

Original Research Article

Patterns, management and outcomes of chest trauma in a rural tertiary care hospital in North Kashmir: a prospective observational study

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ABSTRACT

Background: Chest trauma remains a critical cause of morbidity and mortality, especially in rural and resource-limited settings. The heterogeneity in injury mechanisms and limitations in emergency infrastructure often pose major challenges in timely diagnosis and management. In North Kashmir, civilian trauma accounts for the majority of cases, while conflict-related injuries contribute a smaller but clinically relevant subset.

To analyze the clinical profile, modes of injury, types of chest injuries, management strategies and outcomes of patients presenting with chest trauma at a rural tertiary care hospital GMC Baramulla in North Kashmir over a five-year period.

Methods: This is a Prospective observational study of 430 patients presenting with chest trauma from July 2020 to July 2025 from GMC Baramulla. Data on demographics, type of trauma, injury patterns, treatment modalities, complications and hospital stay were analyzed using descriptive statistics and expressed as frequencies and percentages using standard statistical software.

Results: Blunt trauma accounted for 90.6% of cases, predominantly affecting males (74.4%). Road traffic accidents were the leading cause (46.5%), followed by falls (42.7%). Rib fractures and pulmonary contusions were the most common injuries. Most patients were managed conservatively (53.4%), while 30.2% required intercostal tube drainage and 15.8% underwent thoracotomy. Major morbidities included bronchopleural fistula (1.3%) and empyema (0.2%). More than half of the patients (58.1%) were discharged within five days.

Conclusions: In rural healthcare settings, structured protocols and timely interventions can effectively manage chest trauma with favorable outcomes. Strengthening trauma systems and referral pathways can further improve care delivery.

Keywords: Blunt thoracic injury, Chest trauma, North Kashmir, Rural healthcare, Trauma management

INTRODUCTION

Chest trauma constitutes a significant portion of trauma-related morbidity and mortality worldwide, contributing to approximately 10% of trauma admissions and 25% of trauma-related deaths globally.¹ With the increasing burden of road traffic accidents (road traffic accident (RTA)s), occupational hazards, falls, interpersonal violence and armed conflicts, chest injuries are a growing challenge for trauma surgeons and emergency physicians.² In developing nations like India, especially in rural and

semi-urban regions such as North Kashmir, the prevalence and patterns of chest trauma present unique epidemiological and logistical concerns. The region's topography, transportation delays, limited availability of advanced trauma care and late presentations often worsen outcomes.³ This is particularly relevant in conflict-prone areas, where blast and firearm injuries form a smaller but clinically important subset, adding complexity to chest trauma management.⁴ Blunt chest trauma, largely due to RTAs and falls, comprises the majority of cases globally and locally. It may present with injuries ranging from minor contusions to life-threatening flail chest,

hemopneumothorax or pulmonary contusions.^{5,6} Penetrating trauma, although less frequent, demands rapid surgical intervention and carries high risk for morbidity. The cornerstone of chest trauma management includes accurate diagnosis, early identification of life-threatening conditions and timely intervention, which may range from conservative measures to procedures like tube thoracostomy or thoracotomy.^{7,8}

Modern trauma algorithms such as ATLS have significantly improved initial resuscitation and triage, yet their application in rural resource-limited settings remains suboptimal.^{9,10} Given the scarcity of trauma literature from conflict-affected rural zones in North India, especially Kashmir, this study presents a prospective analysis of 430 patients presenting with chest trauma over a 5 years period at a rural medical college hospital.

This study aims to analyze the patterns, management strategies and outcomes of chest trauma in 430 patients treated at a rural tertiary care hospital in North Kashmir over a five-year period. Our objectives include evaluating the types of chest injuries, modes of trauma, treatment modalities, complication rates and hospital stay durations. The findings aim to contribute to the understanding of chest trauma in resource-limited settings and support evidence-based practices for optimal management in similar rural healthcare environments.

METHODS

Study design

This prospective observational study included 430 patients presenting with chest trauma at GMC Baramulla between July 2020 and July 2025.

Setting

Emergency and surgical department of a rural medical college hospital, (GMC Baramulla) North Kashmir.

Study duration

The study duration was of 5 years (July 2020 to July 2025).

Sample size

The patient size was 430 patients.

Inclusion criteria

All patients presenting with chest trauma (blunt or penetrating).

Exclusion criteria

Incomplete medical records, patient declared dead on arrival or those referred without follow-up.

Initial patient assessment and management

All patients presenting with chest trauma were received in the emergency department and managed according to advanced trauma life support (ATLS) principles. On arrival, vital parameters were recorded, intravenous access was secured and a systematic primary survey focusing on airway, breathing, circulation, disability and exposure (ABCDE) was performed.

After initial stabilization, patients underwent secondary survey and baseline laboratory investigations, including complete blood count, renal function tests and arterial blood gas analysis where indicated. Radiological evaluation was guided by clinical findings and included bedside chest radiography and extended focused assessment with sonography in trauma (eFAST). CT scans of the chest, abdomen or head were performed selectively in hemodynamically stable patients based on suspected associated injuries. Management decisions were subsequently tailored according to clinical status, imaging findings and associated injuries.

RESULTS

Demographic profile and type of trauma

Out of 430 patients, males constituted 74.4% (n=320), females 25.6% (n=110) and forty patients (9.3%) belonged to the Pediatric age group, with a median age of 25 years. Blunt trauma accounted for 90.6% (n=390), while penetrating trauma was observed in 9.3% (n=40). The most common mode of injury was road traffic accidents (46.5%), followed by falls (42.8%), assaults (4.7%) and blast/firearm injuries (2.8%).

Rib fractures were observed in 130 patients (30.2%), followed by pulmonary contusions in 84 (19.5%), pneumothorax in 70 (16.3%) and hemothorax in 60 (14%). Less frequent injuries included flail chest (0.9%), diaphragmatic injuries (0.5%), hemopneumothorax (6.9%) and subcutaneous emphysema (9.3%). Many patients sustained multiple overlapping thoracic injuries, therefore the cumulative frequency of injuries exceeded the total number of patients. Conservative management was sufficient in 53.4% (n=230) of patients, while 30.2% (n=130) required tube thoracostomy. Thoracotomy was performed in 15.8% (n=68), with 9 cases referred to a higher center for cardiothoracic intervention. Laparotomy was necessary in 2 cases due to associated abdominal trauma.

Associated injuries were seen in 132 patients (30.6%), including head injury in 22, abdominal injury in 10 and combined head and abdominal injuries in 20 cases. Complications included bronchopleural fistula in 6 patients (1.3%) and empyema in 1 patient (0.2%). Duration of intercostal tube drainage (ICTD) was ≤ 9 days in 69.1% of cases. Hospital stay was ≤ 5 days in 58.1% of patients, while 27.9% stayed between 6–10 days. No in-

hospital mortality was recorded during the study period. The demographic profile and type of trauma are given in Table 1, modes of injury among the study population are given in Table 2. The various types of chest injuries encountered are shown in Table 3. The management

strategies employed, including conservative treatment and surgical interventions, are summarized in Table 4. The duration of intercostal chest tube drainage for these patients is presented in Table 5 and the overall hospital stay distribution is shown in Table 6.

Table 1: Demographic profile and type of trauma.

Parameters	Value (N/%)
Total patients	430
Sex	
Male	74.4 (n=320)
Female	25.6 (n=110)
Age	
Median age	25 years
Pediatric age group	9.3 (n=40)
Type of trauma	
Blunt trauma	90.6 (n=390)
Penetrating trauma	9.3 (n=40)
Mode of injury	
Road traffic accidents	46.5
Falls	42.8
Assaults	4.7
Blast/firearm injuries	2.8

Table 2: Mode of injury.

Mode of injury	No. of cases	Total (%)
Road traffic accidents	200	46.5
Falls	184	42.8
Assaults	20	4.7
Blast/Firearm injuries	12	2.8
Animal-related trauma	6	1.4
Fall of object on chest	8	1.9

Table 3: Types of chest injury.

Injury types	No. of cases	(%)
Bruise	150	34.9
Abrasion	100	23.3
Laceration	22	5.1
Rib fractures	130	30.2
Flail chest	4	0.9
Pulmonary contusions	84	19.5
Pneumothorax	70	16.3
Hemothorax	60	14
Diaphragmatic injury	2	0.5
Hemopneumothorax	30	7
Subcutaneous emphysema	40	9.3

Table 4: Treatment modalities.

Modality	Patients	(%)
Conservative	230	53.4
Tube thoracostomy	130	30.2
Thoracotomy	68 (9 Referred to CVTS skims)	15.8
Laparotomy (abdominal cases)	2	0.4

Table 5: Duration of intercostal tube drainage (ICTD).

Duration (in days)	Patients	(%)
0–4	20	15.3
5–9	70	53.8
10–14	25	19.2
15–19	15	11.5

Table 6: Hospital stays.

Stay duration (in days)	Patients	(%)
0–5	250	58.13
6–10	120	27.9
11–15	35	8.13
16–20	25	5.81
>20	0	0

DISCUSSION

This prospective observational study of 430 chest trauma cases in rural North Kashmir offers significant insights into the burden and management of thoracic injuries in under-resourced, high-risk regions. The findings are largely consistent with both national and international literature, yet they underscore some unique patterns influenced by geography, healthcare access and sociopolitical factors. Blunt trauma accounted for 90.6% of cases, primarily due to road traffic accident (RTA)s and falls. Similar trends are reported in multicentre analyses from India and Southeast Asia, where blunt trauma ranges from 85–92% in most series.¹¹

The male predominance (74.4%) also aligns with studies globally and in India, reflecting gender-based exposure to outdoor activities and road usage.^{12,13} The median age being around 25 years reflects a demographic at peak occupational and physical activity, comparable to trauma registries from Africa and Asia.¹⁴ Pediatric cases formed a notable 9.3%, which is slightly higher than urban data, possibly due to unsafe play environments and limited supervision in rural settings. Rib fractures were among the most common severe injuries (30.2%), followed by pulmonary contusions (19.5%) and pneumothorax (16.2%).

These figures are in agreement with studies where rib fractures range from 25–39% and are closely associated with increased ICU admissions and prolonged hospitalization.¹⁵ Pulmonary contusions, though often underdiagnosed in resource-limited centers lacking advanced imaging, remain a major determinant of morbidity.¹⁶ Of interest is the relatively high rate of conservative management (53.4%), emphasizing that early resuscitation, pain control and oxygenation can suffice in stable cases. This is supported by recent studies advocating conservative management in over 50% of isolated chest injuries when close monitoring is possible.¹⁷ Tube thoracostomy was required in 30.2% of cases—an

intervention considered both life-saving and cost-effective in resource-constrained environments.¹⁸ The thoracotomy rate (15.8%) is slightly elevated compared to tertiary urban centers (7–10%) but justified due to delayed presentations and more complex injuries.

A subset of patients required referral for cardiothoracic intervention, underlining the necessity of strong referral systems.¹⁹ Subcutaneous emphysema (9.3%) and hemopneumothorax (7%) were noted as complications, while bronchopleural fistula (1.3%) and empyema (0.2%) represented major morbidities.²⁰ These rates are comparable to global data where empyema ranges between 0.3–1% and bronchopleural fistula (BPF) remains a dreaded complication, especially in prolonged tube drainage cases.^{21,22} The mean hospital stay of 5–10 days mirrors the recovery trajectory seen in other Indian trauma units, while the low mortality and morbidity also reflect timely intervention and robust emergency protocols, even within a rural framework.²³ Duration of intercostal chest tube drainage was highest in the 5–9-day range, again matching global trends for simple hemothorax and pneumothorax management.²⁴

Finally, the presence of associated abdominal or head injuries in 12.5% of patients underlines the need for multidisciplinary trauma evaluation. Chest trauma rarely exists in isolation and missed concomitant injuries can worsen outcomes.^{25,26} No mortality was recorded during the study period, underscoring the effectiveness of protocol-based management and this absence of in-hospital mortality may also be attributed to exclusion of patients declared dead on arrival and early referral of hemodynamically unstable patients to higher centers.

Limitations

This study has certain limitations. Being a single-centre observational study, the findings may not fully generalisable to other populations. Additionally, patients declared dead on arrival and those referred immediately to

higher centers were excluded, which may have influenced mortality outcomes. Lack of long term follow-up also limited assessment of delayed complications.

CONCLUSION

Chest trauma remains a major surgical emergency in rural healthcare settings, with blunt thoracic injuries secondary to road traffic accidents and falls constituting the predominant pattern. Early diagnosis, adherence to ATLS principles, prompt tube thoracostomy when indicated and timely referral of complex cases can result in favorable outcomes even in resource-limited environments. Strengthening trauma systems, referral pathways and rural emergency infrastructure may further improve patient outcomes.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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