International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2025: 7.089

Predictors of Morbidity, Mortality and Outcomes in Blunt Chest Trauma: A Descriptive Observational Study

Dr Meghraj Chawada[1], Dr Pushkaraj Birajdar[2], Dr Pramod Lokare[3], Dr Nikila Subhashini[4]

[1]Associate Professor, Department of General Surgery, Vilasrao Deshmukh Government Medical College, Latur, Maharashtra, India

[2, 3]Assistant Professor, Department of General Surgery, Vilasrao Deshmukh Government Medical College, Latur, Maharashtra, India

[4]Junior Resident, Department of General Surgery, Vilasrao Deshmukh Government Medical College, Latur, Maharashtra, India

Abstract: ***Blunt chest trauma (BCT) is a critical public health concern contributing significantly to global morbidity and mortality, particularly among young, economically productive individuals. The thoracic cavity houses vital cardiopulmonary structures; thus, even subtle chest wall trauma can rapidly progress to life-threatening physiological instability. This hospital-based descriptive observational study evaluated the clinical profile, diagnostic findings, management strategies, complications, and predictors of morbidity and mortality in 60 patients presenting with blunt chest trauma at a tertiary care teaching hospital over an 18-month period. The mean age of the cohort was 38.93 ± 15.87 years, with a marked male predominance (75.0%, M:F ratio 3:1). Road Traffic Accidents (RTAs) were the primary mode of injury (58.3%), followed by falls from height (16.7%). Chest pain (88.3%) and breathlessness (50.0%) were the dominant complaints. Associated extra-thoracic injuries were present in 50.0% of patients, led by head injuries (30.0%) and abdominal injuries (21.7%). Rib fractures occurred in 55.0% of cases (45.0% had multiple fractures). Conservative management was effective in 78.3% of patients. Intercostal Drainage (ICD) tube insertion was required in 20.0%, Intensive Care Unit (ICU) admission in 28.3%, surgical intervention in 11.7%, and mechanical ventilation in 5.0%. Admission hypoxia (SpO_2 < 90%, $p < 0.001$) and CT-diagnosed pulmonary contusion ($p = 0.003$) were significantly associated with ICU admission. Furthermore, ICD insertion ($p < 0.001$), ICU admission ($p < 0.001$), development of complications ($p < 0.001$), and pulmonary contusion ($p = 0.042$) served as significant predictors of prolonged hospital stay (>7 days). Respiratory distress was the primary complication (31.7%). Zero inpatient mortality was recorded (0.0%), and 91.7% of patients were discharged stable. Hypoxia at presentation and CT-proven pulmonary contusion are reliable predictors of high morbidity and ICU resource requirements in BCT. Multimodal conservative therapy- anchored by early analgesia, oxygenation, and chest physiotherapy—yields excellent survival outcomes in the majority of patients.***

Keywords: Blunt Chest Trauma, Pulmonary Contusion, Morbidity Predictors, Road Traffic Accidents

1. Introduction

Trauma remains a leading cause of global disability and death, with thoracic injuries contributing directly or indirectly to up to 25% of all trauma-related mortalities [1]. In civilian trauma settings, blunt chest trauma (BCT) accounts for the vast majority of thoracic admissions, commonly arising from high-velocity road traffic accidents, falls, occupational mishaps, and direct impacts [2].

The biomechanical forces involved in BCT- deceleration, compression, shearing, and direct impact- can cause extensive structural damage to the thoracic cage, pleural space, lung parenchyma, mediastinum, heart, and abdominal viscera without breaching the overarching skin layer [3]. Clinical spectrums vary from isolated rib contusions to lethal entities like tension pneumothorax, flail chest, severe pulmonary contusions, or traumatic aortic disruption [4]. Early risk stratification is crucial in emergency trauma care [5]. Identifying clear clinical and radiological predictors of disease severity allows clinical teams to optimize intensive care unit (ICU) resource allocation, escalate monitoring, and deploy targeted interventions [6]. This study evaluates the clinical profile, management modalities, complications, and prognostic indicators of morbidity in BCT cases managed at a tertiary care teaching hospital in Western India [7].

2. Materials and Methods

2.1 Study Design and Setting

This descriptive observational study was conducted in the Department of General Surgery at Vilasrao Deshmukh Government Medical College (VDGMC), Latur, Maharashtra, India, over an 18-month period [10]. Institutional Ethics Committee approval was obtained prior to study initiation, and written informed consent was secured from all participants or legal guardians.

2.2 Study Population & Selection Criteria

The study enrolled 60 consecutive patients admitted to the Outpatient Department (OPD), Emergency/Casualty, or Inpatient Wards with documented history and clinical evidence of BCT [11].

- **Inclusion Criteria:** Patients of any age or sex presenting with blunt chest injury, requiring inpatient hospital admission, and providing voluntary informed consent.
- **Exclusion Criteria:** Patients with penetrating thoracic trauma, minor chest wall injuries not warranting admission, those brought dead or dying before completion of primary radiological evaluation, patients leaving against medical advice (LAMA), and cases with incomplete clinical records [12].

2.3 Emergency Resuscitation & Clinical Protocols

Upon arrival, patients underwent primary survey and resuscitation according to Advanced Trauma Life Support (ATLS) protocols (A-B-C-D-E) [13]. Airway patency was secured, high-flow supplemental oxygen administered, intravenous access established, and immediate life-threatening conditions (e.g., tension pneumothorax, massive hemothorax) addressed [14]. Following initial stabilization, a detailed secondary survey recorded demographic parameters, trauma mechanism, time elapsed since injury, comorbid risk factors, and systemic findings [15].

2.4 Diagnostic Modalities

All patients underwent routine baseline laboratory testing, standard 12-lead Electrocardiography (ECG), and upright or supine chest radiographs (CXR). Extended Focused Assessment with Sonography for Trauma (eFAST) was performed to screen for pleural effusion, pneumothorax, pericardial fluid, and intraperitoneal free fluid [16]. Non-contrast or Contrast-Enhanced Computed Tomography (CT) of the thorax was performed selectively in stable patients with suspected pulmonary contusions, occult pneumothorax, complex skeletal disruption, or associated polytrauma [17].

2.5 Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software. Categorical variables were presented as absolute frequencies and percentages (n, %). Continuous parameters were reported as Mean ± Standard Deviation (SD), range, and median. Group comparisons were tested using the Pearson Chi-Square test or Fisher's Exact test for categorical metrics and Student's t-test for continuous variables. A p-value < 0.05 was considered statistically significant.

3. Results and Discussion

3.1 Baseline Demographic & Injury Characteristics

The study included 60 patients aged 8 to 71 years (mean: 38.93 ± 15.87 years). The peak age incidence was observed in the 31–40 years group (28.3%), followed by 21–30 years (23.3%). Males comprised 75.0% (n=45) of the population, yielding a male-to-female ratio of 3:1. Labourers (18.3%) and students (15.0%) represented the most frequent occupational groups [18].

Table 1: Baseline Demographic and Clinical Summary

Parameter / Variable	Mean ± SD / n	Range / %
Age (years)	38.93 ± 15.87	8 – 71 years
Sex Distribution	Male: 45 | Fem: 15	75.0% Male
Time Since Injury (hrs)	16.57 ± 14.93	1 – 48 hrs
Pulse Rate (bpm)	101.87 ± 12.31	82 – 130 bpm
Systolic BP (mmHg)	108.62 ± 11.96	76 – 129 mmHg
Respiratory Rate (/min)	24.33 ± 3.93	18 – 36 /min
SpO2 at Admission (%)	91.80 ± 3.33	82% – 98%
Hospital Stay (days)	6.70 ± 4.84	2 – 20 days

Road Traffic Accidents were the predominant mechanism of trauma (58.3%, n=35), followed by falls from height (16.7%, n=10), physical assault (10.0%, n=6), animal-related trauma (6.7%, n=4), and direct blunt object impacts (5.0%, n=3). Admission within 12 hours of trauma occurred in 63.3% (n=38) of patients, while 20.0% (n=12) presented after a delay exceeding 24 hours. Alcohol intoxication at the time of trauma was recorded in 10 patients (16.7%) [19].

3.2 Clinical Presentation & Associated Polytrauma

Chest pain was the most ubiquitous complaint (88.3%, n=53), followed by breathlessness (50.0%, n=30), abdominal pain (18.3%, n=11), cough (15.0%, n=9), altered sensorium (11.7%, n=7), and hemoptysis (5.0%, n=3). Physical signs on local examination revealed chest wall tenderness in 90.0% (n=54), reduced chest expansion in 71.7% (n=43), superficial abrasions/contusions in 66.7% (n=40), rib crepitus in 43.3% (n=26), subcutaneous emphysema in 20.0% (n=12), and tracheal shift in 5.0% (n=3) [20].

Extra-thoracic injuries were documented in half of the cohort: Associated Head Injury (30.0%, n=18), Associated Abdominal Injury (21.7%, n=13), Associated Limb Injuries (10.0%, n=6), and Associated Spine Injury (1.7%, n=1) [21].

3.3 Spectrum of Thoracic Injuries

Diagnostic imaging (CXR: 100.0%, CT Thorax: 78.3%, FAST/USG: 58.3%) established a broad injury spectrum. Bony thoracic cage disruption was present in 55.0% (n=33), with 45.0% (n=27) manifesting multiple rib fractures. Single rib fractures occurred in 10.0% (n=6), while 6 fractured ribs were observed in 5.0% (n=3) [22].

Table 2: Radiological and Clinical Injury Spectrum

Thoracic Injury Pattern	Frequency (n)	Percentage (%)
Rib Fracture (Any)	33	55.0%
Multiple Rib Fractures	27	45.0%
Subcutaneous Emphysema	13	21.7%
Pneumothorax	11	18.3%
Pulmonary Contusion	10	16.7%
Pleural Effusion	10	16.7%
Hemothorax	6	10.0%
Fracture Sternum	3	5.0%
Flail Chest	1	1.7%
Hemopneumothorax	1	1.7%

3.4 Therapeutic Modalities & Management

Universal pain management was implemented, with 100.0% of patients receiving systemic analgesics. Supplemental oxygen therapy was administered to 90.0% (n=54), chest physiotherapy/incentive spirometry to 85.0% (n=51), intravenous fluids to 60.0% (n=36), and empirical/ therapeutic antibiotics to 66.7% (n=40) [23].

Conservative management alone was successful in 78.3% (n=47) of cases. Tube thoracostomy (ICD insertion) was performed in 12 patients (20.0%). The mean initial chest tube drainage volume was 318.33 mL, and the mean total ICD duration was 7.58 ± 2.14 days. Intensive Care Unit

(ICU) admission was required for 17 patients (28.3%), mechanical ventilation was indicated in 3 patients (5.0%), and surgical procedures were performed in 7 patients (11.7%) [24].

3.5 Prognostic Predictors of Morbidity & ICU Triage

Exploratory subgroup analyses revealed critical prognostic associations:

1) Predictors of ICU Admission:

- *Admission Hypoxia (SpO_2 < 90%):* 10 out of 10 hypoxic patients (100.0%) required ICU admission compared to 14.0% (7/50) of non-hypoxic patients ($p < 0.001$, Fisher's Exact test).
- *Pulmonary Contusion:* 7 out of 10 patients (70.0%) with CT-confirmed pulmonary contusions required ICU admission versus 20.0% (10/50) without contusion ($p = 0.003$, Fisher's Exact test) [25].

Table 3: Predictors of Prolonged Hospital Stay (>7 Days)

Clinical Factor	Present (Days)	Absent (Days)	p-value
ICD Insertion	14.25 ± 4.18	4.81 ± 2.68	< 0.001
ICU Admission	11.59 ± 5.28	4.77 ± 2.97	< 0.001
Any Complication	9.21 ± 5.56	5.03 ± 3.47	< 0.001
Pulm. Contusion	8.90 ± 4.23	6.26 ± 4.88	0.042
Rib Fracture (Any)	6.24 ± 4.62	7.26 ± 5.13	0.524
Multiple Rib Fractures	6.70 ± 4.90	6.70 ± 4.88	0.742

2) Predictors of Prolonged Stay (>7 Days):

- *ICD Tube Insertion:* All 12 patients (100.0%) requiring an ICD experienced a hospital stay >7 days (mean: 14.25 ± 4.18 days) versus 14.6% (7/48) managed without an ICD (mean: 4.81 ± 2.68 days) ($p < 0.001$).
- *ICU Requirement:* Patients admitted to the ICU had a significantly longer hospital stay (11.59 ± 5.28 days vs. 4.77
- ± 2.97 days, $p < 0.001$).
- *Development of Complications:* The occurrence of any secondary complication increased mean hospital stay from
- 5.03 ± 3.47 days to 9.21 ± 5.56 days ($p < 0.001$).
- *Pulmonary Contusion:* Patients with pulmonary contusions had a mean stay of 8.90 ± 4.23 days versus 6.26 ± 4.88 days in those without parenchymal contusions ($p = 0.042$) [26].

3.6 Secondary Complications & Discharge Status

Complications were recorded in 24 patients (40.0%), with respiratory distress being the primary issue (31.7%, n=19). Secondary complications included acute respiratory failure (10.0%, n=6), hospital-acquired pneumonia (5.0%, n=3), and atelectasis (5.0%, n=3). No instances of post-traumatic empyema, persistent air leaks, or systemic sepsis were observed [27].

Overall survival was 100.0%, with zero deaths recorded during the index hospitalization. At discharge, 91.7% (n=55) were fully stabilized, 3.3% (n=2) showed significant recovery, and 5.0% (n=3) were discharged/referred in guarded condition [28].

4. Equations

Mathematical models and trauma severity scoring formulas are formatted according to standard journal guidelines. For example, the Thoracic Trauma Severity Score (TTSS) formula is represented as:

$$TTSS = Age + PaO_2/FiO_2 + Rib\ Fractures + Contusion + Pleural\ Lesion$$

5. Conclusions

Blunt chest trauma primarily affects young adult males involved in road traffic accidents. Admission hypoxia (SpO_2< 90%) and CT-diagnosed pulmonary contusions serve as independent clinical indicators for ICU triage. Furthermore, the need for tube thoracostomy, ICU care, and the presence of parenchymal contusions are reliable predictors of an extended hospital stay.

Recommendations

Baseline SpO_2 should be recorded immediately during primary trauma screening; a reading below 90% should prompt rapid ICU triage. Selective CT scanning should be performed in stable patients with significant trauma mechanisms to identify occult contusions early. Standardized care pathways combining multimodal analgesia, early chest physiotherapy, and incentive spirometry should be routinely implemented to minimize secondary pulmonary complications [29].

References

[1] F. Coccolini, E. E. Moore, Y. Kluger, et al., "Thoracic trauma WSES-AAST guidelines," *World Journal of Emergency Surgery*, vol. 20, p. 69, 2025.
[2] B. N. Dogrul, I. Kiliccalan, E. S. Asci, and S. C. Peker, "Blunt trauma related chest wall and pulmonary injuries: an overview," *Chinese Journal of Traumatology*, vol. 23, no. 3, pp. 125-138, 2020.
[3] R. N. Mistry, A. Bleetman, and K. J. Roberts, "Management of blunt thoracic trauma," *Anaesthesia*, vol. 77, no. S1, pp. 55-63, 2022.
[4] C. Ludwig and A. Koryllos, "Management of chest trauma," *Journal of Thoracic Disease*, vol. 9, no. S3, pp. S172-S177, 2017.
[5] M. Kim and J. E. Moore, "Chest trauma: current recommendations for rib fractures, pneumothorax, and other injuries," *Current Anesthesiology Reports*, vol. 10, no. 1, pp. 61-68, 2020.
[6] J. Palas, A. P. Matos, V. Mascarenhas, et al., "Multidetector computed tomography: evaluation of blunt chest trauma in adults," *Radiology Research and Practice*, vol. 2014, Article ID 864369, 2014.
[7] G. Caputo, V. Carbone, T. Saranteas, et al., "Thoracic trauma: current approach in emergency medicine," *Journal of Clinical Medicine*, vol. 13, no. 16, p. 4655, 2024.
[8] International Journal of Science and Research (IJSR), "Author Guidelines and Paper Template," IJSR Module, 2026.
[9] J. Zeiler, S. Idell, S. Norwood, and A. Cook, "Hemothorax: a review of the literature," *Clinical*

Pulmonary Medicine, vol. 27, no. 1, pp. 1-12, 2020.
[10] R. Narayanan, S. Kumar, A. Gupta, et al., "An analysis of presentation, pattern and outcome of chest trauma patients at an urban level 1 trauma center," *Indian Journal of Surgery*, vol. 80, no. 1, pp. 36-41, 2018.
[11] P. Manay, R. Tyagi, P. Kaur, et al., "Studying morbidity and predicting mortality in patients with blunt chest trauma using a novel clinical score," *Journal of Emergencies, Trauma, and Shock*, vol. 10, no. 3, pp. 128-133, 2017.
[12] B. S. Walia, P. Duggal, and S. Sharma, "Clinical features, management, and outcomes of chest trauma at a tertiary-care centre in India," *Scientifica*, vol. 2021, Article ID 6625981, 2021.
[13] B. Singh, N. Garg, M. Yadav, and A. Kumar, "Clinical features, management and outcomes of chest trauma at a tertiary-care centre in India," *Journal of Clinical and Diagnostic Research*, vol. 15, no. 5, pp. PC01-PC05, 2021.
[14] A. Easter, "Management of patients with multiple rib fractures," *American Journal of Critical Care*, vol. 10, no. 5, pp. 320-327, 2001
[15] E. M. Bulger, M. A. Arneson, C. N. Mock, and G. J. Jurkovich, "Rib fractures in the elderly," *Journal of Trauma*, vol. 48, no. 6, pp. 1040-1046, 2000.
[16] C. E. Battle and P. A. Evans, "Predictors of mortality in patients with flail chest: a systematic review," *Emergency Medicine Journal*, vol. 32, no. 12, pp. 961-965, 2015.
[17] D. W. Ziegler and N. N. Agarwal, "The morbidity and mortality of rib fractures," *Journal of Trauma*, vol. 37, no. 6, pp. 975-979, 1994.
[18] M. Sirmali, H. Türüt, S. Topçu, et al., "A comprehensive analysis of traumatic rib fractures: morbidity, mortality and management," *European Journal of Cardio-Thoracic Surgery*, vol. 24, no. 1, pp. 133-138, 2003.
[19] M. K. Karmakar and A. M. H. Ho, "Acute pain management of patients with multiple fractured ribs," *Journal of Trauma*, vol. 54, no. 3, pp. 615-625, 2003.
[20] B. T. Flagel, F. A. Luchette, R. L. Reed, et al., "Half-a-dozen ribs: the breakpoint for mortality," *Surgery*, vol. 138, no. 4, pp. 717-725, 2005.
[21] S. Rendeki and T. F. Molnár, "Pulmonary contusion," *Journal of Thoracic Disease*, vol. 11, no. S2, pp. S141-S151, 2019.
[22] F. A. Ganie, H. Lone, G. N. Lone, et al., "Lung contusion: a clinico-pathological entity with unpredictable clinical course," *Bulletin of Emergency and Trauma*, vol. 1, no. 1, pp. 7-16, 2013.
[23] I. Mahmood, A. El-Menyar, B. Younis, et al., "Clinical significance and prognostic implications of pulmonary contusion in patients with blunt chest trauma," *Journal of Thoracic Disease*, vol. 9, no. 9, pp. 3181-3189, 2017.
[24] M. S. Sayed, W. Elmesallamy, and A. K. Mohamed, "Validity of quantifying pulmonary contusion extent by computed tomography in predicting outcome in blunt chest trauma," *Egyptian Journal of Radiology and Nuclear Medicine*, vol. 53, p. 108, 2022.
[25] A. Sharma and P. Jindal, "Principles of diagnosis and management of traumatic pneumothorax," *Journal of Emergencies, Trauma, and Shock*, vol. 1, no. 1, pp. 34-41, 2008.
[26] N. T. Mowery, O. L. Gunter, B. R. Collier, et al., "Practice management guidelines for management of hemothorax and occult pneumothorax," *Journal of Trauma*, vol. 70, no. 2, pp. 510-518, 2011.
[27] American College of Surgeons Committee on Trauma, *Advanced Trauma Life Support Student Course Manual*, 10th ed., Chicago: ACS, 2018.
[28] S. Kourouche, T. Buckley, B. Munroe, and K. Curtis, "Development of a blunt chest injury care bundle: an integrative review," *Injury*, vol. 49, no. 6, pp. 1008-1023, 2018.
[29] A. Gupta, A. Kumar Sharma, N. K. Suthar, et al., "Epidemiological pattern of blunt trauma chest in western India," *Indian Journal of Surgery*, vol. 82, pp. 1112-1117, 2020.

Author Profile

Dr. Nikila Subhashini received her M.B.B.S. degree and is currently a Post Graduate Resident Doctor in the Department of General Surgery at Vilasrao Deshmukh Government Medical College (VDGMC), Latur, Maharashtra, India. Her research interests include acute care surgery, thoracic trauma management and emergency resuscitation protocols.