

Outcome analysis of Post-traumatic Laryngotracheal Injury Repair (Retrospective Case Series)

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Abstract:Introduction:Laryngotracheal injury is one of the rare of presentation of head and neck trauma. Traumatic injuries to larynx can be grouped as blunt trauma neck or penetrating injury neck. In previous reports , majority of injuries to larynx secondary to accidents were due to blunt trauma neck.Due to change in urban lifestyle and use of seat belts , the incidence of blunt trauma neck has reduced and that of penetrating injury neck is on the rise .Mortality rates from laryngotracheal injury range from 2-18%.In this single institutional case series , the patients presenting to our hospital with laryngotracheal injury had been studied. Aim : The aim of this case series is to study the various outcomes after laryngotracheal injury repair Methodology : All patients with laryngotracheal injury presenting to Emergency services between September 2015 and October 2017 have been recruited into the study and the outcomes are studied. A total of 20 patients have been studied. The outcome variables studied are rates of decannulation , voice restoration , duration of hospital stay , use of stenting , need for single or staged surgery. Results: 19 out of 20 patients underwent single stage surgery except 1 patient who had to undergo staged procedure. Average number of hospital stay was 12 days, Minimum duration being 4 days for Grade I, Maximum duration being 41 days for Grade IV. Grade IV injury patients after discharge had multiple out patient visits upto a period of 1-2 months . All patients had Ryles tube removed on Postoperative day five. 16 patients were successfully decannulated and 3 are still tracheostomised and under follow up. Successful decannulation rate of 80 % was observed in our series. Voice restoration achieved in all 16 patients who were decannulated. 80 % success rate was achieved in voice restoration. Conclusion: Though laryngotracheal injury is uncommon and a life threatening injury , if management is planned according to the Schaefer-Fuhrman grading system successful decannulation and voice restoration rates are possible. Systematic approach and timely management is required for a favourable outcome. [Manu B SEAJCRR 2017; 7(43):9-13]

Key Words: post traumatic, Laryngotraheal Injury, closing

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Introduction: The laryngotracheal structures are delicate structures and provide vital functions like protection of lower airway , breathing , voice and swallowing.Injury to the laryngotracheal framework can be life-threatening , hence knowledge on expert and timely management is crucial.

Patients with suspicion of laryngotracheal injury are history of trauma to neck, voice change ,breathing difficulty, aspiration / swallowing difficulty, coughing / vomiting blood .Patients with suspicion of laryngotracheal injury ,Dysphonia ,Signs of injury in neck – ecchymosis , laceration involving neck ,Signs of impending airway obstruction, Subcutaneous emphysema, Tenderness over laryngotracheal framework.

Traumatic injuries to larynx can be grouped as blunt trauma neck or penetrating injury neck¹. In previous

reports , majority of injuries to larynx secondary to accidents were due to blunt trauma neck².

Due to change in urban lifestyle and use of seat belts , the incidence of blunt trauma neck has reduced and that of penetrating injury neck is on the rise .Mortality rates from laryngotracheal injury range from 2-18%³

Aims: The aim of this case series is to study the various outcomes after laryngotracheal injury repair.

Material and Methods: All patients with laryngotracheal injury presenting to Emergency services between September 2015 and October 2017 have been recruited into the study and the outcomes of total of 20 patients have been studied.

The outcome variables studied are rates of decannulation , voice restoration , duration of hospital stay , use of stenting , need for single or staged surgery.

Patients with airway compromise and exposed airway due to penetrating injury neck underwent emergency tracheostomy. The primary objective at this stage was to secure airway and to prevent aspiration. Further management was based on the severity of the injury

Table 1 : Grading of severity of injury(Schaefer-Fuhrman)

Group	Severity	Treatment
1	Minor endolaryngeal haematoma / laceration without fractures	Observation Humidified air Head of bed elevation +/- Steroids
2	More severe oedema/haematoma/minor mucosa disruption without exposed cartilage/undisplaced fractures	Direct laryngoscopy Oesophagoscopy +/- Tracheostomy +/- Steroids
3	Massive oedema /large mucosal lacerations/exposed cartilage/unstable fracture /vocal cord immobility	Tracheostomy Direct laryngoscopy Oesophagoscopy Exploration/repair No stent necessary
4	More severe Group 3, disruption of anterior larynx/unstable fracture/ two or more fracture lines/severe mucosal injuries (patients with partial cricotracheal separation have been included in this group)	Tracheostomy Direct laryngoscopy Oesophagoscopy Exploration/repair Stent required
5	Complete laryngotracheal separation	Tracheostomy Complex laryngotracheal repair

Patients underwent the following investigations

- Chest x-ray
- USG neck was avoided to avoid dislodgement of blood clots
- X ray soft tissue neck or Contrast enhanced CT scan of neck
- Flexible fiberoptic laryngoscopy (Endoscopic assessment was undertaken either on the same day of presentation or after definitive surgery)

Results: Total no. of cases : 20.

Male : Female ratio = 19:1.

Age group : 17-56 years . Detail results are displayed in following table

Table 2 : Type of injury

S.no.	Type of injury	No. of patients (percentage)
1	Blunt trauma neck	7 (35%)
2	Penetrating injury neck	13 (65 %)

Table 3: Zone of injury

S.No.	Zone of Injury	No. of patients
1	I	1
2	II	12
3	III	1

Management after evaluation of Blunt trauma neck (n=7) only Tracheostomy was done 6, Tracheostomy and neck exploration was required for one patient. And that of Penetrating neck injury (n=13) Only tracheostomy was done for one patient, Tracheostomy and neck exploration was done for 11 patients and only Neck exploration for one patient

Table 4 : Grade of injury and percentage of occurrence in our series

S.No.	Grade of injury	No.of patients (percentage)
1	Grade I	1 (5%)
2	Grade II	5 (25%)
3	Grade III	7 (35%)
4	Grade IV	7 (35%)
5	Grade V	0

Protocol for different grade of injury : Grade I:

Patients with only neck laceration and no or minimal airway injury (Grade I) should undergo Contrast enhanced CT scan to rule out any associated injury to great vessels , oesophagus. Such patients' wound was sutured primarily and observed for any breathing difficulty with administration of humidified oxygen , IV steroids , IV antibiotics , anti-reflux treatment using IV Proton pump inhibitors.(Figure 1)

Grade II: All Grade II patients underwent Emergency tracheostomy as all these patients had subcutaneous emphysema from the lower border of mandible till the suprasternal notch. These patients had Ryles tube

inserted to provide rest to larynx by avoiding swallowing.(Figure 2)

Grade III: All Grade III patients underwent emergency tracheostomy. Most of Grade III patients (71%) required neck exploration in addition to emergency tracheostomy. These patients had large lacerations and displaced cartilage fractures .(Figure 3)

Figure 1 :Grade 1 injury with hematoma

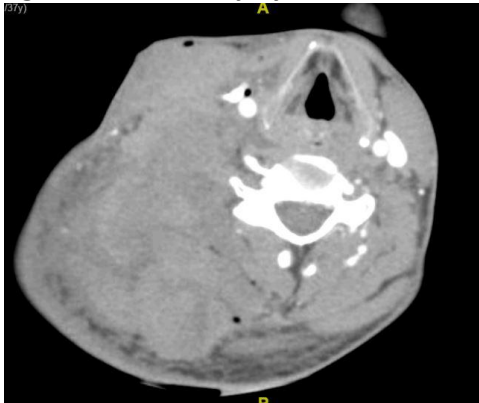


Figure 2 : Grade II injury with subcutaneous emphysema

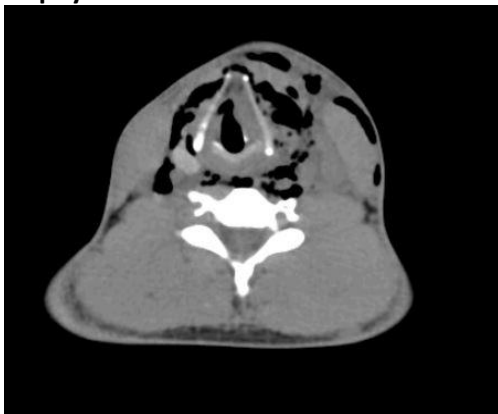
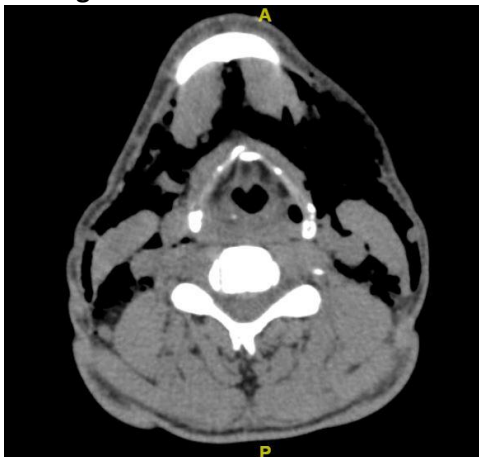


Figure 3: Grade III injury with displaced thyroid cartilage fracture and subcutaneous emphysema



During neck exploration and larynx repair , wound swab/tissue bits from exposed laryngeal cartilage framework was sent for culture sensitivity. Cartilage pieces without any viable mucosa was debrided .Cut ends of mucosa was sutured with 3-0 vicryl , membrane with 3-0 vicryl , muscle with 3-0 vicryl. Fractured cartilages were kept in approximating position using 2-0 prolene sutures which were taken in perichondrial plane connecting the two cartilages. (Figure 4)

Grade IV: All Grade IV patients underwent emergency tracheostomy and neck exploration with larynx repair. Emergency tracheostomy was performed bedside under local anaesthesia following which these patients underwent neck exploration under general anaesthesia in operating room. (Figure 5)

Figure 4 : Intraoperative image showing shattered anterior larynx



Figure 5 : Grade IV injury with damaged anterior larynx



Patients who had extensive mucosal injury and anterior larynx damage first underwent debridement to remove cartilage pieces without viable mucosa.

Anterior commissure was then sutured by suturing the damaged vocal cord. Mucosa was then sutured using 3-0 vicryl followed by cartilage repair and membrane repair. Membrane repair (thyrohyoid membrane, cricothyroid membrane, cricotracheal membrane) was done externally. The laryngeal cartilage framework was strengthened and the tension in suture line was reduced using 2-0 Prolene sutures in perichondrial plane.

Patients with partial laryngotracheal separation after primary suturing had thyroid gland mobilised and brought in front of the defect. Strap muscles were sutured using 3-0 vicryl. These measures were made in an attempt to aid healing of the defect. Stenting was used in three cases of Grade IV injury. Nasotracheal tube was inserted intraoperatively and was positioned at the level of thyroid-cricoid cartilage. Stent was removed on Post Operative Day 2 or 3. Suction Drains were kept in injuries which were large and were usually removed in Post Operative Day-3. Skin sutured with 3-0 prolene and hammock sutures using 2-0 silk was taken to maintain the neck in flexion and to relieve tension in suture lines. Hammock sutures were removed on Post Operative Day-3. (Figure 6)

Figure 6: After repair



Outcome analysis : 19 out of 20 patients underwent single stage surgery. 1 out of 20 patients required surgery in 4 stages. Emergency tracheostomy with neck exploration and larynx repair. MLS assisted laser excision and dilatation of posterior glottic and subglottic band. Endoscopic dilatation of Grade I stenosis in II, III tracheal rings. Endoscopic dilatation of Grade I stenosis in II, III tracheal rings.

Average number of hospital stay was 12 days. Minimum duration being 4 days for Grade I. Maximum duration being 41 days for Grade IV. Grade IV injury patients after discharge had multiple outpatient visits

upto a period of 1-2 months. All patients had Ryles tube removed on Postoperative day 5.

Decannulation rate in our series 16 patients were successfully decannulated and 3 are still tracheostomised and under follow up. Successful decannulation rate of 80 % was observed in our series. Voice restoration achieved in all 16 patients who were decannulated. 80 % success rate was achieved in voice restoration.

Before decannulation, patients underwent endoscopic assessment (flexible / rigid 0 degree) to visualize the vocal cords, mobility, glottic chink adequacy. NCCT neck was undertaken to rule out any granulation/stenosis. Patient's tracheostomy tube was changed to Fullers and was downsized to size 28 Fr. Trial block was given and patients were observed during the daytime. Patients were then admitted and was given trial block in night time and if tolerated, closure of tracheocutaneous fistula was done

Discussion: Blunt laryngeal trauma secondary to sporting injuries was analyzed by Mendis et al⁴ and found out that Out of 13 patients with Grade I, II, III injuries, 9 underwent surgery and 4 managed conservatively. Rate of decannulation and voice restoration was 83%. Our results were very much comparing with decannulation and voice restoration rate of 80%.

Neck Trauma ENT Prospects by kavitha et al⁵ analyzed 17 patients with laryngotracheal injuries and discussed the management plan undertaken and postoperative complications. 12 patients underwent tracheostomy. Voice restoration was not studied as there was loss of patients to follow up.

Shire et al⁶ in their Pediatric laryngeal trauma: a case series at a tertiary children's hospital concluded that Dyspnea is not indicator of severity and computed tomography added very little information on laryngeal injury. Surgical exploration is recommended for blunt trauma neck patients. Intubation via orotracheal route is less traumatic. But in our study we strongly recommend a temporary tracheostomy for all patients with suspected trauma to neck as intubation from above causes more mucosal injury to larynx.

Schaefer SD et al⁷ in their Management of acute blunt and penetrating external laryngeal trauma had

concluded that Optimal treatment of acute laryngeal trauma includes early identification of injuries utilizing a directed history and physical examination. Timely management of the wounded airway is essential. The choice of intubation, tracheotomy, or cricothyrotomy must be individualized. Computed tomography (CT) may assist in differentiating patients who can be observed versus those who require surgical exploration. In selected patients, laryngeal electromyography and stroboscopy may also be useful. Surgery should begin with direct laryngoscopy and rigid esophagoscopy to evaluate the hard and soft tissues of the larynx, and to visualize the pharynx and esophagus. Minor endolaryngeal lacerations and abrasions may be observed, whereas more significant injuries require primary closure via a thyrotomy. Laryngeal skeletal fractures should be reduced and fixated. Laryngeal stenting is reversed for massive mucosal trauma, multiple fracture of thyroid and traumatic anterior commissure disruption.

Stanley RB et al⁸ in their Manual strangulation injuries of the larynx concluded that Laryngeal injuries secondary to manual strangulation are seen more often by the forensic pathologist than by the otolaryngologist. Forces sufficient to cause thyroid and cricoid cartilage fractures are usually sufficient to cause acute asphyxia and death. Computed tomography seems to be an excellent noninvasive technique to evaluate and verify cartilaginous laryngeal fractures and soft-tissue injury. Recognition of the potential for such injuries is the key to management and treatment.

Durao et al⁹ Management of laryngeal trauma: Case reports and literature review concluded that Laryngeal trauma is a rare injury and may result in lifelong complications or even death if diagnosis or treatment is delayed. Directed history, physical examination, laryngeal endoscopy and CT imaging help to delineate injuries and course of treatment. The choice of intubation, tracheotomy, cricothyrotomy and surgical repair must be individualized. Sufficient experience now exists to recommend specific treatments, and to preserve voice and airway function Bryan et al¹⁰ management of laryngeal trauma had concluded that fracture of larynx are rarely associated with maxillofacial injury. So proper evaluation of laryngeal trauma and timely management from an important role in management of maxillofacial injury.

Conclusion: Though laryngotracheal injury is uncommon and a life threatening injury, if management is planned according to the Schaefer-Fuhrman grading system successful decannulation and voice restoration rates are possible. Systematic approach and timely management is required for a favourable outcome.

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