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Spectrum of Cervical Injuries and Result of Surgical Management in Cut Throat Cases

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ABSTRACT

OBJECTIVE: To evaluate the frequency, management and outcomes of cervical tracheal injuries in penetrating neck trauma at a high-volume trauma center.

METHODOLOGY: A prospective cross-sectional study on cut throat cases was conducted at the Department of Thoracic Surgery, Jinnah Postgraduate Medical Centre, Karachi, from December 2022 to March 2024. Patients (>12 years) presenting with laryngo-tracheal framework or platysma breach were included and managed according to Advanced Trauma Life Support protocols, followed by surgical exploration and repair. Demographics, mechanism of injury, presentation time, operative details, and outcomes were recorded and analyzed using SPSS version 22.

RESULTS: The cohort comprised 30 patients (80% of whom were male), with a mean age of 34.6±10.8 years. Mechanisms of injury were homicidal (n=13; 43.3%), suicidal (n=11; 36.6%), and accidental (n=6; 20%). All patients sustained tracheal injury with 50% complete transection and 50% anterior wall involvement, often with associated thyroid (n=15; 50%) and esophageal (n=13; 43.3%) trauma. The airway was secured via tracheostomy (n=17; 56.6%) or endotracheal intubation (n=13; 43.3%). Morbidity occurred in 53.3% (n=16) of cases, the most common being atelectasis (n=14; 46.6%) and wound infection (n=11; 36.6%). Respiratory distress post-weaning ventilatory support occurred in (n=6; 20%), and aspiration pneumonia in (n=5; 16.6%), mainly with combined trachea-esophageal injuries. Mortality was 10% (n=3), exclusively among patients presenting >2 hours post-injury with hypoxia and major associated injuries.

CONCLUSION: Penetrating cervical tracheal injuries require rapid airway stabilization and early surgical intervention to optimize outcomes. Delayed presentation, complete tracheal transection, and associated cervical injuries significantly increase morbidity and mortality.

KEYWORDS: Cut throat, penetrating neck injuries, laryngo-tracheal framework, cervical tracheal injury, complete tracheal transection, delayed presentation.

INTRODUCTION

Cervical and anterior neck injuries present variably depending on the extent and mode of injury. Penetrating neck trauma has an overall incidence of 5-10% and mortality as high as 11% in those with concomitant injuries[1]. Disruption of the platysma muscle is an essential criterion for penetrating neck trauma, which poses a threat to underlying vital structures. Stab wounds and neck laceration from violent assault are the most common cause worldwide, followed by gunshot wounds, self-inflicted injuries, road traffic accidents, and other high-velocity impacts[2]. According to Roon and Christensen's classification, neck injuries are divided into three anatomical zones. Zone I extend from the clavicles to the cricoid cartilage and includes the thoracic outlet. Zone II lies above Zone I, covering the area between the cricoid cartilage and the angle of the mandible. Zone III extends from the angle of the mandible to the base of the skull. While Zone I and III are protected by surrounding bones, Zone II lacks bony protection, rendering it more susceptible to injury[3].

Isolated laryngo-tracheal injuries are uncommon but carry a high risk of immediate mortality if not promptly managed, as reported in up to 75 % cases by Parida PK et al. Clinical red signs indicating compromised laryngeal framework include respiratory distress, stridor, hemoptysis, emphysema and hematemesis[4]. Optimal resuscitation, haemorrhage control, and airway stabilization are the most critical components of acute management. Airway maintenance is the priority and defines the course of the outcome. The airway may be secured by endotracheal intubation or tracheostomy at or below the level of injury[3].

Hemorrhage and airway compromise lead to hypovolemic shock and hypoxia, which may result in cerebral hypoperfusion, carbon dioxide retention, diminished consciousness, and subsequent myocardial infarction. If not addressed promptly, these conditions can result in significant morbidity and mortality[5]. Delays in surgical intervention further increase the risk of wound infection and other complications. Therefore, accurate and timely management is crucial for achieving a successful clinical outcome[4].

The rationale of the study is to assess the frequency and outcome of cervical tracheal injuries in penetrating trauma in a high-output trauma center. Local literature is scarce on this subject; however, the last study conducted in 2016 by Khatri DK et al.[6] focused only on the pattern of injury in cervical trauma.

METHODOLOGY

A prospective cross-sectional study of cut throat cases was conducted at the Department of Thoracic Surgery, Jinnah Postgraduate Medical Centre, Karachi, from December 2022 to March 2024. Ethical approval was obtained from the Institutional Review Board (letter NO.F.2-81/2022-GENL/329/JPMC), and informed consent was secured from the guardians of all patients. Patients who presented with either incomplete tracheal injury involving only the anterior cartilaginous wall with an intact posterior membrane or with complete tracheal transection, resulting in separation of all tracheal layers with loss of airway continuity following cut throat injuries, aged above 12 years, were included, while those who had penetrating injuries via gunshot or intrinsic injuries were excluded. Screening for major vascular injuries like carotid and internal jugular, and neurological injuries was ruled out via a multi-disciplinary approach.

All patients who fell into the inclusion criteria were included in this study. All patients were assessed and managed according to the Advanced Trauma Life Support (ATLS) protocol. After securing the airway and performing wound packing in the emergency room, patients were promptly taken to the operating Theatre for surgical intervention. In cases of associated non-thoracic injuries, a multi-disciplinary approach was followed.

Complete tracheal injury is defined as loss of all layers, including anterolateral cartilaginous and posterior membrane, with no continuity of the airway. An incomplete tracheal transection is categorized as one in which only the anterior wall is compromised, with an intact posterior wall of the trachea. Both of them can have associated esophageal and vascular injury. In addition, patients with an oxygen saturation level below 90% were labeled as hypoxic.

All patients were explored surgically under general anesthesia. A nasogastric tube was placed to facilitate identification of the esophagus. Wounds were cleaned thoroughly, injuries identified, and bleeders repaired or ligated. Incomplete tracheal injuries involving the anterior cartilaginous part were repaired with Vicryl 2/0 or 3/0 sutures in an interrupted manner. Complete tracheal transection necessitated cross-field ventilation with subsequent repair of the posterior wall of the trachea. It was followed by the removal of cross-field ventilation, placement of an oropharyngeal tube, and then repair of the anterior wall in an interrupted manner. Esophageal injuries, if present, were repaired with 3/0 Vicryl suture. Additionally, a muscle flap was interposed between the trachea and the esophagus. The wound was closed in layers after securing hemostasis.

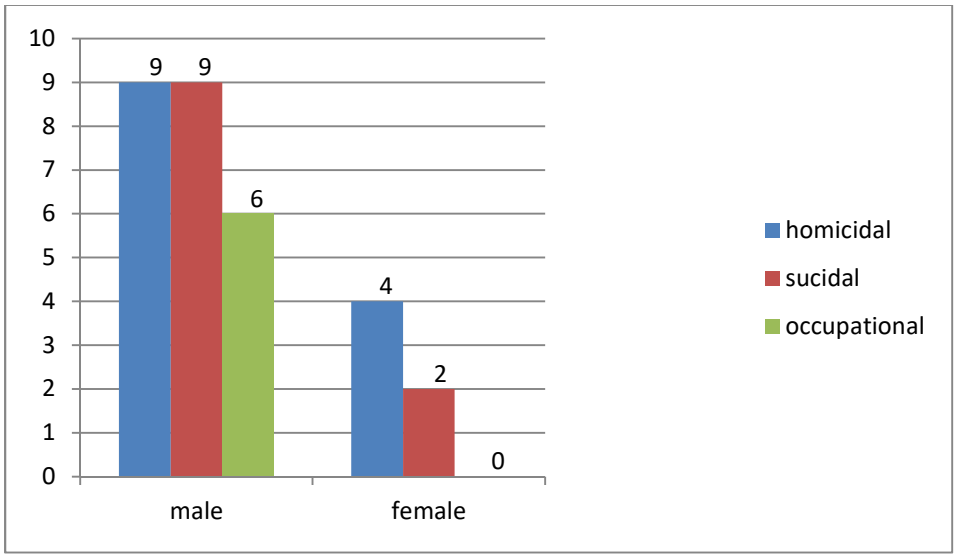
Data collection was conducted using a structured questionnaire that included demographic details, mechanism of injury, time interval between injury and emergency presentation, details of medical and surgical management and clinical outcomes.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) Statistics version 22. Frequencies and percentages were calculated for categorical variables, while mean and standard deviation were used for continuous variables. The Chi-square test was applied for statistical analysis, with a p-value of ≤ 0.05 considered statistically significant.

RESULTS

The study included 30 cases with a male predominance (n=24, 80%). Mean age was 34.6 ± 10.8 years, and the median was 32.50 (range=20-65) years. Mode of injury observed was homicidal (n=13, 43.3%), suicidal (n=11, 36.6%) and accidental cut throat injuries (n=6, 20%), with a higher propensity of male gender; however, the p-value was not significant in all types. **Figure 1** shows the correlation of the mode of injury and gender.

Figure 1: Gender based stratification with mode of injury



The majority of cases (n=18, 60%) presented within 02 hours of the incident with active bleeding (n=28; 93%) from the wound site involving skin and muscles of the neck. Tracheal injury was identified in all 30 cases. Hypoxia and respiratory distress were found in n=23 (76.6%), however, more pronounced with complete transection of trachea (n=14, 60.86%) than limited anterior tracheal wall involvement (n=9, 39%). Emergency airway was stabilized with a tracheostomy tube in 17 (56.6%) patients and with an endotracheal tube in 13 (43.3%) patients. **Table I** represents demographic details and presentation.

Table I: Demographic characteristics and clinical presentation

Variables	No. of patients	Percentage %
Gender		
Male	24	80
Female	6	20
Tool of injury		
Knife	17	56.6
Glass cut	9	30
Clothesline wire	4	13.3
Duration		
Presentation within 02 hours	18	60
Presentation after 02 hours	12	40
Symptoms and Signs		
Active bleeding	30	100
Skin and neck muscle involvement	30	100
Respiratory distress and hypoxia	23	76.7
Disorientation	17	56.7
Hypotension	17	56.7
Hematemesis	10	33.3

Cut throat injuries primarily involved trachea (n=30, 100%) and were often associated with trauma to the adjacent structures; thyroid (n=15, 50%), esophagus (n=13, 43.3%) and others as detailed in **Table II** below.

Table II: distribution according to structures involved

Structure involved	Frequency	Percentage %
Complete transection of the trachea	15	50
Anterior wall of the trachea involvement	15	50
Thyroid gland injury	15	50
Esophageal injury	13	43.3
Vascular injury	10	33.3
Hyoid injury	2	6.66

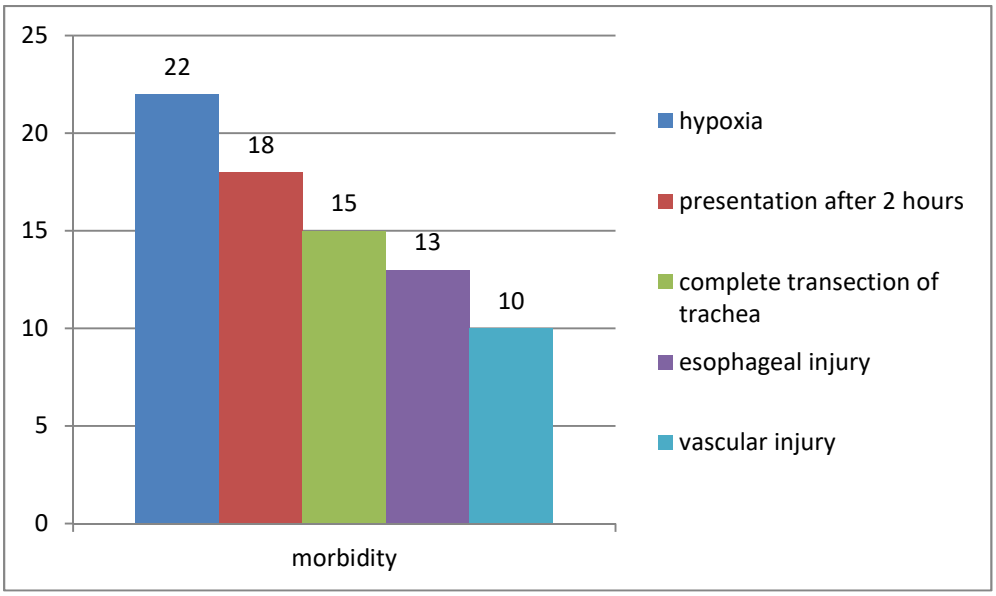
All cases were offered primary repair. A nasogastric tube was passed in all patients, with or without apparent esophagal injury, and removed once oral feeding started. A muscle flap was placed between the trachea and esophagus in 13 (43.3%) cases, who sustained injury to both structures following primary repair. Hilar/mediastinal release was performed in only 1 (3.33%) case, as the length was inadequate for primary repair. A guarding suture was applied in 19 (63.3%) cases and removed on the 5th post-operative day. Elective extubation in the critical care unit was carried out in 15 (50%) cases; all had complete transection of the trachea. The patient was successfully extubated on the operating table. **Figure 2** briefly demonstrates the intraoperative technique and closure.

Figure II: A - Presentation. B- Anchoring sutures. C - Primary closure

Morbidity was more pronounced among those who reported late, with 7 out of 12 cases (58%), as opposed to those who arrived within 2 hours, where morbidity was found in 9 out of 18 cases (50%). Atelectasis was seen in 14 (46%) cases, wound infection in 11 (36.6%), respiratory distress in 6 (20%), pneumonia in 5 (16%), wound dehiscence in 3 (10%), bleeding and myocardial infarction in 2 each (6.6%) and sepsis in 1 (3.3%). Patients with altered orientation (n=17, 56.6%) were found to be significantly related to hypoxemia (p=0.003). Furthermore, complications were more common in complete tracheal transection cases (p=0.001), oesophagal

injury (p=0.000), thyroid injury (p=0.03), and hypotension (p=0.03). A significant correlation was observed in complete tracheal transection and atelectasis (p=0.001). Factors leading to complications are summarized in **Figure 3.**

Figure 3: Factors correlating to morbidity



The majority of the patients (n=27, 90%) were discharged home. Out of these, 4 (14.81%) cases had to undergo tracheostomy after primary repair. Mortality was reported in n=3 (10%) cases, all had delayed presentation, pronounced hypoxia, vascular and esophageal injury, complete transection and myocardial infarction as the leading cause; however, it was not statistically significant. The average hospital stay was 9.40 days, with a median of 8 days. On follow-up consultation, stridor was seen in 6 (20%) and dysphagia in 4 (13.3%) cases; however, 9 patients failed to follow up after the initial visit in the outpatient department.

DISCUSSION

Penetrating neck injuries are particularly challenging for clinicians due to the proximity of numerous vital structures and the lack of substantial soft tissue protection. While these injuries are relatively rare, they carry a high risk of severe outcomes that require a multi-disciplinary approach[1]. The airway, blood vessels, gastrointestinal tract, and nervous system can all be affected, either separately or together. Management becomes even more complex in remote or resource-limited pre-hospital settings[7]. Although they account for only 5–10% of all traumatic injuries, cut throat and cervical injuries are associated with high morbidity and mortality[8]. The causes of cut-throat injuries are generally classified as suicidal, homicidal, or accidental. While **Chakraborty D et al.**[9] and **Olding J et al.**[2] identified suicide as the most common cause, predominantly affecting males, our findings indicate a higher incidence of homicidal cases, though with a similar male predominance.

At initial assessment, the most frequently observed symptom was respiratory distress, typically presenting as difficulty breathing and stridor[4]. In our study, a significant proportion of patients (76.7%) presented with stridor as the initial symptom, indicating respiratory compromise. This finding is slightly higher than that reported by **Parida PK et al.** [4], who observed stridor in 69.2% of their cases. Patients should be managed as per the ATLS (advanced trauma life support) protocol. Clinical signs indicating potential airway compromise, such as stridor, hoarseness, bubbling at the wound site, or subcutaneous emphysema, should prompt early intubation, alongside standard indications such as a Glasgow Coma Scale (GCS) score below 8 [3]. Our study reported a similar finding, indicating the need for airway stabilization in such cases. When endotracheal intubation is not feasible, a cricothyroidotomy is the preferred invasive airway management technique. **Loss L. et al.**[10] further noted that in cases where a tracheal injury is already present, it may be appropriate to insert an endotracheal tube (ETT) directly into the tracheal laceration as a temporary measure until the patient can be stabilized for definitive airway repair. In our study, tracheostomy was performed in 60% (n=15) cases, with 13 showing complete tracheal transection. The remaining 40% (n=10) had their airways managed with ETT, all involving injuries confined to the anterior tracheal wall.

For operative assessment, the evaluation begins with a review of the distance of the injury from the vocal cord and the structural integrity of the laryngeal framework. Simple tracheal lacerations without tracheal ring detachment can be repaired primarily. Injuries involving the thyroid or other laryngeal cartilages are repaired by approximating the cut ends using 3-0 Prolene sutures, while transected trachea are usually sutured circumferentially with interrupted 3-0 Prolene. However, in our study, Vicryl 2-0 was used for all cases instead, differing from the approach described by **Gupta D. et al.**[11]. To maintain a tension-free anastomosis, restriction of neck movement is essential[12]. In most of our cases, this was achieved by applying guarding sutures, securing the chin to the sternum. Prompt surgical exploration is vital, as delays can lead to increased risk of complications such as laryngeal stenosis, fibrosis, and granulation tissue formation. Meticulous, early, layered repair of the mucosa, pharynx, oesophagus, and vascular structures is crucial to minimize the risk of severe complications such as laryngotracheal stenosis, dysphonia, wound dehiscence, granulation tissue, and fistula formation[4].

Morbidity and long-term complications are proportionately associated with delays in prompt and definitive management[13]. **Rajat J. et al.** broadly categorized complications into three stages. Immediate complications, which result from airway obstruction due to displaced or fractured structures and expanding hematomas, or hemorrhage leading to shock. Intermediate

complications may include surgical emphysema, infections, and the formation of fistulous tracts. Late complications can involve hoarseness of voice, stridor due to tracheal stenosis or esophageal strictures, and the development of hypertrophic scars[2,13]. Tracheal stenosis-related complications have been reported in up to 41% cases; however, our study observed a lower incidence of 20% [14].

Post-operative complications were observed in 53.3% of cases, a significant increase from the 5.7% reported in the existing literature. The most commonly encountered issues were superficial surgical site infections and wound dehiscence, followed by both hospital-acquired and aspiration pneumonia[15,16]. Atelectasis was noted in 46.6% of patients of our study, particularly in those who underwent primary repair for complete tracheal transections, compared with those with limited anterior wall involvement. Wound infections occurred in 36.6% of cases, higher than the 23.5% reported by **Sachdeva et al**[15]. Additionally, 20% of patients experienced respiratory distress and difficulty maintaining a patent airway after being weaned off ventilatory support, a complication more pronounced in those who underwent repair of complete airway injury. Aspiration pneumonia occurred in 16.6% of cases in our study, predominantly in patients with combined esophageal and tracheal injuries[17]. Among the patients who died, myocardial infarction and sepsis were identified as the primary contributing factors.

The majority of mortalities were attributed to hypovolemic shock and surgical site infections, both of which were significantly influenced by delayed presentation[3]. Predictors of mortality included hemodynamic instability at the time of admission, low Glasgow Coma Scale (GCS) scores, and the presence of associated injuries[18]. **Nowicki JL et al.** [19] reported a mortality rate of 23–30% in cases involving aero-digestive and laryngotracheal injuries. Another review quoted a mortality of 5.5% [14]. In contrast, we observed a mortality rate of 10%, though the underlying causes were similar. Effective management of these injuries requires a multi-disciplinary approach, with timely and appropriate intervention being crucial for favorable outcomes[1].

CONCLUSION

Cut-throat cervical injuries are rare among patients presenting to public hospital emergency departments, yet they demand prompt and targeted management, as inappropriate treatment can be fatal. Initial assessment follows the Advanced Trauma Life Support (ATLS) protocol, with airway protection via orotracheal intubation or tracheostomy being critical to survival. This study describes a spectrum of patients with cut throat injuries resulting from suicidal, homicidal, or accidental causes. Rapid stabilization of the airway and circulation, followed by meticulous repair of injured structures, is essential to reduce complications. Injuries to the laryngo-tracheal framework, whether isolated or combined with aero-digestive tract damage, pose a substantial threat and are associated with significant morbidity and mortality.

Ethical permission: Jinnah Post Graduate Medical Centre, Karachi, Pakistan, ERC letter No. F.2-81/2022-GENL/329/JPMC.
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AUTHOR CONTRIBUTION

Zafar R: Contribution to concept, manuscript drafting, analysis and interpretation of data
Ahmed T: Critical review, has given final approval of the version to be published.
Sikander N: Contribution to interpretation of data and manuscript formation.
Naz S: Acquisition and collection of data.
Qadir M: Literature search, collection and analysis of data.
Mazcuri M: Contribution to analysis, interpretation of data, manuscript formation and critical review.

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