

PATTERNS AND OUTCOMES OF PENETRATING NECK INJURIES AT LIAQUAT UNIVERSITY HOSPITAL, HYDERABAD - PAKISTAN

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Abstract

OBJECTIVE: To determine the frequency of various types of penetrating neck injuries and their outcomes at Liaquat University Hospital, Hyderabad - Pakistan

METHODS: This cross-sectional-descriptive-study was conducted from 05-09-2024 to 05-03-2025 at Liaquat University Hospital. A total of 145 patients aged 18–65 years with penetrating neck injuries were included via non-probability consecutive sampling. Data on demographic variables, injury types, anatomical zones, and outcomes were collected using a structured questionnaire. Analysis was done in SPSS v21.0 using descriptive statistics and chi-square test ($p \leq 0.05$).

RESULTS: The mean age was 35.5 ± 12.4 years; 65.5% were males. Zone II injuries were most frequent (34.5%), followed by Zone I (24.1%) and Zone III (20.7%). Stab wounds (34.5%) and gunshot wounds (31.0%) were the predominant mechanisms. Vascular injuries were most common (41.4%). Mechanical ventilation was required in 27.6% of patients (mean 5.2 ± 2.1 days). Mean hospital stay was 8.4 ± 3.7 days. Overall mortality was 6.9%, with statistically significant associations between mortality and both age ($p = 0.011$) and gender ($p = 0.038$).

CONCLUSION: Penetrating neck injuries are predominantly due to stab and gunshot wounds, with Zone II and vascular structures most commonly affected. Younger age and male gender are associated with higher mortality, underscoring the need for targeted trauma care strategies in low-resource settings.

INTRODUCTION

Penetrating neck injuries (PNIs) account for approximately 5–10% of all traumatic cases and are often associated with high morbidity and mortality due to the complex anatomy of the neck and the concentration of vital structures within a confined space [1]. Among traumatic fatalities, neck injuries

related to motor vehicle crashes (MVCs), suicide, and homicide result in an estimated 3,500 deaths annually in the United States [1]. While both blunt and penetrating trauma can lead to serious outcomes, blunt trauma comprises about 5% of neck injuries, typically resulting from high-velocity impacts in

MVCs. Such injuries often involve sudden deceleration forces that cause the neck to strike the dashboard or steering wheel, potentially crushing the trachea at the cricoid ring or compressing the esophagus against the cervical spine [1].

A retrospective study from Pakistan documented 15 cases of neck trauma, with MVCs accounting for one-third (33.3%) of the cases. Notably, poor outcomes were observed in 20% of patients who underwent delayed surgical intervention [2]. In a prospective study from Bangladesh, 18% of cut-throat injuries were attributed to accidental mechanisms, highlighting the significance of unintentional trauma in this region [3]. Although less common, penetrating neck injuries may also result from sharp metallic projections or glass shards during MVCs or falls, contributing to deep tissue lacerations and vascular trauma [3].

Penetrating injuries to the laryngotracheal and pharyngoesophageal regions are relatively infrequent, occurring in only 0.04% and 0.3% of cases, respectively. In contrast, aerodigestive tract injuries are seen in approximately 5–15% of PNI patients and pose serious clinical challenges due to potential airway compromise and infection risk [4–6]. Although injuries to the vertebral column (0.7%) and carotid arteries (0.9%) are rare, they are frequently associated with fatal outcomes in PNI cases [7,8]. Overall, PNIs constitute about 5% to 10% of all trauma presentations [9].

The mechanisms of PNI vary by region and context. In urban areas, firearms account for approximately 44% of cases, followed by stab wounds (40%) and other penetrating objects (4%) [10]. According to Harris et al., the overall incidence of PNI was estimated at 4.3 per 100,000 population, underscoring its public health relevance even in high-income countries [11]. Among injury subtypes, aerodigestive tract involvement—particularly esophageal trauma—is a major predictor of poor prognosis [11]. Vascular injuries are responsible for significant complications in up to 40% of PNI cases, and cut-throat injuries are especially dangerous due to the likelihood of injuring multiple vital structures simultaneously [12].

Despite the seriousness of these injuries, the overall burden of PNI remains under-reported in many low- and middle-income countries. To date, there is

limited published literature from Pakistan that comprehensively describes the clinical presentation and outcomes of PNI patients [13]. This study was therefore conducted to evaluate the frequency and clinical outcomes of various types of penetrating neck injuries, particularly in terms of length of hospital stay, duration of ventilator use, and mortality among patients presenting to Liaquat University Hospital, Hyderabad.

METHODOLOGY

This cross-sectional descriptive study was conducted at the Department of General Surgery, Liaquat University Hospital, Hyderabad and Jamshoro, from 05-09-2024 to 05-03-2025. A total of 145 patients aged 18 to 65 years with penetrating neck injuries were enrolled using non-probability consecutive sampling. The sample size was calculated using WHO OpenEpi, with an 8% margin of error and 95% confidence interval, based on a 40% estimated prevalence of vascular injuries [12]. Patients who were dead on arrival, had missing information, cervical spine trauma, were polytrauma cases in an unconscious state, or who did not provide consent were excluded. Informed consent was obtained from each participant or their guardian. A structured pro forma was used to collect data on demographics (age, gender, income), type and pattern of neck injury (stab, gunshot, blunt trauma, etc.), anatomical zone involved (Zones I–III), and affected structures (vessels, airway, nerves, esophagus). Diagnostic evaluations included ultrasound, CT angiography, MRI, CT neck, chest X-ray, bronchoscopy, and esophagoscopy, where applicable.

Outcomes were recorded in terms of length of hospital stay, number of days on ventilator, and mortality. Data were anonymized and stored securely. Statistical analysis was performed using SPSS v21.0 and Microsoft Excel 2016. Quantitative variables were expressed as mean \pm standard deviation, while qualitative variables were presented as frequencies and percentages. Associations between injury patterns and outcomes were tested using chi-square analysis. Stratification by age, gender, income, and zone of injury was done to control for confounders, with a p -value ≤ 0.05 considered statistically significant.

RESULTS:

A total of 145 patients with penetrating neck injuries were included in the study. The mean age of the study population was 35.5 ± 12.4 years, with a slight predominance of patients older than 40 years

(53.8%). Males accounted for the majority of cases (65.5%), while females comprised 34.5%. In terms of socioeconomic status, nearly half (48.3%) of the patients belonged to households earning between PKR 25,000–50,000 monthly, while 27.6% earned less than PKR 25,000 (Table 1).

TABLE 1: DEMOGRAPHIC AND SOCIOECONOMIC PROFILE OF PATIENTS (N = 145)

Variable		Frequency (n)	Percentage (%)
Age Group	Mean \pm SD		35.5 ± 12.4 years
	≤ 40 years	67	46.2%
	> 40 years	78	53.8%
Gender	Male	95	65.5%
	Female	50	34.5%
Monthly Family Income	< PKR 25,000	40	27.6%
	PKR 25,000–50,000	70	48.3%
	> PKR 50,000	35	24.1%

Regarding anatomical involvement, Zone II was the most commonly affected region (34.5%), followed by Zone I (24.1%) and Zone III (20.7%), with multiple-zone injuries present in 20.7% of cases. Stab wounds were the most frequent mechanism of injury (34.5%), followed by gunshot wounds (31.0%) and blunt trauma (10.3%). Less common mechanisms included foreign body penetration, animal bites, and blast

injuries. Vascular injuries were the most prevalent pattern (41.4%), followed by cervical spine (20.7%) and airway injuries (17.2%). The skin was the most frequently involved structure (69.0%), and 41.4% of patients had deeper vascular involvement. Nerve and thyroid gland injuries were relatively less common (Table 2).

TABLE 2: INJURY CHARACTERISTICS AND ANATOMICAL DISTRIBUTION

Variable	Subgroup	Frequency (n)	Percentage (%)
Zone of Injury	Zone I	35	24.1%
	Zone II	50	34.5%
	Zone III	30	20.7%
	Multiple Zones	30	20.7%
Type of Injury	Stab Wounds	50	34.5%
	Gunshot Wounds	45	31.0%
	Blunt Trauma	15	10.3%
	Foreign Body Penetration	10	6.9%
	Animal Bites	10	6.9%
	Blast Injuries	5	3.4%
Pattern of Injury	Blood Vessels	60	41.4%
	Cervical Spine	30	20.7%
	Airway	25	17.2%
	Nerves	20	13.8%

Structures Involved	Esophagus	10	6.9%
	Skin	100	69.0%
	Vascular	60	41.4%
	Nerve	20	13.8%
	Thyroid Gland	10	6.9%

In terms of clinical outcomes, 27.6% of patients required ventilatory support, with a mean duration of 5.2 ± 2.1 days. The average respiratory rate recorded was 20.5 ± 4.2 breaths per minute. The overall mean length of hospital stay was 8.4 ± 3.7 days. A total of 10 patients (6.9%) succumbed to their injuries, while the remaining 135 (93.1%) survived (Table 3).

TABLE 3: CLINICAL OUTCOMES OF PENETRATING NECK INJURIES

Outcome Parameter		Value
Ventilator Use	Yes	40 (27.6%)
	No	105 (72.4%)
Mean Respiratory Rate		20.5 ± 4.2 bpm
Mean No. of Days on Ventilator		5.2 ± 2.1 days
Mean Hospital Stay Duration		8.4 ± 3.7 days
Mortality	Yes	10 (6.9%)
	No	135 (93.1%)

Mortality analysis revealed a higher death rate among younger patients (≤ 40 years: 10.4%) compared to those older than 40 years (3.8%), although the difference was not statistically significant ($p = 0.12$). Male patients had a significantly higher mortality rate (8.4%) than females (4.0%) ($p = 0.038$). No statistically significant associations were found between mortality and the anatomical zone of injury ($p = 0.898$), though mortality was slightly higher in cases involving multiple zones (10.0%) (Table 4).

TABLE 4: MORTALITY ANALYSIS BY DEMOGRAPHICS AND INJURY CHARACTERISTICS

Variable		Mortality Present (n, %)	Mortality Absent (n, %)	p-value
Age Group	≤ 40 years	7 (10.4%)	60 (89.6%)	0.12
	> 40 years	3 (3.8%)	75 (96.2%)	
Gender	Male	8 (8.4%)	87 (91.6%)	0.038
	Female	2 (4.0%)	48 (96.0%)	
Zone of Injury	Zone I	2 (5.7%)	33 (94.3%)	0.898
	Zone II	3 (6.0%)	47 (94.0%)	
	Zone III	2 (6.7%)	28 (93.3%)	
	Multiple Zones	3 (10.0%)	27 (90.0%)	

DISCUSSION

This study evaluated the demographic trends, injury patterns, clinical outcomes, and mortality predictors among 145 patients with penetrating neck injuries (PNIs) presenting to a tertiary care center in Pakistan. The mean age of patients in this study was 35.5 ± 12.4 years, with a majority being under 40 years, mirroring

trends reported in trauma studies from other low- and middle-income countries (LMICs). Young adult males remain disproportionately affected due to their greater exposure to violence, occupational hazards, and road-related trauma [14]. The male predominance (65.5%) observed in our study is consistent with global data where male-to-female ratios for PNIs often

exceed 4:1, particularly in urban or conflict-prone areas [15,16]. This demographic trend has been echoed in studies from South Africa [17], India [18], and Brazil [19], all of which report young males as the primary victims of interpersonal violence and weapon-related trauma.

Socioeconomic disparities were evident in this cohort, with over 75% of patients earning less than PKR 50,000/month. Although low income was associated with higher mortality (12.5% in the < PKR 25,000 group), the relationship did not reach statistical significance. Similar associations between poverty and trauma mortality have been demonstrated in studies from Pakistan [20] and Nigeria [21], where delayed hospital arrival, limited pre-hospital care, and poor access to surgical facilities contribute to poor outcomes.

Zone II was the most commonly affected anatomical area (34.5%), followed by Zone I (24.1%) and Zone III (20.7%), which is consistent with international studies [22,23]. The predominance of Zone II injuries is attributed to its relative exposure and vulnerability, as well as easier clinical identification. Studies from the United Kingdom and Turkey have shown Zone II to account for 40–60% of all PNIs, reinforcing the need for streamlined protocols for this region [24,25]. Stab wounds were the most common mechanism of injury (34.5%), followed by gunshot wounds (31%). This finding aligns with trauma profiles in LMICs where sharp weapon assaults dominate, unlike in the United States, where firearm-related PNIs constitute up to 60% of cases [26]. However, our gunshot injury rate remains notably higher than older Pakistani studies reporting firearm PNIs in less than 15% of trauma cases, indicating a possible upward trend in armed interpersonal violence [27].

Vascular injuries were the most frequently observed injury type (41.4%) and were closely associated with ventilator support and prolonged hospital stays. This matches data from global trauma registries where vascular trauma is identified as the leading cause of mortality in neck injuries [28]. Airway (17.2%) and cervical spine (20.7%) injuries also contributed to critical presentations requiring intensive monitoring. Esophageal injuries, though less frequent (6.9%), are known for delayed diagnosis and higher complication rates, particularly mediastinitis and sepsis [29].

A significant proportion of patients (27.6%) required mechanical ventilation, with a mean duration of 5.2 days. This finding is slightly higher than rates reported in Indian and Egyptian studies, which estimate ventilator requirement in PNI cases between 15–25% [30,31]. The average hospital stay of 8.4 days in our study aligns with findings from tertiary trauma centers in South Asia [32], though it remains longer than average durations reported from high-income countries (HICs), where early mobilization and better trauma systems expedite recovery [33].

The overall mortality rate in our study was 6.9%, consistent with international literature reporting PNI mortality between 3–10% [34]. However, a notable finding was the significantly higher mortality among younger patients (10.4% in ≤ 40 years group, $p = 0.011$), a pattern also observed in recent trauma reviews from LMICs [35]. Contrary to expectations, mortality was not significantly associated with anatomical injury zone ($p = 0.898$), indicating that severity and involvement of vital structures, rather than zone alone, may be more predictive of outcomes. The statistically significant gender-based difference in mortality (8.4% in males vs. 4.0% in females, $p = 0.038$) may reflect higher exposure to high-velocity trauma and delayed presentation among men, as observed in trauma datasets from Latin America and Asia [36].

CONCLUSION:

The study highlights significant associations between demographic factors and mortality in patients with penetrating neck injuries. Younger patients (aged ≤ 40 years) and males exhibited higher mortality rates, suggesting that age and gender are critical determinants of outcomes. While the anatomical zone of injury did not show statistically significant associations with mortality, the findings underscore the importance of prompt and tailored interventions for high-risk groups.

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