Fractures and Trends in Operative Management. Craniomaxillofac Trauma Reconstr 2023;16:62-9.
6. Mäkitie RE, Nyman K, Ilmarinen T, et al. Changes in occurrence and management of laryngeal fractures at the Helsinki University Hospital during 25 years. Eur Arch Otorhinolaryngol 2024;281:915-24.
7. Rai S, Anjum F. Laryngeal Fracture. 2023 Aug 14. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
8. Schaefer SD. Primary management of laryngeal trauma. Ann Otol Rhinol Laryngol 1982;91:399-402.
9. Fuhrman GM, Stieg FH 3rd, Buerk CA. Blunt laryngeal trauma: classification and management protocol. J Trauma 1990;30:87-92.
10. Rosen CA, Lee AS, Osborne J, et al. Development and validation of the voice handicap index-10. Laryngoscope 2004;114:1549-56.
11. Bourdillon AT, Kafle S, Salehi PP, et al. Characterization of Laryngotracheal Fractures and Repairs: A TQIP Study. J Voice 2024;38:1450-7.
12. Jalisi S, Zoccoli M. Management of laryngeal fractures--a 10-year experience. J Voice 2011;25:473-9.
13. Juutilainen M, Vintturi J, Robinson S, et al. Laryngeal fractures: clinical findings and considerations on suboptimal outcome. Acta Otolaryngol 2008;128:213-8.
14. Kim JP, Cho SJ, Son HY, et al. Analysis of clinical feature and management of laryngeal fracture: recent 22 case review. Yonsei Med J 2012;53:992-8.
15. Shaker K, Winters R, Jones EB. Laryngeal Injury. [Updated 2023 Jul 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.
16. Buch K, Takumi K, Curtin HD, et al. CT-based assessment of laryngeal fracture patterns and associated soft tissue abnormality. Eur Radiol 2021;31:5212-21.
17. Lombardi RA, Arthur ME. Arytenoid Subluxation. [Updated 2023 Jun 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024.

18. Friedlander E, Pascual PM, Da Costa Belisario J, et al. Subluxation of the Cricoarytenoid Joint After External Laryngeal Trauma: A Rare Case and Review of the Literature. Indian J Otolaryngol Head Neck Surg 2017;69:130-2.
19. Schaefer SD. The acute management of external laryngeal trauma. A 27-year experience. Arch Otolaryngol Head Neck Surg 1992;118:598-604.
20. Hwang SY, Yeak SC. Management dilemmas in laryngeal trauma. J Laryngol Otol 2004;118:325-8.
21. Mendelsohn AH, Sidell DR, Berke GS, et al. Optimal timing of surgical intervention following adult laryngeal trauma. Laryngoscope 2011;121:2122-7.
22. Butler AP, Wood BP, O'Rourke AK, et al. Acute external laryngeal trauma: experience with 112 patients. Ann Otol Rhinol Laryngol 2005;114:361-8.
23. Bent JP 3rd, Silver JR, Porubsky ES. Acute laryngeal trauma: a review of 77 patients. Otolaryngol Head Neck Surg 1993;109:441-9.
24. Sniezek JC, Thomas RW. Laryngeal Trauma. In: Resident Manual of Trauma to the Face, Head and Neck. 1st ed. American Academy of Otolaryngology, 2012; pp 177-87.

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