Management of Laryngotracheal Trauma During the COVID 19 Pandemic: Our Experience

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Abstract  Objective To study the outcomes in terms of airway, voice and swallowing as well as the economic impact of the trauma on patients’ finances and the constrained health infrastructure due to the pandemic.

Materials and methods Study design Retrospective study. Setting: Tertiary care teaching hospital. Subjects and methods: A retrospective study was done of the 19 subjects who sustained acute laryngotracheal trauma during the SARS CoV-2 pandemic and was managed at our institution from January 2020 to September 2021.

Results Change in voice was the most common presenting symptom and thyroid cartilage fractures were the commonest cartilage injury noted. It was found that 93% (decannulated) of the patients had good functional outcome and 90% of them required financial support to meet the medical expenses.

Conclusion During the COVID 19 pandemic, it was not only, early presentation, timely detection and intervention by the treating team, but also the multidisciplinary teamwork and the support system that facilitated the recuperation and restoration of these traumatized individuals back into society with good laryngeal function.

Keywords  Wounds · Non-penetrating injuries · Non-penetrating wounds · Penetrating wounds · Blunt injuries · Neck injuries · Deliberate self-harm · Tracheostomy · SARS-CoV-2 · COVID -19

Abbreviations
SARS-CoV-2  Severe acute respiratory syndrome corona virus 2
DSH  Deliberate self harm
SARI  Severe acute respiratory infections

Introduction

In India about 2.16% of the patients with head and neck injuries require hospitalisation [1, 2]. Laryngotracheal injuries are considered a life-threatening emergency as airway obstruction can cause irreversible brain damage or death within minutes [3, 4]. Considerable force is required to cause alteration to this relatively mobile framework. Disruption of the well protected laryngotracheal framework interferes with normal breathing, phonation and swallowing thereby affecting the patient’s quality of life. Blunt trauma contributes to more than 60% of these injuries [1]. The management protocol for laryngotracheal injuries begin with assessing the airway irrespective of the type of injury. Early recognition
of an impending airway occlusion and intervention timing are major determinants of a good outcome [5]. The present study aimed at assessing the management outcome of laryngotracheal injuries in terms of patient’s airway, voice and swallowing as well as the financial burden on patient and their families and the stretched health infrastructure during the pandemic.

India experienced a major sociodemographic and technological transition during the SARS CoV 2 pandemic. The greatest challenge it faced was to find the fine balance between lives and livelihood. Restrictions imposed led to rapid decline in income for families that could not telework [6]. In a country, where the majority of the people lack health insurance coverage and pay their hospital bills, obtaining quality medical and timely emergency care is always a challenge for those in the lower socioeconomic group [7]. The health infrastructure during the pandemic with scarce resources and overstretched health care workers (HCWs) struggled to cope with the influx of patients. Injuries (e.g., acute laryngotracheal trauma) result from a sudden exposure to an external energy and can be influenced by social, environmental, cultural or biological factors [8]. Injuries are differentiated from other health conditions due to its acuteness, varying severity, interaction between agent-host – environment and their chance of repetitiveness [9]. Prevention, acute care and rehabilitation of other illnesses took a backseat worldwide as the attention shifted to the control of the COVID pandemic and management of SARS CoV 2 infection [10].

Subjects and Methods

A retrospective study was conducted in accordance with the applicable regulatory requirements after the institutional review board approval (IRB Min No.14410 dated 22.12.2021). Subjects with laryngotracheal injuries between January 2020 – September 2021 treated by the Laryngology unit of the Department of ENT in a university affiliated teaching hospital in South India were included in this study. Each subject’s demographic data, type and mode of injury, clinical, endoscopic and radiological examination details, concomitant injuries, comorbid illness, severity of the injury, type of management offered, complications, socioeconomic status, length of hospital stay and their financial capacity to meet this unexpected crisis was looked at.

Statistical Methods

The collated data was summarised and the statistical analysis was performed using STATA/IC 15.0 software.

| Table 1  | Demographic data |
|--------------------------|-------------------|
| Characteristic          | N (%)             |
| Mean age in years       | 39                |
| Sex                      |                   |
| Male                     | 15 (79%)          |
| Female                   | 4 (21%)           |
| Presentation             |                   |
| Primary                  | 6 (32%)           |
| Referred                 | 13 (68%)          |
| Timing of presentation   |                   |
| <24 h                    | 16 (84%)          |
| >24 h                    | 3 (16%)           |
| Type of injury           |                   |
| Blunt                    | 10 (53%)          |
| Penetrating              | 9 (47%)           |
| COVID status             |                   |
| Negative                 | 11 (58%)          |
| Not known                | 8 (42%)           |
| Total number of subjects | 19                |

Results

Nineteen subjects (15 Male and 4 female) with a mean age of 39 years (range 16–75 years), all of whom lived within 100 kms of the hospital had been treated for laryngotracheal injuries. Six had presented directly to our Emergency Department (ED) and 13 were referred after primary care. Sixteen reached within 24 h of the injury whereas the other three presented after. 58% of the subjects were confirmed to be COVID negative during treatment, the status was unknown in the others as screening was not mandatory then. The demographic profile and baseline characteristics are presented in Table 1.

Aetiology (Tables 1 and 2)

Ten subjects suffered injuries due to blunt trauma while the other nine subjects had penetrating injuries with road traffic accidents (36.8%) being the commonest mode of injury followed by deliberate self-harm (21%) Figs. 1A and B.

Closed neck injuries were seen in 53% of the patients with laryngotracheal injuries. Among the penetrating injuries (47%), 78% (n = 7) laryngotracheal injuries occurred in Christensen’s neck zone 2 with 11% each involving zone 1 and 3.

Signs and Symptoms

The clinical presentation at primary survey by the ENT team varied depending on the type, mode and degree of injury. Change in voice (n = 15) was the most common
presenting symptom, others were bleeding, dyspnoea, dysphagia, odynophagia, neck pain and neck swelling. Subcutaneous emphysema was seen in 10 subjects indicating a breach in the airway.

Table 2 Mode of injury sustained and the type of injury

| Mode of injury | Type of injury | Blunt | Penetrating |
|----------------|----------------|-------|-------------|
| 1  Accidental   |                |       | 13 (68%)    |
| Road traffic    | 6              | 1     |             |
| Strangulation (Cloth) | 2       |    |             |
| Domestic (child play) | 1     | 0   |             |
| Bull gore       | 3              | 0     |             |
| 2  DSH*(Suicidal) | 0           | 4     | 4 (21%)     |
| 3  Assault (Homicidal) | 1       | 1     | 2 (11%)     |

*DSH-Deliberate self-harm

Fig. 1  A Deliberate self-harm with hesitation cuts and a lacerated neck wound with an endotracheal tube through the breached thyrohyoid membrane and a paramedian vertical fracture line on the left lamina of the thyroid cartilage. B Endoscopy showed an edematous epiglottis detached from its attachment to the thyroid cartilage

Fig. 2  A CECT Neck image sagittal view-Endotracheal tube seen in-situ through the disrupted thyrohyoid membrane (white arrow) in the patient with the findings shown in Fig. 1A and B. B CECT Neck axial view-Fractured cricoid cartilage: showing the impacted and inwardly displaced fractures of the lateral portion of cricoid cartilage (white arrow) at the junction of the arch and the lamina on both sides

Evaluation

At arrival all the subjects were evaluated by the team at the emergency department (ED) for injuries and the possibility of SARS-CoV-2 infection. Since COVID status reporting of the nasopharyngeal sampling took almost > 4 h, and due to the high infectivity rate of the SARS CoV2 virus, patients were cohort into “COVID-suspect zones” and “green zones” based on the presence or absence of SARS CoV2 symptoms and the recording of their temperature and oxygen saturation levels. Separate donning and doffing areas were earmarked for HCWs working in these zones [11].

Primary laryngeal assessment at the ED was done clinically with flexible laryngoscopy whenever feasible (n = 11, 58%) and imaging (n = 16, 84%) in subjects with stable airway Figs. 2A and B.

During the primary survey, 8 subjects were found to have the following concomitant injuries: maxillofacial (n = 4), chest (n = 2), spine (n = 2), skull base (n = 1), intracranial
(n = 2), brachial plexus (n = 1) and axial skeletal injuries (n = 2).

**Treatment**

Our primary goal was to secure and safeguard the airway in all the patients with acute laryngotracheal trauma. This was done prior to detailed evaluation and surgical exploration. Only 2 patients had stable airway that could be managed conservatively with humidification, antibiotics, steroids and anti-reflux measures. The other subjects had their airway secured either by endotracheal intubation (n = 7) or tracheostomy (n = 10) before direct laryngoscopy (n = 13), esophagoscopy (n = 8) and neck exploration. Over three fourth (84%) of the subjects were tracheostomised. The severity of the injuries and their treatment strategies were in accordance with Schaefer Fuhrman’s grading [12]. The injuries observed during surgical exploration are mentioned in Table 3.

The membranous defects and displaced or fractured cartilages were approximated using absorbable sutures (polyglactin). The airway was stented with endotracheal tubes in two subjects with grade 3 blunt injury.

Looking at the socioeconomic status according to Modified Kuppusamy’s scale [13], nearly half the subjects (n = 9; 47%) fell into the Upper lower class. The remaining belonged to the Lower middle (n = 5; 26%), Upper (n = 4; 21%) and Lower (n = 1; 6%) classes. The patient’s ability to meet the total hospital expenses incurred for the management is shown in Fig. 3. Only 10.5% were able to meet the expenses completely despite the admission period being less than 2 weeks in 89.6%.

**Complications (Table 4)**

The complications observed were classified based on the damage to the vital structures in the high-risk zone and tabulated as direct consequence of trauma or indirect/repercussions during the hospital stay. Vocal fold dysfunction was noted among 42% (n = 8) of the subjects.

**Outcomes (Tables 4 and 5)**

A vigilant follow up was done for a period ranging from 6 months to 2 years. The decannulation rate observed in our study was 93%. The voice quality was good in 11 subjects and the other five have communicable voice.

Six subjects required alternate feeding during the first week (four had aspiration, one was on ventilator support and the other required it because of the intermaxillary fixation

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**Table 3** Injuries observed during surgical exploration

| Laryngeal framework injuries | Numbers involved (n) |
|-----------------------------|----------------------|
| Epiglottis                  |                      |
| Avulsion                    | 4                    |
| Thyroid cartilage #         |                      |
| Undisplaced                 | 3                    |
| Displaced                   | 4                    |
| Comminuted                  | 1                    |
| Cricoid cartilage #         |                      |
| Stable                      | 1                    |
| Unstable                    | 1                    |
| Cricotracheal separation    | 1                    |
| Trachea                     |                      |
| Fracture                    | 2                    |
| Thyrohyoid membrane         | 4                    |
| Cricothyroid membrane       | 1                    |

**Fig. 3** Financial ability of the subject to settle the hospital bill
for maxillomandibular complex fracture). One subject with severe hypoxic injury, is still undergoing rehabilitation hence is tracheostomy dependent for airway protection and on nasogastric feeding. One subject with hypoxic injury died despite supportive treatment.

**Discussion**

The cornerstone in management of acute laryngotracheal trauma is securing a stable airway following which one’s focus can be directed to addressing the injuries sustained. This study is the first to report on the outcome of management of external laryngotracheal trauma during the COVID-19 pandemic.

External laryngotracheal trauma is infrequent but can be life threatening due to injuries to the adjacent aero digestive system and the neurovascular system. Management of these injuries are often a great challenge yet extremely gratifying. The type of such injuries seen may have regional differences too like for instance bull gore injury at Jallikattu in Southern India during Pongal festivities [5]. Blunt trauma due to road traffic accidents are the most common cause worldwide [1, 8]. The presentation could be contrasting between a penetrating and blunt injury with penetrating injuries being obvious while blunt injuries can appear subtle and become overt with time.

Interestingly during the COVID 19 pandemic, despite imposed travel restrictions including mandatory quarantine and a prolonged lockdown to minimize the risk of virus transmission, road traffic accidents (42%) still remained the single highest cause of laryngotracheal injuries as in non-pandemic times [14–16]. This was followed by deliberate self-harm (16%).

The lockdown during the COVID 19 pandemic led to job losses and increased unemployment, causing financial difficulties to meet daily needs and the loneliness and isolation affected mental health [7]. The prevalence of anxiety and depression among those who were quarantined or whose family members were quarantined during the COVID-19 outbreak, was high [17, 18]. A linear relationship between the lockdown and effect on the mental health has been reported by Fountoulakis et al. [19]. Three out of the four subjects (75%) with self-inflicted injury had no prior mental health illness and the deliberate self-harm was directly related to loss of employment due to COVID as noted by Posel et al. too [20].

As seen in two female subjects in this study, traditional Indian attire increases the risk for accidental strangulation due to entanglement of neck stoles (dupatta), headscarf or sarees in the machinery at workplace as well as while riding a two wheeler [15, 21]. 80% of these subjects were males exposed to outdoor activities and therefore subject to greater risk on the roads [22–24]. The mean age of the subjects who sustained laryngotracheal trauma was 39 years; the fourth decade being considered to be the highly productive period [25].

Blunt injury was seen in just over half the number of patients (53%). These were due to the violent impact of the blunt trauma causing soft tissue injury leaving the skin intact. Delay in diagnosis of blunt laryngeal trauma occurs as the clinical signs are often subtle and these subjects may present only with soft signs and imaging enables early intervention and improved outcomes [9]. Addressing the laryngotracheal framework armoured with the information obtained from the axial multidetector computed tomography (MDCT) and the on-table assessment can prevent poor outcomes like a compromised airway and poor voice [23, 26, 27].

Two subjects who developed hypoxic ischemic injury had closed neck injuries. The first subject’s symptom evolved over 48 h, had acute respiratory arrest, intubated yet sustained hypoxic injury before reaching our hospital, responded poorly to the supportive treatment and died. The second subject with Schaefer Fuhrman’s grade 5 injury in the neck zone 1 who presented after 11 h in respiratory distress (critical airway because of a near complete laryngotracheal separation), suffered a cardio-pulmonary arrest as the airway was being secured by a tracheotomy and was resuscitated. Due to manifestation of further neurological deficits the laryngotracheal injury was not repaired.

Table 4: Outcome of the management of the laryngotracheal injuries

| Mortality       | 1 (5%) |
|-----------------|--------|
| **Airway**      |        |
| Tracheostomised | 16 (84%) |
| Decannulated with good airway | 15 (93%) |
| **Swallowing**  |        |
| Alternate feeding initially | 6 (31%) |
| Resumed oral feeds | 4 (66.7%) |
| **Voicing**     |        |
| Good            | 11 (57.9%) |
| Communicable    | 5 (26.3%) |
| Poor            | 2 (10.5%) |

Two subjects had history of loss of consciousness as one of the presenting symptoms. Laryngotracheal repair was not carried out as MRI brain showed diffuse axonal injury. We highlight the importance of assessing the neurological status, especially in intubated patients prior to surgical intervention.

Those patients who were treated within 24 h of the injury had better outcome than those who presented late, adding to literature that support, early and appropriate intervention [15, 22, 28, 29].
Table 5  Details of all the laryngotracheal injury patients treated

| Subjects | Name | Type of Injury | Time of presentation | Schaeffer Grade | Airway control | Tracheostomy | Tracheostomy | Stent | Weeks to decannulation | Airway | Voice | Swallowing | Complications | Associated injuries |
|----------|------|----------------|----------------------|-----------------|----------------|--------------|--------------|-------|------------------------|--------|-------|-----------|---------------|-------------------|
| 1        | A    | Blunt          | 6 h 30 min           | 3               | Tracheostomy  | Tracheostomy | Endotracheal tube (removed 12th day) | 12    | Good                    | Good   | Good  | Good (12 weeks) | Aspiration     |                   |
| 2        | B    | Penetrating    | 12 h 30 min          | 3               | Endotracheal intubation | Tracheostomy | Tracheostomy | 8     | Good                    | Good   | Good  | Good (8 weeks) | Aspiration Left vocal cord paresis | Peristomal granulations |
| 3        | C    | Penetrating    | 12 h                 | 4               | Endotracheal intubation | Tracheostomy | Tracheostomy | 1     | Good                    | Good   | Good  | Good       | Peristomal granulations | Wound dehiscence (12th POD) |
| 4        | D    | Blunt          | 6 h                  | 2               | Tracheostomy  | Tracheostomy | Tracheostomy | 6     | Good                    | Communicable | Good  | Good       | Right vocal cord immobile | Peristomal granulations |
| 5        | E    | Penetrating    | 6 h 45 min           | 4               | Tracheostomy  | Tracheostomy | Tracheostomy | 3     | Good                    | Good   | Good  | Good       | Aspiration Left vocal cord paresis | Peristomal granulations |
| 6        | G    | Penetrating    | 3 h 30 min           | 3               | Tracheostomy  | Tracheostomy | Tracheostomy | 27    | Good                    | Communicable | Good  | Good (7 weeks) | Suprastomal granulations | Right ear canal stenosis Right Grade V LMN facial palsy (House Brackmann) Left Above knee amputation |
| 7        | H    | Penetrating    | 8 h                  | Tracheal        | Endotracheal intubation | Tracheostomy | Tracheostomy | 4     | Good                    | Good   | Good  | Good       | Left internal jugular vein thrombosis |                   |
| 8        | I    | Blunt          | 6 h                  | 2               | Conservative  | Tracheostomy  | Tracheostomy | Tracheostomy | 7     | Good                    | Good   | Good  | Good       | Esophageal web (10 months) |                   |
| 9        | J    | Penetrating    | 2 h                  | 4               | Tracheostomy  | Tracheostomy | Tracheostomy | 7     | Good                    | Good   | Good  | Good (4 weeks) | Aspiration |                   |
| Subjects | Name | Type of Injury | Time of presentation | Schaeffer Grade | Airway control | Tracheostomy | Stent | Weeks to decannulation | Airway Voice | Swallowing | Complications – Trauma related | Associated injuries |
|----------|------|----------------|----------------------|----------------|---------------|--------------|-------|------------------------|--------------|-----------|-----------------------------|------------------|
| 10       | K    | Blunt          | 5 h 30 min           | 1              | Conservative  | Tracheostomy |   8   | Good                   | Good         | Good      | Good (3 weeks)              | Suprastomal granulations |
| 11       | L    | Penetrating    | 4 h                  | 3              | Endotracheal tube through the wound | Tracheostomy |   8   | Good                   | Good         | Good      | Good                        | Scrub typhus |
| 12       | M    | Blunt          | 27 h                 | 3              | Tracheostomy | Tracheostomy |   2   | Good                   | Communicable | Good      | Left vocal cord immobile    | Pancreatic pseudocyst (Chronic calcific pancreatitis) |
| 13       | N    | Penetrating    | 4 h 30 min           | Tracheal       | Endotracheal intubation | Tracheostomy |   10  | Good                   | Good         | Good      |                             |                  |
| 14       | O    | Penetrating    | 5 h                  | 4              | Endotracheal intubation | Tracheostomy |   8   | Good                   | Good (6 weeks) | Good      | Aspiration Left vocal cord paresis Left vocal cord immobile |                  |
| 15       | P    | Blunt          | 2 h 30 min           | 3              | Tracheostomy | Tracheostomy |   7   | Good                   | Communicable | Good      | Hypoxia Ischemic Encephalopathy |                  |
| 16       | R    | Blunt          | 13 h                 | Tracheal       | Endotracheal intubation | Conservative |   4   | Mortality 4th day      | Good         | Good      | Suprastomal granulations Right vocal cord immobile |                  |
| 17       | S    | Blunt          | 3 h                  | 3              | Endotracheal intubation | Tracheostomy |   9   | Good                   | Communicable | Good      | Suprastomal granulations Right vocal cord immobile |                  |
| 18       | T    | Strangulation  | 11 h                 | 5              | Tracheostomy | Tracheostomy |   5   | Dependent              | Poor         | Poor      | Dependent (Hypoxic Ischemic Encephalopathy Bilateral Adductor paralysis) |                  |
As delayed intervention results in granulation tissue formation and scarring which may result in airway stenosis [30], early and accurate diagnosis of laryngotracheal fractures, exposed cartilages will improve outcomes and prevent development of compromised airway and poor voice and dysphagia.

COVID 19 pandemic led to several changes in the way medicine was practised [31]. However only minor changes were required in the overall approach to managing laryngotracheal trauma. During the pandemic, the Standard Institutional Operating COVID guidelines were followed during admission, evaluation, transit, surgical explorations and follow up [11]. Radiological imaging was preferred over laryngoscopy in SARS CoV2 suspect patients. Surgical tracheostomy was performed following the ENT UK guidelines [32]. This was practised to minimize the risk of aerosol generation of SARS-CoV-2, reducing the exposure risk to both the healthcare workers and the subject’s family members, if subclinical infection was present.

COVID 19 pandemic stretched the institutional financial resources due to drop in income with reduced footfalls, all elective surgeries put on hold as well as an increase in the expenditure due to escalation in the cost price of regular hospital items and the requirement of additional items like PPE etc. [33]. The institution was declared a COVID care centre and so majority of the healthcare workers of the institution were engaged directly or indirectly in COVID 19 care and manpower for ENT patients was thin on the ground.

The economic crisis due to COVID 19 pandemic pushed millions of Indians into poverty due to rising unemployment [7]. With the majority (90%) of the workforce in the informal sector it was estimated that almost 400 million of them would be pushed into poverty due to the lockdown imposed due to the pandemic [6, 34, 35]. With exponential increase in the health care cost and unemployment rate, subjects with poor economic reserves struggled to make ends meet. 90% of the subjects required financial support which was provided during this unprecedented time with the available limited resources.

The airway, neurological, vascular, enteral and infective complications encountered suggest the need for multidisciplinary team management of the trauma subjects. A good airway as evidenced by a successful decannulation rate of 93% was obtained which was similar to outcome in a study reported by Bent et al. [36]. Debridement of suprastomal granulations relieved the airway occlusion in three subjects prior to decannulation. Four subjects with aspiration improved with swallowing exercises, motivation and sequential review. This highlights the importance of follow up of these patients for improving outcomes in the management of patients with laryngotracheal trauma. Forty two percent had vocal fold dysfunction probably due to laryngeal nerve injuries, which persisted on follow up. A good to communicable

| Subjects Name | Type of Injury | Time of presentation | Schaeffer Grade | Airway control | Tracheostomy | Stent | Weeks to decannulation | Tracheostomy | Stent | Tracheostomy | Time of presentation |
|---------------|----------------|---------------------|----------------|----------------|-------------|-------|-----------------------|-------------|-------|-------------|---------------------|
| Schaeffer Grade | Airway control | Time of presentation | Stent | Weeks to decannulation | Tracheostomy | Stent | Tracheostomy | Time of presentation |
| U | Blunt | 4 h | 3 | | | | | |
| 19 | | | | | | | | |

Table 5 (continued)
voice obtained in 84% of the subjects was comparable to other studies [12, 36].

Limitation of this study is the short follow-up period.

Conclusion

The economic crisis due to lockdown, travel restrictions, border closures and loss of employment saw a majority of the patients being unable to pay the hospitalisation bills during the COVID-19 pandemic.

This study highlights that during the COVID 19 pandemic, it was not only, early presentation, timely detection and intervention by the treating team, but also the multidisciplinary teamwork and the support system that facilitated the recuperation and restoration of these traumatized individuals back into society with good laryngeal function.

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Authors’ contributions

The following is the contribution of the authors towards submission of this manuscript: JJE Sargunmaraj – concept and study design, acquisition of data, analysis and interpretation of data, drafting the manuscript, final approval of the version to be submitted. SS Mathews—concept and study design, analysis and interpretation of data, critical revision of the manuscript and final approval of the manuscript. JE Ninan, RT Boaz, NS Mani, RR Inja, R Basak—analysis and interpretation of data, critical revision of the manuscript and final approval of the manuscript. Rita Ruby A Albert—acquisition of data, analysis and interpretation of data, critical revision of the manuscript and final approval of the version to be submitted.

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Data Availability

All data that are relevant for the study are included in this published article. Further datasets analyzed during the current study are available from the corresponding author on reasonable request.

Code availability

Not applicable.

Declarations

Conflicts of interest

The authors have no conflict of interest to disclose in this work.

Ethical approval

The institutional review board (Research and Ethics committee) reviewed and approved this study (IRB Min No:14410 dated 22.12.2021).

Consent to participate and publication

Retrospective study and so consent not obtained and no identifiable details of the subjects submitted.

References

1. Sethi RKV, Koizin ED, Lee DJ, Shrime MG, Gray ST (2014) Epidemiological survey of head and neck injuries and Trauma in the United States. Otolaryngol-Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg 151(5):776–784
2. Prasad KC, Prasad SC, Shenoy SV, Kumar A (2009) Management of head and neck Trauma in a developing country. Ind J Otolaryngol Head Neck Surg 61(Suppl 1):35–43
3. Shaker K, Winters R, Jones EB. Laryngeal Injury. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 [cited 2022 Aug 29]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK561500/
4. Jain U, McCunn M, Smith CE, Pittet JF (2016) Management of the traumatized airway. Anesthesiology 124(1):199–206
5. Schaefer SD (2014) Management of acute blunt and penetrating external Laryngeal Trauma. Laryngoscope 124(1):233–244
6. Dev SM, Sengupta R (2020) Covid-19: Impact on the Indian economy [Internet]. Indira Gandhi Institute of Development Research, Mumbai Working Papers. India; 2020 Apr. Report No.: 2020–013. Available from: https://ideas.repec.org/p/ind/igiwpp/2020-013.html
7. National Family Health Survey (NFHS -5), 2019 – 2021. India Report; Government of India. Ministry of Health and Family Welfare [Internet]. Available from: https://dhsprogram.com/pubs/pdf/FR375/FR375.pdf
8. Gururaj G. Injuries in India: A national perspective. Burd Dis.:23.
9. Mohan D, Tiwari GN (eds) (2014) Injury prevention and control. CRC Press, London, p 320
10. Fox DK, Waken RJ, Johnson DY, Hammond G, Yu J, Fanous E et al (2022) Impact of the COVID-19 pandemic on patients without COVID-19 with acute myocardial infarction and heart failure. J Am Heart Assoc Cardiovasc Cerebrovasc Dis. 11(6):e022625
11. Abhilash KPP, David S, St Joseph EV, Peter JV (2022) Acute management of COVID-19 in the emergency department: an evidence-based review. J Fam Med Prim Care 11(2):424–433
12. Schaefer SD (1992) The acute management of external laryngeal Trauma: A 27-year experience. Arch Otolaryngol Neck Surg 118(6):598–604
13. Ananthan VA (2021) Modified Kuppuswamy scale for socio-economic status of the Indian family- Update based on New CPI (IW) series from September 2020. J Fam Med Prim Care 10(5):2048–2049
14. Singhai J, Nigam R, Jain AK (2018) The demographic study of otorhinolaryngological Trauma among patients with head and neck trauma and their management in a Tertiary care centre. Ind J Otolaryngol Head Neck Surg 70(2):249–255
15. Cherian TA, Rupa V, Raman R (1993) External laryngeal trauma: analysis of thirty cases. J Laryngol Otol 107(10):920–923
16. Patra PK, Kalaiarasi R, Alexander A (2018) Management of Laryngotracheal Trauma among patients with head and neck trauma and their management in a Tertiary care centre. Ind J Otolaryngol Head Neck Surg 70(2):249–255
17. Cheriyan TA, Rupa V, Raman R (1993) External laryngeal trauma: analysis of thirty cases. J Laryngol Otol 107(10):920–923
18. Patra PK, Kalaiarasi R, Alexander A (2018) Management of Laryngotracheal Trauma among patients with head and neck trauma and their management in a Tertiary care centre. Ind J Otolaryngol Head Neck Surg 70(2):249–255
19. Fiorillo A, Sampogna G, Giallonardo V, Del Vecchio V, Luciano M, Albert U et al (2020) Effects of the lockdown on the mental
health of the general population during the COVID-19 pandemic in Italy: results from the COMET collaborative network. Eur Psychiatry 63(1):e87

20. Posel D, Oyenubi A, Kollamparambil U (2021) Job loss and mental health during the COVID-19 lockdown: evidence from South Africa. PLoS ONE 16(3):e0249352

21. Kohli A, Verma SK, Agarwal BB (1996) Accidental strangulation in a rickshaw. Forensic Sci Int 78(1):7–11

22. Jewett BS, Shockley WW, Rutledge R (1999) External Laryngeal Trauma analysis of 392 patients. Arch Otolaryngol Neck Surg 125(8):877–880

23. Sethi RKV, Khatib D, Kligerman M, Kozin ED, Gray ST, Naunheim MR (2019) Laryngeal fracture presentation and management in United States emergency rooms. Laryngoscope 129(10):2341–2346

24. Sachdeva K, Upadhya A (2017) Neck Trauma: ENT prospects. Ind J Otolaryngol Head Neck Surg 69(1):52–57

25. Bent JP, Silver JR, Porubsky ES (1993) Acute laryngeal trauma: a review of 77 patients. Otolaryngol-Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg 109(3 Pt 1):441–449

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