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Clinical Characteristics and Management Strategies for Polytrauma Patients in a Tertiary Care Center: A Retrospective study

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ABSTRACT

Introduction: Polytrauma remains a critical public health issue due to its substantial costs, loss of productive life, and the societal dependency resulting from disabilities. Modernization has led to a rise in unintentional injuries, creating a global epidemic. This study aims to evaluate the clinical profiles and management strategies of polytrauma patients to enhance patient outcomes.

Materials and Methods: A prospective observational study was conducted on 145 adult trauma patients admitted to the ICU at a multidisciplinary 24-hour emergency tertiary care hospital. Data were collected using a predefined semi-structured questionnaire. Inclusion criteria encompassed adult patients with polytrauma and an Injury Severity Score (ISS) ≥ 16 . Data were presented as frequencies, percentages, and bar diagrams and analyzed using SPSS version 20, with a P-value < 0.05 considered statistically significant.

Results: The majority of patients were aged 18-40 years, with a mean age of 28.52 years. Males comprised majority of the study population. Based on the ISS, 2.07% of patients scored 16-30, 31.03% scored 31-45, 62.76% scored 46-60, and 4.14% scored 61-75. Management strategies included resuscitation (88.97%), early appropriate care/early definitive fixation (15.17%), safe definitive surgery (13.79%), damage control orthopedics (26.90%), early total care (20%), and isolated musculoskeletal surgeries (MuST) (2.76%).

Conclusion: Trauma predominantly affects younger males, with road traffic accidents being the most common cause. The most frequently reported ISS range was 45-60. Complications among study patients included pulmonary embolism, resuscitation-induced coagulopathy, septic shock, sepsis, multi-organ failure, ventilator-associated pneumonitis, and death.

Key Words: Polytrauma, management, complications, injury severity score

INTRODUCTION

Polytrauma is a significant cause of morbidity and mortality worldwide, affecting both developed and developing nations. The term "polytrauma" refers to patients with blunt trauma who have injuries affecting multiple body regions or cavities, which compromise the patient's physiology and can lead to dysfunction in uninjured organs [1-3]. The Berlin definition of polytrauma categorizes it as a condition where a patient has an Abbreviated Injury Severity Score of ≥ 3 in two or more different body regions, combined with at least one of the following physiological parameters: systolic blood pressure (SBP) ≤ 90 mm Hg, Glasgow Coma Scale (GCS) score ≤ 8 , base excess ≤ -6.0 , international normalized ratio (INR) ≥ 1.4 , partial thromboplastin time ≥ 40 seconds, or age ≥ 70 years [4,5].

For optimal outcomes in trauma patients, comprehensive trauma care is essential, encompassing a robust prehospital care system, skilled personnel, adequate infrastructure, necessary equipment, and a steady supply of resources [6-8]. Two critical components in managing polytrauma patients are resuscitation and damage control orthopaedics. Early recognition and management of trauma-induced coagulopathy during resuscitation are crucial to prevent complications [8].

Trauma remains a significant public health issue due to its high economic cost, loss of productive life, and the societal burden of disability. Santry et al. have recently proposed a quadrimodal distribution of trauma-related deaths: the first peak occurs at the injury scene, the second peak in the emergency department (ED), the third peak during hospitalization, and the fourth peak after patient discharge [9].

Modernization has led to an increase in various unintentional injuries, resulting in a global epidemic [10]. This study aimed to assess the clinical profile of polytrauma patients and their management strategies to identify ways to improve patient outcomes.

MATERIAL AND METHODS

A prospective observational study was conducted involving 145 adult patients with a history of trauma admitted to the ICU of a multidisciplinary 24-hour emergency tertiary care hospital. Data collection was performed using a predefined semi-structured questionnaire.

Inclusion and Exclusion Criteria: The study included adult patients with polytrauma and an Injury Severity Score (ISS) ≥ 16 . Patients with traumatic injuries involving only one system and those who did not provide consent were excluded. Purposive sampling was utilized for patient selection.

Initial Evaluation and Assessment: All polytrauma patients underwent an initial evaluation and rapid systematic assessment to identify potential life-threatening conditions. Information was collected on injury history, fracture characteristics, associated injuries, medical comorbidities, and provisional treatment techniques. Blood investigations (total count, hematocrit, blood grouping, arterial blood gas values, lactic acid, pH, and base excess) were performed, followed by appropriate resuscitation.

Organ System Assessment and Injury Scoring: Various organ systems involved in the trauma were assessed, and the ISS scoring system was applied to grade the severity of polytrauma. Only patients with an ISS > 16 were included in the study. Following initial assessment and stabilization, patients were transferred to the ICU for further management. Depending on the severity of injury and acidosis, management included administration of crystalloids, colloids, sodium bicarbonates, and blood transfusions for those with severe blood loss and hemorrhagic shock.

Secondary Assessment: Eight hours post-admission, a second set of blood samples was taken to assess hematocrit values, hemoglobin, arterial blood gas values, lactic acid, pH, and base excess. Injuries were classified based on anatomical areas: traumatic brain injury/skull fracture, maxillofacial injury, chest wall injury, abdominal injury, extremity injury, and soft tissue injuries. The physiological severity of injuries was calculated using the ISS.

Surgical Management: Once acidosis was corrected, as determined by pH, lactic acid, and base excess values, patients underwent definitive surgeries based on fracture patterns and anesthesia type. Postoperative care was managed by ICU intensivists. Treatment details, including the need for various management modalities such as resuscitation, damage control orthopedics, early appropriate care, trauma-induced coagulopathy management, and prevention of second-hit injury, were documented.

Complications and Follow-Up: Complications associated with polytrauma and its treatment were assessed, including local wound infections, sepsis, septic shock, pulmonary complications (e.g., ARDS, pulmonary embolism, pneumonia), acute renal failure, multiple organ dysfunction syndrome (MODS), deep venous thrombosis (DVT), and death. Patients were followed up for one month to monitor these complications.

Early Appropriate Care Protocol: The Early Appropriate Care protocol was adhered to, relying on continuous reassessment of acidosis as a response to resuscitation. Surgery was permitted when specific laboratory criteria were met, with definitive fixation occurring within 36 hours of injury.

This protocol aimed to reduce pulmonary and other complications and shorten hospital stay [11-13].

Data Analysis: Data were presented as frequencies, percentages, and bar diagrams. Analysis was performed using SPSS version 20, with a P-value < 0.05 considered statistically significant.

RESULTS

In this study, the baseline characteristics of the polytrauma patient population were analyzed (Table 1), revealing a predominance of younger individuals with a mean age of 28.52 years. Specifically, 56.55% of the patients were between 18 and 40 years old, while 35.17% were aged 41 to 60 years, and a smaller fraction (8.28%) were over 60 years of age. The majority of injuries resulted from road traffic accidents (68.97%), with falls from heights constituting 20.00%, and assaults and miscellaneous causes contributing to 4.14% and 6.90%, respectively. The average time to reach the hospital was 3.6 hours.

Table 1: Baseline characteristics of study population

Parameter	n	%
Age (in years)		
18 – 40	82	56.55
41 – 60	51	35.17
>60	12	8.28
Mean ± SD	28.52 ± 13.78	
Mode of injury		
Road traffic accidents	100	68.97
Fall from height	29	20.00
Assault	6	4.14
Miscellaneous	10	6.90
Time to reach hospital (hours)	3.6 ± 5.54	

Regarding the Injury Severity Scores (ISS) in the cohort (Table 2), a substantial majority of patients (62.76%) had an ISS ranging from 46 to 60, indicating severe injuries. The remaining patients had ISS scores in the following ranges: 31 to 45 (31.03%), 16 to 30 (2.07%), and 61 to 75 (4.14%).

Table 2: Injury Severity Scores in polytrauma patients

Injury Severity Score (≥ 16)	n	%
16 - 30	3	2.07
31 - 45	45	31.03
46 - 60	91	62.76
61 - 75	6	4.14

Management approaches varied, with resuscitation being the most common intervention, applied to 88.97% of patients (Table 3). Other management strategies included damage control orthopedics (26.90%), early total care (20.00%), early appropriate care/early definitive fixation (15.17%), and safe definitive surgery (13.79%). The least frequent approach was MuST surgery for isolated musculoskeletal injuries, utilized in only 2.76% of cases.

Table 3: Management approaches in polytrauma patients

Management	n	%
Resuscitation	129	88.97
Early appropriate care/early definitive fixation	22	15.17
Safe definitive surgery	20	13.79
Damage control orthopedics	39	26.90
Early total care	29	20.00
MuST surgery (isolated Musculoskeletal injuries)	4	2.76

Complications observed in the study included multi-organ failure (6.90%), septic shock (4.14%), and death (15.17%), with other complications such as pulmonary embolism (2.76%), sepsis (2.07%), and pneumonitis while on ventilation (2.07%). Resuscitation-induced coagulopathy was the least common complication, occurring in just 0.69% of patients. These findings highlight the significant challenges in managing polytrauma patients, underscoring the critical need for effective and timely interventions to improve outcomes (Table 4).

Table 4: Complications in polytrauma patients

Complication	n	%
Pulmonary embolism	4	2.76
Resuscitation induced coagulopathy	1	0.69
Septic shock	6	4.14
Sepsis	3	2.07
Multi organ failure	10	6.90
Pneumonitis while on Ventilation	3	2.07
Death	22	15.17

Figure 1 shows the istribution of types of injury in polytrauma patients. In terms of injury types, this study found that extremity fractures were most common, followed by soft tissue injuries,

traumatic brain injuries and skull fractures, maxillofacial injuries, abdominal injuries, chest wall injuries, and spine injuries.

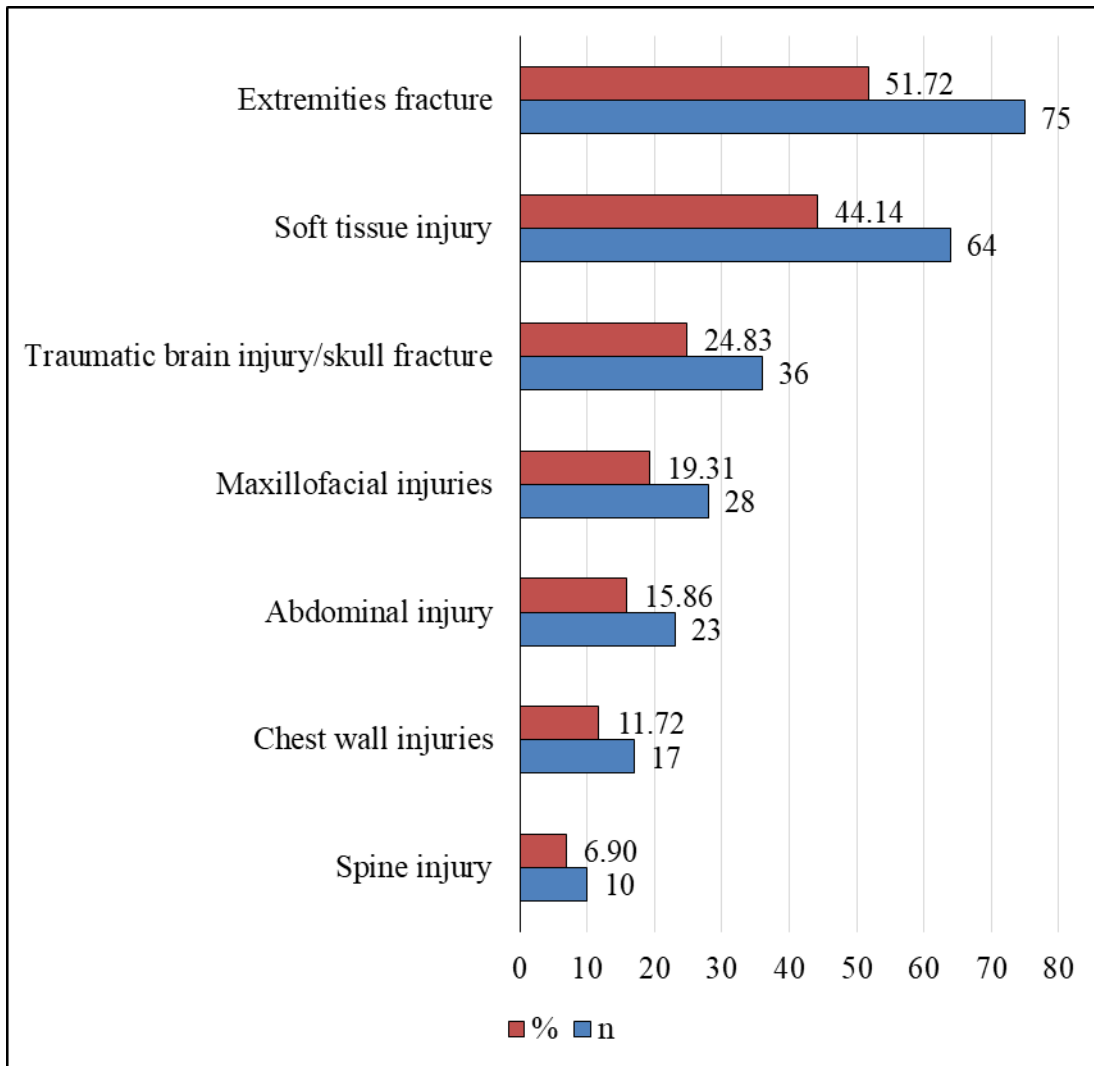


Figure 1: Distribution of types of injury in polytrauma patients

DISCUSSION

Recommendations for fracture care in polytrauma have evolved significantly, moving away from both unreflected total care strategies and the avoidance of early definitive fixation towards more nuanced management approaches [14].

In this study, the majority of patients were aged between 18 and 40 years. Similarly, Jain M et al. found that the 21-30 age group was the most affected [15]. Various studies have reported that young adults (20-40 years) are particularly prone to injuries [16-21]. A male predominance was observed in this study, with males comprising more than 65% of the patient population, consistent with other studies [16-19]. Jain M et al. also reported a higher percentage of males (82%) compared to females (18%) [15].

The average time to hospital admission since injury in this study was 3.6 hours. Garg A et al. described a latent period between injury and hospital admission, with 40% of their patients admitted within 2 hours of injury, and a mortality rate of 26 patients in this group. The majority of patients (48.33%) in their study presented within 2 to 8 hours after injury [22].

In terms of injury types, this study found that extremity fractures were most common, followed by soft tissue injuries, traumatic brain injuries and skull fractures, maxillofacial injuries, abdominal injuries, chest wall injuries, and spine injuries. Tesfaye Abebe's study, however, reported soft tissue injuries as the most common type (44.2%), followed by extremity fractures (24%) and traumatic brain injuries/depressed skull fractures (11.6%) [23]. Similar findings regarding the prevalence of fractures were reported by Pathak et al. and Mitra et al. [24,25], while Wui et al. and Kashid et al. noted head injuries as the most prevalent [26,27].

In this study, the Injury Severity Score (ISS) distribution was majority in 46-60. Jain M et al. reported a median ISS of 17, with extremity fractures (54%) and head injuries (50%) being the most common [15]. Sandeep DN et al. observed an ISS range of 19-66 with a mean of 36.97 ± 10.86 [28]. Garg A et al. reported a higher mean ISS of 23.51 ± 11.32 , compared to 19.9 ± 13.7 in the study by Ali et al. [29].

The predominant mode of injury in this study was road traffic accidents, followed by falls from height. Sandeep DN et al. also found that road traffic accidents were the most common mode of injury among all patients [28]. Similarly, Garg A et al. reported road traffic accidents as the leading cause of injury (51%), followed by falls from height (25%) [22].

Management strategies in this study included resuscitation, early appropriate care/early definitive fixation, safe definitive surgery, damage control orthopedics, early total care, and isolated musculoskeletal surgeries. Complications reported included pulmonary embolism, resuscitation-induced coagulopathy, septic shock, sepsis, multi-organ failure, ventilator-associated pneumonitis, and death. Previous studies have also reported on similar management modalities and complications [30].

CONCLUSION

Trauma was predominantly observed in the younger age group and males, with road traffic accidents being the most common cause. The most frequently reported Injury Severity Score (ISS) range was 45-60. Extremity fractures were noted in more than 50% of patients, followed by soft tissue injuries. Management approaches included resuscitation, early appropriate care or early definitive fixation, safe definitive surgery, damage control orthopedics, early total care and isolated musculoskeletal surgeries. The complications reported in this study included pulmonary embolism, resuscitation-induced coagulopathy, septic shock, sepsis, multi-organ failure, pneumonitis acquired under mechanical ventilation, and death. These results highlight the critical nature of trauma management and the need for effective interventions to reduce complications and improve patient outcomes.

REFERENCES

1. Kalsotra N, Mahajan V, Kalsotra G, et al. Epidemiology of polytrauma in a tertiary care centre. *J. Evolution Med. Dent. Sci.* 2016;5(47):3021-3025.
2. Butcher N, Balogh ZJ. The definition of polytrauma: the need for international consensus. *Injury.* 2009;40(Supplement 4)–S22.
3. Matar ZS. The clinical profile of polytrauma and management of abdominal trauma in a general hospital in the central region of the Kingdom of Saudi Arabia. *The Internet J Surg.* 2008;14:11.
4. Rau CS, Wu SC, Kuo PJ, Chen YC, Chien PC, Hsieh HY, Hsieh CH. Polytrauma defined by the new Berlin Definition: A validation test based on propensity-score matching approach. *Int J Environ Res Public Health.* 2017;14(9):1045.
5. Pape HC, Lefering R, Butcher N, Peitzman A, Leenen L, Marzi I, et al. The definition of polytrauma revisited: An international consensus process and proposal of the new ‘Berlin definition’. *J. Trauma Acute Care Surg.* 2014;77:780–786.
6. Chandran A, Hyder AA, Peek-Asa C. The global burden of unintentional injuries and an agenda for progress. *Epidemiol Rev.* 2010;32(1):110–120.
7. Krug EG, Sharma GK, Lozano R. The global burden of injuries. *Am J Public Health.* 2000;90(4):523–526.
8. Upadhyaya GK, Iyengar KP, Jain VK, Garg R. Evolving concepts and strategies in the management of polytrauma patients. *J Clin Orthop Trauma.* 2021;12(1):58-65.
9. Santry HP, Psinos CM, Wilbert CJ, Flahive JM, Kroll-Desrosiers AR, Emhoff TA, Kiefe CI. Quadrimodal distribution of death after trauma suggests that critical injury is a potentially terminal disease. *J Crit Care.* 2015;30(3):656.e1-7.

10. Byun CS, Park IH, Oh JH, Bae KS, Lee KH, Lee E. Epidemiology of trauma patients and analysis of 268 mortality cases: Trends of a single center in Korea. *Yonsei Med J.* 2015;56:220–6.
11. Vallier HA, Moore TA, Como JJ, Wilczewski PA, Steinmetz MP, Wagner KG, et al. Complications are reduced with a protocol to standardize timing of fixation based on response to resuscitation. *J Orthop Surg Res.* 2015;10:155.
12. Vallier HA, Wang X, Moore TA, Wilber JH, Como JJ. Timing of orthopaedic surgery in multiple trauma patients: development of a protocol for early appropriate care. *J Orthop Trauma.* 2013;27(10):543–51.
13. Weinberg DS, Narayanan AS, Moore TA, Vallier HA. Prolonged resuscitation of metabolic acidosis after trauma is associated with more complications. *J Orthop Surg Res.* 2015;10:153.
14. Pape HC, Leenen L. Polytrauma management - What is new and what is true in 2020? *J Clin Orthop Trauma.* 2021;12(1):88-95.
15. Jain M, Radhakrishnan RV, Mohanty CR, Behera S, Singh AK, Sahoo SS, et al. Clinicoepidemiological profile of trauma patients admitting to the emergency department of a tertiary care hospital in eastern India. *J Family Med Prim Care.* 2020;9(9):4974-4979.
16. Kumar S, Mahima, Srivastava DK, Kharya P, Sachan N, Kiran K. Analysis of risk factors contributing to road traffic accidents in a tertiary care hospital. A hospital based cross-sectional study. *Chin J Traumatol.* 2020;23:159–62.
17. Islam M, Khan M, Hossain M, Mani K, Min R. Road traffic accidents in Bangladesh: Why people have poor knowledge and awareness about traffic rules? *Int J Crit Illn Inj Sci.* 2020;10:70–5.

18. Onyemaechi N. Road traffic injuries in a Nigerian referral trauma center: Characteristics, correlates, and outcomes. *Int J Crit Illn Inj Sci.* 2020;10:64–9.
19. Awasthi B, Raina S, Verma L. Epidemiological determinants of road traffic accidents in a largely rural hilly population. *J Sci Soc.* 2019;46:79–85.
20. Singh R, Singh HK, Gupta SC, Kumar Y. Pattern, severity and circumstances of injuries sustained in road traffic accidents: A tertiary care hospital-based study. *Indian J Community Med.* 2014;39:30–4.
21. Hadaye R, Rathod S, Shastri S. A cross-sectional study of epidemiological factors related to road traffic accidents in a metropolitan city. *J Fam Med Prim Care.* 2020;9:168–72.
22. Garg A, Thakur DS, Thakur B, Purohit P, Singh V, Chauhan N. A prospective study of comparison of scoring systems in trauma patients. *Int J Res Med Sci.* 2022;10:2184-9.
23. Abebe T, Boru Y, Belay E, Abebe A, Kefyalew M, Kifle F. Clinical profile and outcomes of trauma patients visiting the emergency department of a trauma center, Addis Ababa, Ethiopia. *Afr J Emerg Med.* 2022;12(4):478-483.
24. Mitra S, Sarkar A, Saren A, Haldar D, Saha I, Sarkar G. Road traffic injuries: A study on severity and outcome among inpatients of a tertiary care level hospital of West Bengal, India. *J Emerg Trauma Shock.* 2018;11:247–52.
25. Pathak SM, Jindal AK, Verma AK, Mahen A. An epidemiological study of road traffic accident cases admitted in a tertiary care hospital. *Med J Armed Forces India.* 2014;70:32–5.
26. Wui LW, Shaun GE, Ramalingam G, Wai KMS. Epidemiology of trauma in an acute care hospital in Singapore. *J Emerg Trauma Shock.* 2014;7:174–9.

27. Kashid M, Rai S, Nath S, Gupta T, Shaki O, Mahender P, et al. Epidemiology and outcome of trauma victims admitted in trauma centers of tertiary care hospitals – A multicentric study in India. *Int J Crit Illn Inj Sci.* 2020;10:9–15.
28. Sandeep Dn, Bhadbhade V. A prospective study on management of polytrauma with early appropriate care. *Indian J Orthop Surg.* 2019;5(2):118-122.
29. Ali D, Ertan S, Kenan AT, Cemil C, Bedia G, Mehmet Y, et al. Comparison of trauma scoring systems for predicting the effectiveness of mortality and morbidity on pediatric patients. *Biomed Res.* 2014;25(2):228-32.
30. Kumar SR, Mohan CRV, Anusha DV. Clinical profile and management of polytrauma patients in a tertiary care center, Telangana India. *J Cardiovasc Dis Res.* 2024;15(3):697-705.s