ISSN: 2320-9267

Indian Journal of Pharmaceutical and Biological Research (IJPBR)

Journal homepage: www.ijpbr.in

RESEARCH ARTICLE

Distribution of Chest Trauma Severity Using Thorax Trauma Severity Score Among Patients in a Tertiary Care Institute of North East India

Debraj Datta Choudhury[1*], Nilotpal Chakma[2], Tapash Rudra Paul[3], Abhirami P P[4], Bhupendra Kumar Sahu[5]

ABSTRACT

Background: Chest trauma is a major contributor to traumarelated morbidity and mortality worldwide, accounting for nearly onequarter of trauma deaths. The Thorax Trauma Severity Score (TTSS) has been validated as a prognostic tool, but regional data from NorthEast India remain limited.

Objective: To estimate the proportion of different grades of chest trauma using TTSS among patients attending a tertiary-care teaching hospital in NorthEast India.

Methods: This observational crosssectional study included 210 patients with isolated chest trauma admitted between June 2024 and November 2025. Patients were categorised into five TTSS groups (I–V) based on cumulative scores ranging from 0 to 25. Demographic data, mechanism of injury, laterality, and hospitalisation status were analysed.

Results: A total of 210 patients were included, of whom 180 (85.7%) were male, and 30 (14.3%) were female, yielding a maletofemale ratio of 6:1. The mean age was 42.1 ± 15.8 years, with the largest subgroup in the 41–50year range (23.3%). More than half of the patients (54.8%) were from urban areas, while 45.2% resided in rural regions; 84.8% lived in plains and 15.2% in hilly terrain. Road traffic accidents were the predominant mechanism of injury (76.7%), followed by falls (11.9%) and assaults (8.6%). Rightsided chest trauma was most frequent (56.7%), with leftsided injuries in 24.8% and bilateral involvement in 18.6%. Distribution across TTSS categories showed that most patients belonged to Groups I and II (scores 0–10), while fewer cases were observed in higher severity groups (III–V).

Conclusion: TTSS effectively stratified patients into severity categories, with higher scores associated with greater need for hospitalisation. The findings validate TTSS as a reliable tool for stratifying chest trauma severity in NorthEast India.

Keywords: Chest trauma; Thorax Trauma Severity Score; Rib fractures; Road traffic accidents; Epidemiology; Severity distribution.

Indian J. Pharm. Biol. Res. (2026): https://doi.org/10.30750/ijpbr.14.2.41

Introduction

Trauma continues to be a major public health challenge worldwide, contributing substantially to morbidity, mortality, and longterm disability. The World Health Organization estimates that injuries account for nearly 10% of all global deaths, with road traffic accidents, falls, and interpersonal violence being the leading causes.[1] In 2017, India officially recorded 464,910 road traffic accidents, which resulted in 147,913 deaths and 470,975 injuries. This translates to an average of 1,274 accidents per day, resulting in approximately 405 fatalities and 1,290 injuries.[2] Within this spectrum of injuries, thoracic trauma represents a critical subset, ranking as the second most common cause of death in polytrauma patients after head injury.[3] Chest trauma contributes to approximately onequarter of traumarelated deaths globally, underscoring its clinical significance.[4]

The pathophysiological consequences of chest trauma are diverse, ranging from mechanical complications such as massive hemothorax and tension pneumothorax to parenchymal injuries like pulmonary contusion and acute respiratory distress syndrome (ARDS).[5] Although a majority of thoracic injuries can be managed conservatively or with tube thoracostomy, a significant proportion of patients require intensive care admission and ventilatory support.[6] Rib fractures, one of the most common manifestations of chest trauma, demonstrate a dose–response relationship with increasing severity. Flagel et al. highlighted that the risk burden rises with each additional rib fracture, particularly when six or more ribs are involved.[7] In elderly patients, the impact is even more pronounced, with higher risks of pneumonia and death compared to younger individuals.[8,9]

Accurate prognostic assessment is essential for guiding clinical decisionmaking, triaging patients to intensive care, and optimising resource allocation. Several trauma scoring systems have been developed, including the Injury Severity Score (ISS), Revised Trauma Score (RTS), and Trauma and Injury Severity Score (TRISS).[10] Recognising this gap, Pape et al. introduced the Thorax

[1]MBBS, Post Graduate Trainee, Department of General Surgery, Agartala Government Medical College & Govind Ballav Pant Hospital, Tripura, India

[2]MS (General Surgery), FNB (Minimal Access Surgery), Professor, Department of General Surgery, Agartala Government Medical College & Govind Ballav Pant Hospital, Tripura, India

[3]MS (General Surgery), Assistant Professor, Department of General Surgery, Agartala Government Medical College & Govind Ballav Pant Hospital, Tripura, India

[4]MBBS, Post Graduate Trainee, Department of General Surgery, Agartala Government Medical College & Govind Ballav Pant Hospital, Tripura, India

[5] MBBS, Post Graduate Trainee, Department of General Surgery, Agartala Government Medical College & Govind Ballav Pant Hospital, Tripura, India

Corresponding Author: Debraj Datta Choudhury, MBBS, Post Graduate Trainee, Department of General Surgery, Agartala Government Medical College & Govind Ballav Pant Hospital, Tripura, India, E-mail: debraj2akash@gmai.com

How to cite this article: Choudhury DD, Chakma N, Paul TR, Abhirami PP, Sahu BK. Distribution of Chest Trauma Severity Using Thorax Trauma Severity Score Among Patients in a Tertiary Care Institute of North East India. Indian J. Pharm. Biol. Res. 2026;14(2):230-235.

Source of support: Nil

Conflict of interest: None.

Received: 20/05/2026 **Revised:** 29/05/2026 **Accepted:** 19/06/2026 **Published:** 22/06/2026

Trauma Severity Score (TTSS) in 2000 as a chestspecific severity index.[11] TTSS incorporates five parameters—age, PaO_2/FiO_2 ratio, pulmonary contusion, pleural involvement, and rib fractures—each graded from 0 to 5, yielding a cumulative score ranging from 0 to 25. Higher TTSS values reflect greater injury severity, incorporating factors such as age, oxygenation status, pulmonary contusion, pleural involvement, and rib fractures.[12]

Regional data from NorthEast India remains scarce. Differences in demographic profiles, injury mechanisms, and healthcare infrastructure may influence the distribution of chest trauma severity and the applicability of TTSS thresholds. Local epidemiological studies are therefore essential to determine whether TTSS can reliably stratify patients in this region. Understanding the proportion of patients across different TTSS categories—low, moderate, and high severity—will provide valuable insights into the burden of chest trauma and guide institutional resource planning.

The present study aims to estimate the distribution of chest trauma severity using the TTSS among patients attending Agartala Government Medical College, a tertiary-care teaching hospital in NorthEast India. By categorising patients according to TTSS grades, this study seeks to establish a baseline epidemiological profile of chest trauma severity in the region. Such data will not only contribute to regional trauma literature but also strengthen the evidence base for adopting TTSS as a routine prognostic tool in clinical practice.

Materials And Methodology

Study type and Design

This was an observational, crosssectional study.

Study Setting and Duration

The study was conducted in the Department of General Surgery at Agartala Government Medical College & Govind Ballabh Pant Hospital from June 2024 to November 2025 (1.5 years).

Study Population and Sample Size

All patients presenting with chest trauma to AGMC & GBPH during the study period who provided informed consent and met the inclusion criteria were enrolled. As census sampling was performed, no formal sample size calculation was required.

Sampling Technique

Census sampling was adopted, including all eligible patients during the study period.

Inclusion Criteria

- Patients primarily attending for chest trauma.
- Patients with associated minor head injury, minor abdominal injury, or extremity injury.

Exclusion Criteria

- Patients with moderate to severe head injury.
- Patients with moderate to severe abdominal injury.

Study Tool

Data were collected using a pretested structured interview proforma based on the TTSS. TTSS incorporates five parameters:

- Age
- PaO_2/FiO_2 ratio
- Pulmonary contusion
- Pleural involvement
- Rib fractures

Each parameter is graded from 0 to 5, yielding a cumulative score ranging from 0 to 25. Patients were categorised into

five severity grades (Grades I–V) based on their total score (Table 1).

Methods of Data Collection

Written informed consent was obtained from all eligible patients. Each consenting subject was assessed using TTSS parameters. Due to the limited availability of arterial blood gas (ABG) samples, PaO_2/FiO_2 ratios were calculated using the conversion scale from the EPICII study.

Table 1: Thorax Trauma Severity Scoring System

Parameters	*Findings*	*Score*
Age	<30 years of age	0
	30-41 years of age	1
	42-54 years of age	2
	55-70 years of age	3
	>70years of age	5
PaO2/FiO2	>400	0
	301-400	1
	201-300	2
	150-200	3
	<150	5
Pulmonary Contusions	None	0
	1 lobe, unilateral	1
	1 lobe, bilateral	2
	2 lobes, unilateral	2
	<2lobes, bilateral	3
	>2 lobes, bilateral	5
Pleural Involvement	None	0
	Pneumothorax	1
	U/L Hemothorax or Hemopneumothorax	2
	B/L Hemothorax or Hemopneumothorax	3
	Tension Pneumothorax	5
Rib Fractures	0	0
	1-3	1
	4-6 unilateral	2
	>3 bilateral	3
	Flail chest	5

*Group I:- 0-5, Group II: 6-10, Group III: 11-15, Group IV: 16-20, Group-5: 21-25

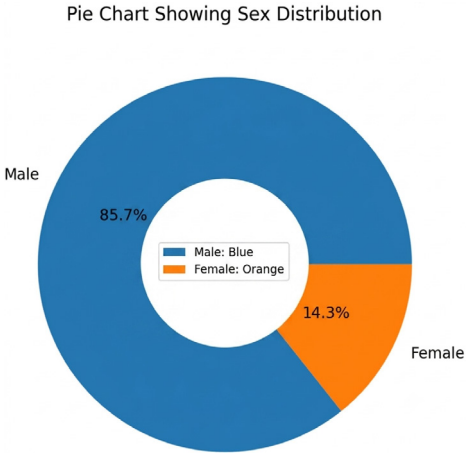

Figure 1: Sex distribution of the study participants

Ethical Considerations

Approval was obtained from the Institutional Ethics Committee (Ref. No. F.4(6-13)/AGMC/Medical Education/ IEC Approval/2022/6829).

Data Analysis

Data were analysed using SPSS software, version 25. Results were expressed as frequencies and percentages and presented using bar diagrams and pie charts. Appropriate statistical tests were applied according to the nature of the data.

Results

A total of 210 patients with isolated chest trauma were enrolled at AGMC and GBP Hospital over a period of 1.5 years, fulfilling the inclusion and exclusion criteria. Among them, 180 (85.7%) were male, and 30 (14.3%) were female, yielding a maletofemale ratio of approximately 6:1 (Figure 1).

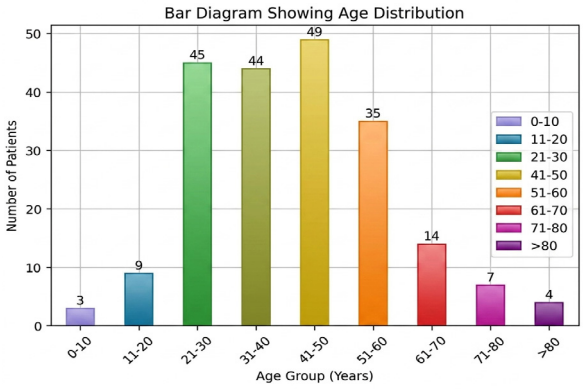

Figure 2: Age distribution of the study participants

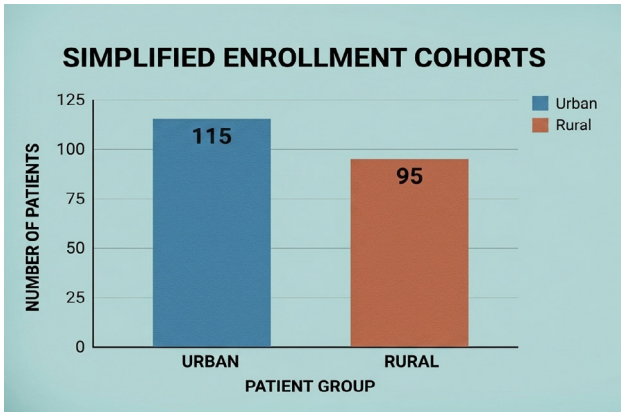

Figure 3: Distribution of study participants (Urban vs Rural)

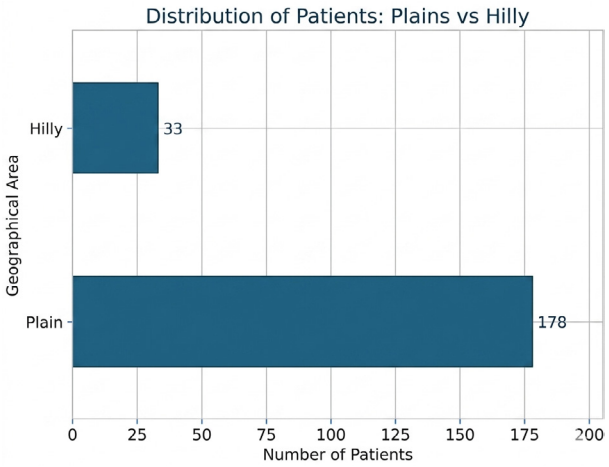

Figure 4: Distribution of study participants (Plains vs Hilly)

Figure 2 shows that the mean age of the study cohort was 42.1 ± 15.8 years. Twelve patients (5.7%) were younger than 20 years, while 25 (11.9%) were older than 60 years. The largest subgroup was the 41–50year age group, comprising 49 patients (23.3%), followed by the 21–30year group with 45 patients (21.4%) and the 31–40year group with 44 patients (21.0%).

Figure 3 indicates that in the study population, 54.8% of patients were from urban areas and 45.2% from rural areas.

Figure 4 illustrates that the majority of patients (84.8%) resided in the plains, while 15.2% were from hilly regions.

Road traffic accidents (RTA) were the predominant mode of injury, accounting for 161 cases (76.7%). This was followed by accidental falls in 25 patients (11.9%) and assault in 18 patients (8.6%). Six patients (2.9%) sustained

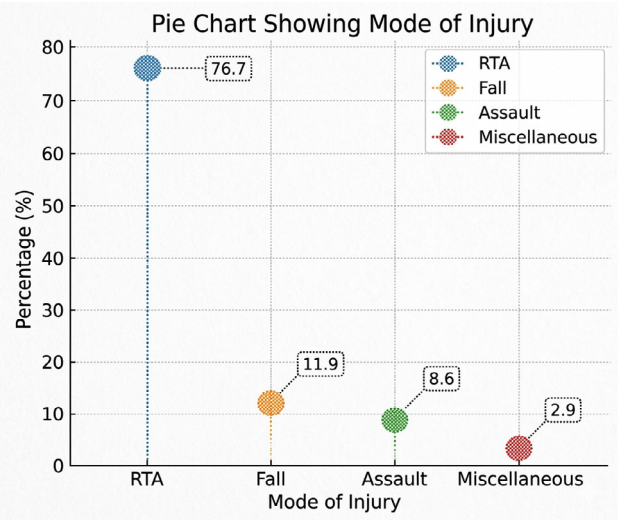

Figure 5: Mode of injury

injuries from miscellaneous causes such as animal attacks, impact by heavy objects, and collapse of mud walls. The majority of injuries were blunt in nature. Notably, among the assault cases, 5 of 18 patients presented with penetrating chest trauma (Figure 5).

A total of 119 patients (56.7%) sustained isolated rightsided chest injuries, 52 (24.8%) had leftsided involvement, and 39 (18.6%) presented with bilateral injuries (Figure 6).

Discussion

Chest trauma continues to be a major contributor to traumarelated morbidity and mortality worldwide, accounting for nearly onequarter of all trauma deaths and ranking second only to head injury in polytrauma patients.[13] In the present study, 210 patients with isolated chest trauma

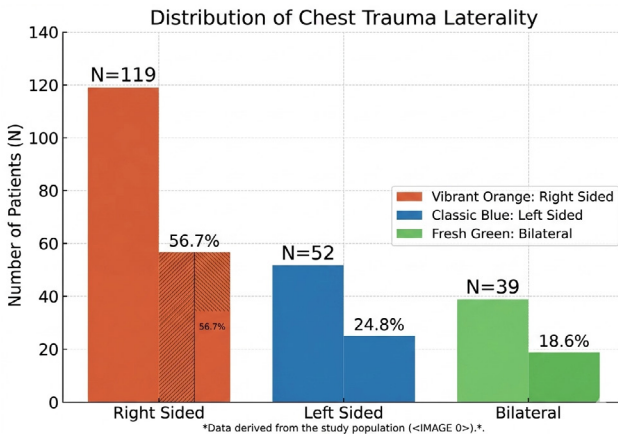

Figure 6: Distribution of chest trauma laterality

were evaluated using the TTSS, providing valuable insights into the distribution of severity in a tertiary care setting in North East India.

The demographic profile revealed a striking male predominance (85.7%), with a maletofemale ratio of approximately 6:1. This finding is consistent with previous Indian and international studies, where males are disproportionately affected due to greater exposure to road traffic accidents, occupational hazards, and outdoor activities.[14,15] Such gender disparity highlights the need for targeted preventive strategies, including stricter enforcement of traffic regulations and workplace safety measures.

The mean age of 42.1 years underscores the vulnerability of the economically productive age group. Similar age distributions have been reported in other trauma registries,[16] reflecting the heavy burden chest trauma imposes on the working population. This has significant socioeconomic implications, as injuries in this age group not only affect individual health but also contribute to loss of productivity and increased healthcare costs.

Road traffic accidents emerged as the predominant mechanism of injury (76.7%), followed by falls (11.9%) and assaults (8.6%). This pattern mirrors national statistics, where RTAs remain the leading cause of chest trauma.[5,7] The high proportion of RTArelated injuries emphasises the urgent need for road safety interventions, including improved infrastructure, public awareness campaigns, and stricter enforcement of helmet and seatbelt use. Falls and assaults, though less frequent, highlight the importance of communitylevel injury prevention strategies.

Laterality analysis revealed that rightsided injuries were most common (56.7%), followed by leftsided (24.8%) and bilateral involvement (18.6%). Bilateral injuries were associated with higher severity, consistent with the pathophysiological burden of extensive rib fractures and pleural involvement.[17] Rib fractures, particularly when multiple or bilateral, are markers of increased severity.[18] This finding reinforces the clinical importance of careful radiological assessment and early recognition of bilateral involvement, as these patients may require closer monitoring and more aggressive management.

The distribution of patients across TTSS categories showed that the majority were in Groups I and II (scores 0–10), indicating lowtomoderate severity. A smaller proportion fell into higher severity groups (III–V), reflecting the relatively lower incidence of extreme chest trauma in this cohort. This stratification provides valuable epidemiological data for regional healthcare planning, as it highlights the predominance of mildtomoderate cases and identifies a subset of patients at risk of severe complications.

Overall, the present study contributes regional data to the growing body of literature on TTSS. Documenting demographic trends, mechanisms of injury, and the distribution of severity underscores the applicability of TTSS in North East India. These findings can guide institutional resource allocation, strengthen trauma care protocols, and inform preventive strategies tailored to local epidemiological patterns.

Conclusion

This study highlights the prognostic utility of TTSS in stratifying chest trauma severity among patients in a tertiary care hospital in NorthEast India. The majority of patients had low-to-intermediate TTSS scores, while a smaller proportion were in higher-severity categories. TTSS proved useful in stratifying chest trauma severity in this regional population. These results confirm TTSS as a simple, reproducible, and clinically relevant scoring system that can guide triage, predict hospitalisation needs, and optimise resource allocation in trauma care. Regional validation strengthens the applicability of TTSS in diverse healthcare settings and underscores its role in stratifying chest trauma severity.

Study limitations

Several limitations must be acknowledged. First, the study was conducted in a single tertiary care centre, which may limit generalizability to other regions with different healthcare infrastructures. Second, the observational design precludes causal inference, and confounding factors such as comorbidities and prehospital care were not fully accounted for. Third, arterial blood gas analysis was not universally available, and PaO_2/FiO_2 ratios were estimated using conversion scales, which may introduce measurement bias. Finally, the relatively small number of patients in higher TTSS groups limits the ability to fully describe distribution patterns at the extreme end of severity. Future multicentric studies with larger cohorts and standardised diagnostic protocols are warranted to refine TTSS thresholds and validate its prognostic accuracy across varied populations.

References

1. Franklin RC, Sleet DA. Injury prevention and health promotion: A global perspective. Health Promot J Austr. 2018;29(2):113-6.
2. Pal R, Ghosh A, Kumar R, Galwankar S, Paul SK, Pal S, et al. Public health crisis of road traffic accidents in India: Risk

factor assessment and recommendations on prevention on the behalf of the Academy of Family Physicians of India. J Family Med Prim Care. 2019;8(3):775-83.

3. Demetriades D, Murray J, Charalambides K, Alo K, Velmahos G, Rhee P, et al. Trauma fatalities: time and location of hospital deaths. J Am Coll Surg. 2004;198(1):20-6.
4. Adal O, Tareke AA, Bogale EK, Anagaw TF, Tiruneh MG, Fenta ET, et al. Mortality of traumatic chest injury and its predictors across sub-saharan Africa: systematic review and meta-analysis, 2024. BMC Emerg Med. 2024;24(1):32.
5. Kim M, Moore JE. Chest Trauma: Current Recommendations for Rib Fractures, Pneumothorax, and Other Injuries. Curr Anesthesiol Rep. 2020;10(1):61-8.
6. Battle CE, Hutchings H, Evans PA. Risk factors that predict mortality in patients with blunt chest wall trauma: a systematic review and meta-analysis. Injury. 2012;43(1):8-17.
7. Flagel BT, Luchette FA, Reed RL, Esposito TJ, Davis KA, Santaniello JM, et al. Half-a-dozen ribs: the breakpoint for mortality. Surgery. 2005;138(4):717-23; discussion 723-5.
8. Bulger EM, Arneson MA, Mock CN, Jurkovich GJ. Rib fractures in the elderly. J Trauma. 2000;48(6):1040-6; discussion 1046-7.
9. Cheng R, Yang M, Zhang Y, Cho WC, Ma D, Chen D, et al. Risk factors affecting pulmonary complications in elderly patients with isolated rib fractures. J Thorac Dis. 2025;17(2):542-50.
10. Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. J Trauma. 1987;27(4):370-8.
11. Mohideen BJ, Hazra D, Sahu S, Chandy GM. Validation of the Thoracic Trauma Severity Score (TTSS) for predicting emergency room and hospital outcomes in patients with thoracic trauma: a prospective observational study from India. Med J Dr DY Patil Vidyapeeth. 2025;18(5):85563.
12. Khamees AR, Hussein HK, Hmaydoosh G, Moqbel I, Mahfoud A, Alhaibi YAE, et al. Comparison of the Thoracic Trauma Severity Score (TTSS) and Trauma and Injury Severity Score (TRISS) in predicting clinical outcomes in chest trauma patients: protocol for a prospective cohort study from Iraq. Int J Surg Protoc. 2025;29(4):167-75.
13. Cai Q, Jiang Y, Zhu B, Huang C, Wang Z. Global burden and trends of severe chest injuries from 1990 to 2021 and projections to 2045. Medicine (Baltimore). 2025;104(51):e46393.
14. Walia BS, Dugg P, Aulakh KS, Sharma S, Kapur V. Study of trauma profile and outcomes at a tertiary care centre: a cohort of 1000 cases. J Clin Diagn Res. 2021;15(8):PC016.
15. Karajizadeh M, Yadollahi M, Yousefi MR, Bordbar N. Mortality risk factors in chest trauma patients in a level one trauma center in southern Iran. Sci Rep. 2025 Sep 2;15(1):32310. doi: 10.1038/s41598-025-13830-6. Erratum in: Sci Rep. 2025;15(1):43571.
16. Pati S, Dwivedi R, Athe R, Dey PK, Swain S. Minimum data set (MDS) based trauma registry, is the data adequate? An evidence-based study from Odisha, India. J Family Med Prim Care. 2019;8(1):7-13.
17. Dogrul BN, Kiliccalan I, Asci ES, Peker SC. Blunt trauma related chest wall and pulmonary injuries: An overview. Chin J Traumatol. 2020;23(3):125-38.
18. Raats JH, Brameier DT, van der Velde D, Javedan H, Weaver MJ. Frailty index predicts adverse short- and long-term outcomes in older adults with rib fractures. Injury. 2025;56(5):112144.