

Chest trauma management; An experience at trauma center, postgraduate medical institute, Quetta

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ABSTRACT

BACKGROUND & OBJECTIVE: Chest trauma is a leading cause of global morbidity and mortality, especially among young adults. The rising incidence in Pakistan underscores the need for local research to inform effective management. The objective of the current study is to determine the variety of chest trauma and its associated factors among patients admitted to the Trauma Centre, Postgraduate Medical Institute (PGMI), Quetta.

METHODOLOGY: A cross sectional quantitative study was conducted at Trauma Centre PGMI Quetta from March 1, 2024, to August 31, 2024, after obtaining ethical approval (PGMIQ/ERC/16/2024). We reviewed 200 chest trauma patients, admitted to the surgical unit of the trauma centre and analyzed the data. Fisher tests analyzed the relationship between management approaches and patient status upon arrival, as well as thoracotomy findings and initial management approaches.

RESULTS: Of the 200 patients, 167 (83.5%) were male, and 33 (16.5%) were female. Most (69.5%) had injuries from road traffic accidents or falls. Rib fractures occurred in 75 (37.5%) patients, with 40 (20%) on the left side and 35 (17.5%) on the right. Fisher's Exact test revealed significant associations between management approach and patient arrival status ($p = 0.013$) and between management approach and thoracotomy findings ($p = 0.000$), respectively.

CONCLUSION: Chest trauma is a significant health concern, particularly among young males, often caused by road accidents and falls. While most cases involve blunt trauma and can be managed conservatively, thoracotomy is typically required for hemothorax cases with vascular or pulmonary injuries.

KEYWORDS: Chest Trauma, Thoracic Injury, Trauma Management, Trauma Center.

INTRODUCTION

Injury is a significant global health issue, particularly among individuals under the age of 35, where it stands as the primary cause of death and long-term disability^[1]. Trauma, as a subsection of injury, ranks as the third leading cause of mortality across all age groups and is the foremost cause of death during the first four decades of life^[2]. Trauma accounts for approximately 35 million emergency department visits annually in the United States, underscoring its widespread impact on healthcare systems^[3]. Chest trauma, a critical area of concern within trauma care, presents unique challenges due to the wide range of injuries it encompasses, from minor rib fractures to severe, life-threatening damage to thoracic organs. Common causes of chest trauma include accidents,

falls, assaults, and motor vehicle collisions (MVCs). According to data from the National Medical Centre's 2021 statistical yearbook, severe trauma frequently involves the chest, following injuries to the head and neck in prevalence^[4].

As one of the most common forms of unintentional traumatic injury, chest trauma is the second most frequently occurring and the third leading cause of death among patients with multiple injuries, following head and abdominal trauma^[5]. The mortality associated with chest trauma is notably high, with some studies reporting rates as high as 60%^[6]. Furthermore, chest injuries contribute to 25% of all deaths in patients with severe trauma, making it a significant contributor to global morbidity and mortality.

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Chest trauma is generally categorized based on the mechanism of injury into three main types: blunt, penetrating, and blast injuries. Blunt chest trauma typically results from motor vehicle collisions, falls from significant heights, physical assaults, or impacts from blunt objects [7]. Thoracic compression injuries occur when the force exerted on the chest exceeds the structural integrity of the ribcage, leading to rib fractures. Such fractures are often associated with more serious thoracic conditions, including pneumothorax, hemothorax, pulmonary contusions, and pulmonary lacerations [8].

Penetrating injuries can pose an immediate threat to life. These injuries are generally localized to the trajectory of the penetrating object, with the extent of tissue damage being influenced by the amount of energy transferred along the object's path. The energy transfer is determined by factors such as the velocity of the injury, the mass and surface area of the object, and the density of the affected tissues. For instance, denser organs like the liver absorb more energy compared to less dense organs, such as the lungs [9,10]. Although civilian blast injuries are rare, the potential rise in terrorist incidents in our country makes them more important. Blast injuries are categorized into four types. Primary injuries result from barotrauma caused by the pressure wave near the explosion site. Secondary injuries occur due to flying debris or projectiles, and quaternary injuries include burns, toxic exposures, or other factors. Often, a single patient may experience multiple types of blast injuries simultaneously [11].

Severe trauma poses a significant global public health challenge, with post-traumatic bleeding being a major concern for healthcare systems. Uncontrolled bleeding and traumatic coagulopathy are leading causes of preventable multi-organ failure and death if not promptly diagnosed and managed [12]. Around one-third of patients with severe trauma arrive at the hospital in a coagulopathic state. A systematic approach to diagnosis and treatment has been shown to significantly reduce preventable deaths from traumatic injuries [13].

There remains an unmet need in managing trauma-related pain throughout a patient's recovery. Poor pain control is a key risk factor for chronic pain syndrome, a highly disabling condition [14]. Nearly two-thirds of patients report moderate pain a year after injury, with three-quarters experiencing pain that disrupts daily activities, work, and causes psychological, emotional, and cognitive issues, including decreased self-esteem and depression. These consequences heighten the risk of distress, which in turn exacerbates the pain and creates a vicious cycle of trauma, pain, and stress, continually feeding into each other [15].

Effective management of chest trauma is essential to improving patient outcomes. During the initial assessment, various diagnostic tools, including physical examination, anteroposterior (AP) radiography, and extended focused assessment with sonography in trauma (eFAST), are commonly employed to evaluate the extent of chest injuries [16]. The complexity and potential severity of chest trauma highlight the necessity for rapid and precise intervention in

trauma care settings. Several studies have examined injuries by region or as multisystem trauma, but the incidence of chest trauma is notably rising in Quetta. Despite this, local research is uncommon on the incidence and outcomes of chest trauma management.

This study aims to identify the patterns, causes, management strategies, and outcomes of chest trauma at the Trauma Centre, PGMI Quetta. The findings will help to enhance understanding of chest trauma incidence and guide the development of effective management protocols, awareness programs, and preventive measures to reduce fatalities.

METHODOLOGY

This cross-sectional study was conducted at Trauma Centre PGMI Quetta, for a period of six months from 1st of March 2024 to 31st August 2024, after obtaining ethical permission from the ethical review committee of the institute vide approval No. PGMIQ/ ERC/16/2024. Each participant was assigned a unique code number to maintain patient privacy and confidentiality. Data was collected from patients admitted with chest trauma at the surgical unit of the Trauma Centre, PGMI Quetta. The data of 200 patients was collected by non-probability consecutive sampling and was analyzed. The sample size was calculated by formula $n = z^2 p (1-p) / d^2$ where confidence level (z) = 1.96, prevalence 10% = 0.1 and absolute precision (d) = (5%) 0.05 [17]. All patients of chest trauma were included in the study. Patients whose required information was missing and patients with multi-organ involvement were excluded from the study.

Statistical analysis was done on IBM SPSS version 22. All the demographic results are presented in the form of frequency and percentage. The chi-square test and Fisher's Exact Test were conducted wherever applicable to examine whether the management approach varies according to the patient's status upon arrival and to determine if thoracotomy findings differ based on the initial management approach. Statistical significance was evaluated at the 95% confidence level.

RESULTS

Table-I presents the demographics of the Out of 200 patients, 167 (83.5%) were male, and 33 (16.5%) were female. In terms of age distribution, 16 (8.0%) were in the 1-14 years' age group, 98 (49.0%) were aged 15-30 years, 78 (39.0%) were in the 31-45 years' age group, and 8 (4.0%) belonged to the 46-60 years' age group. Regarding nationality, 163 (81.5%) were Pakistani, 34 (17.0%) were Afghan refugees, and 3 (1.5%) had other nationalities. In terms of arrival state, 118 (59.0%) arrived at the emergency department in a life-threatening state, 72 (36.0%) arrived in a state where urgent treatment was required but it was not life-threatening, 07 (3.5%) required observation, and 3 (1.5%) were referred to other facilities. In terms of aetiology of injury, it was seen that out of 200 patients, 27(13.5%) patients had a history of gunshot wounds, 34 (17%) patients had stab wounds to the chest, and 139(69.5%) patients presented with injuries related to road traffic accidents (RTA) or a history of falls.

Table-I: Demographic features of chest trauma patients.

Demographics		n(%)
Gender	Male	167(83.5)
	Female	33(16.5)
Age	1-14	16(8.0)
	15-30	98(49.0)
	31-45	78(39.0)
	46-60	8(4.0)
Nationality	Pakistani	163(81.5)
	Afghan Refuges	34(17.0)
	Other	3(1.5)
Status at Arrival	Emergency / Life-threatening	118(59.0)
	urgent/ not life-threatening	72(36.0)
	stable/ conservative & need Observation	07(3.5)
	Referred	3(1.5)
Total		200(100)

Table-III: Clinical indications and findings of thoracotomy.

Variables	Categories	n(%)
Findings on thoracotomy	Lung Injury	4(2.0)
	Cardiac Injury	2(1.0)
	Vascular Injury	15(7.5)
	Non thoracotomy patient	179
Indications of Thoracotomy	Hemothorax	19(9.5)
	Pneumothorax (persistent air leak)	2(1.0)
	No Indication of thoracotomy	179(89.5)
Total		200(100)

Table-II: Patient injury pattern and management approaches.

Variables	Categories	n(%)
Pattern of injury	Left Rib fracture	41(20.5)
	Right Rib Fracture	36(18)
	Lung Contusion	30(15)
	Left Pneumothorax	22(11)
	Right Pneumothorax	10(5)
	Left Hemothorax	12(12)
	Right Hemothorax	17(8.5)
	Flail chest	9(4.5)
	Major Vascular Injury	15(7.5)
	Pneumomediastinum	4(2.0)
Management approach	Chest Intubation	61(30.5)
	Emergency Thoracotomy	21(10.5)
	Laparotomy	4(20)
	Admitted and observation	114(57.0)
Total		200(100)

It was further studied that out of a total of 200 patients, 77 (38.5%) presented with rib fractures, with 41 (20.5%) occurring on the left side and 36 (18%) on the right table no 2. Additionally, 30 (15%) patients sustained lung contusions. Pneumothorax was noted in 32 (16%) patients, with 22 (11%) on the left side and 10 (5%) on the right. Hemothorax injuries were observed in 12(6%) patients on the left and 17 (8.5%) on the right. Major vascular injuries were found in 15 (7.5%) patients, while 4 (2%) patients had pneumomediastinum and diaphragm injuries, respectively. Out of 200 patients, 179(89.5%) did not need thoracotomy on initial assessments, while 21(10.5%) needed thoracotomies on initial assessments. Out of these 21(10.5%) patients requiring thoracotomy, 2(1%) had lung injury, 2(1%) had cardiac injury and 15(75%) had vascular injury as shown in Table -III.

Table -IV: Association between management approach and patient's status at arrival.

Variables	Groups	Management approach				Total	Fishers Test	P-value
		Chest Intubation n(%)	Emergency Thoracotomy n(%)	Laparotomy n(%)	Admitted and observation n(%)			
Status at Arrival	Emergency (Life Threatening)	39(19.5)	11(5.5)	0(0.0)	68	118	18.994	0.013
	Urgent	17(8.5)	10(5.0)	4(2.0)	41(20.5)			
	Stable	6(3.0)	0(0.0)	0(0.0)	1(0.5)			
	Referred	2(1.0)	0(0.0)	0(0.0)	1(0.5)			
Findings on thoracotomy	Lung Injury	0(0.0)	2(1.0)	0(0.0)	0(0.0)	2(1.0)	105.354	≤0.001
	Cardiac Injury	0(0.0)	2(1.0)	0(0.0)	0(0.0)			
	Vascular Injury	0(0.0)	15(7.5)	0(0.0)	0(0.0)			
	Trivial chest Injury	64(0.32)	2(1.0)	4(2.0)	111(55.5)			
Total		64(0.32)	21(10.5)	4(2.0)	111(55.5)	200(100)		

Table-IV illustrates the association between management approaches and patients' status upon arrival. Out of 200 patients, 118(59%) were admitted as an emergency, who were in a life-threatening state. Among them, 68(34%) were serious and were kept under observation in HDU, 39(19.5%) required immediate chest intubation, and 11(5.5%) needed emergency thoracotomies. Additionally, 72(36%) required urgent treatment but were not in a life-threatening state. Among them

41(20.5%) were admitted for observation, 10(5%) underwent emergency thoracotomies, 17(8.5%) were chest intubated and 4(2%) required laparotomy due to diaphragmatic injury. It was further noted that 7(3.5%) were stable, and 3(1.5%) were referred. The Fisher's Exact test yielded a value of 18.994 with a p-value of 0.013, indicating a significant association ($p < 0.05$) between the management approach and arrival status at the hospital. Out of 200 patients, 179(90.5%) patients did not need thoracotomy, whereas 21(10.5%) patients needed thoracotomy on initial assessments. Out of these 21 patients, 2(1%) had lung injury, 2(1%) had cardiac injury, and 15(7.5%) had vascular injury on thoracotomy, whereas 2(1%) patients had no injury found on thoracotomy. The Fisher's Exact test yielded a value of 105.354 with a p-value of 0.000 (105.354), indicating a significant association ($p < 0.05$) between the management approach and thoracotomy findings at the hospital.

DISCUSSION

This study investigates chest trauma patterns, causes, management, and outcomes at the Trauma Centre, PGMIQ. Its findings will inform strategies to reduce fatalities by enhancing understanding of chest trauma, improving management protocols, and promoting awareness and prevention programs.

This study found that 83% (167/200) of chest trauma patients were male, with 88% (176/200) aged between 15 and 45 years. Similar demographics were reported in other studies [18,19]. The high incidence among young males in Baluchistan may be attributed to the traditional and tribal system, where this age group is often the primary breadwinner and more likely to be exposed to traumatic injuries. Road traffic accidents (RTAs) and falls accounted for 69.5% of injuries, with blunt trauma to the chest wall being the leading cause. These findings align with studies conducted in Saudi Arabia and Nigeria [20,21]. The vulnerability of the working-class population to injury may be a contributing factor to these trends.

Clinical presentations of chest trauma patients varied from simple rib fractures to life-threatening vascular or cardiac injuries. Consistent with previous studies, the most common findings were rib fractures, lung contusions, pneumothorax, and hemothorax [22]. Treatment approaches differed, with most cases managed conservatively. A few required chest intubations, while 10.5% underwent emergency thoracotomy due to massive hemothorax or lung laceration. These findings align with studies by Waseem M and Mattox. [23].

Regarding hospital stays, 87% of patients had stays of more than 5 days. In contrast to our study, Waseem M reported that 77.5% of patients had a prolonged hospital stay [18]. This might be due to the fact that, usually, after chest trauma, there is an increased incidence of chest infection and breathing complications in injured patients.

Given that most chest trauma cases result from road traffic accidents (RTAs) and falls among breadwinners, adopting job safety and driving protocols is crucial to prevent trauma and reduce chest trauma-related deaths. Implementing job

safety measures and driving protocols can decrease hospital admissions and the need for costly intensive care unit (ICU) management for chest injuries.

LIMITATION: This single-institution study in Baluchistan has limitations that may impact its broader applicability in Pakistan. However, it provides valuable insights into the local situation, offering a nuanced understanding of the regional context. While generalizing findings to the national level requires caution, this study reflects the prevailing regional circumstances. Aside from this, our six-month study at the Trauma Centre, PGMI, focused on chest trauma injuries, not long-term complications.

RECOMMENDATION: To gain a more comprehensive understanding of the patterns, etiology, management strategies and potential long-term complications of chest trauma in Pakistan, there is a pressing need for additional multicentric studies with larger sample sizes.

CONCLUSION

Chest trauma represents a major health issue, especially among young male adults, with road traffic accidents (RTAs) and falls identified as the predominant causes. Blunt trauma is the most frequent form of injury, and the majority of cases are effectively managed through conservative treatment. However, thoracotomy is most commonly indicated in cases of hemothorax, typically resulting from vascular and pulmonary injuries.

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Authors Contributions:

Muhammad Arif Khan: Substantial contributions to the conception or design of the work.

Muhammad Iqbal Khan: The acquisition and analysis of data for the work.

Riffat Arbab: Interpretation of data for the work.

Abdullah Khan: Drafting the work .

Maria Mahmood: Reviewing it critically for important intellectual content.

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