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Research Article

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Multiple Trauma (Polytrauma) in Greece: Demographics, Severity, and Clinical Outcomes in A Hospital Setting

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Abstract

Introduction: Multiple trauma or Polytrauma, a complex condition involving multiple injuries affecting various body regions, remains a global health concern, particularly impacting the most productive age group. Despite advances in diagnostic and therapeutic approaches, polytrauma continues to be a leading cause of worldwide mortality and disability. This study investigates the demographics, injury severity, and clinical outcomes of polytrauma patients in a Greek hospital.

Methods: A retrospective cross-sectional study was conducted on a sample of 71 patients admitted to the Department of Emergency Incidents and the Intensive Care Unit of Papa Georgiou General Hospital, Thessaloniki, from August 2018 to August 2020. Data collected included patient gender, age, mode of transportation, injury mechanism, Injury Severity Score, admitting department, duration of Intensive Care Unit stay, days until extubation, hospitalization days, and patient outcomes.

Results: The study included 80.3% male and 19.7% female patients, with an average age of approximately 45 years. Falls from significant heights and motor vehicle accidents were the most common injury mechanisms. The Injury Severity Score demonstrated varying injury severity levels among patients, with a notable standard deviation, indicating the diversity of encountered injuries. Significant associations were found between injury mechanism and hospital admission, highlighting the importance of timely patient triage. Moreover, the Injury Severity Score correlated significantly with hospital outcomes and influenced hospitalization and ICU stay durations.

Discussion: The study provides valuable insights into the demographic characteristics, injury severity, interventions, and patient outcomes in polytrauma cases. The findings underscore the necessity of a multidisciplinary approach to manage traumatic injuries effectively, considering the involvement of different hospital departments. Understanding factors influencing ICU stay, intubation, and overall hospitalization can guide healthcare professionals in setting realistic treatment goals and predicting patient outcomes after traumatic injury.

Keywords: Multiple trauma; Polytrauma; Injury severity; Injury Severity Score (ISS)

Abbreviations: WHO: World Health Organization; ISS: Injury Severity Score; AIS: Abbreviated Injury Scale; ED: Emergency Department; ICU: Intensive Care Unit EMS: Emergency Medical Services; $\chi 2$: Chi-Squared Test; ANOVA: Analysis of Variance

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Introduction

The World Health Organization (WHO) has declared that multiple trauma remains a global health concern, particularly for the most productive age group. Despite advances in diagnostic and therapeutic algorithms, multiple trauma continues to be the leading cause of worldwide mortality and disability [1]. Multiple trauma refers to the simultaneous occurrence of two or more injuries affecting different parts of the body, and it can be caused by various factors such as motor vehicle accidents, falls, or violent assaults. Its severity stems from the simultaneous impact of injuries on different organs and systems of the body, making it complex to manage. While medical efforts have evolved, there is still a need for ongoing research to identify novel diagnostic and therapeutic approaches in managing multiple trauma [2]. In developed nations, trauma stands as the principal cause of mortality among individuals aged 1 to 45 years and ranks as the third leading cause of death across all age cohorts. Notably, 50% of these fatalities affect young individuals aged 15 to 44 years [3]. The European Union alone incurs an estimated economic burden of approximately 70 billion euros annually, primarily attributed to motor vehicle accidents. Globally, nearly 16,000 individuals succumb to diverse trauma-related causes on a daily basis, constituting a staggering five million deaths annually worldwide. Within Greece, the incidence of accidents amounts to approximately 24,000 cases annually, encompassing road accidents, occupational mishaps, and acts of violence, resulting in an average of 2,500 fatalities and 32,000 injuries. Among the 32,000 injuries, roughly 4,500 pertain to patients in critical condition. Notably, 20% of mortalities occur during the hospitalization of the injured, predominantly attributed to septic conditions (78%) and multiple organ failure. Furthermore, 30% of deaths manifest within mere hours following the injury, while the remaining 50% transpire in the immediate minutes at the scene of the accident [4].

Polytrauma patients are commonly the result of a sequence of highly violent and abrupt traumatic events. Typically, these occurrences stem from falls from significant heights, motor vehicle accidents, occupational incidents, or unforeseeable accidents caused by diverse and unpredictable physical factors. Additionally, intentional acts of violence targeting specific individuals may also lead to polytrauma. Each of these etiologies elicits distinct impacts on the affected individuals, potentially resulting in either permanent organ system impairments or even fatalities in the polytrauma population [5]. The evaluation of the polytrauma patient's severity holds exceptional significance, irrespective of the evaluation level, be it at the accident scene, the Emergency Department (ED), or the Intensive Care Unit (ICU). As a result, various assessment protocols for polytrauma patients have been developed over time. Indeed, the appropriate selection of an assessment protocol can prove vital in determining the patient's overall health trajectory. These distinct evaluation systems may encompass both anatomical and physiological elements of the injured individual, as well as their synergistic integration [6]. The Injury Severity Score (ISS) serves as a comprehensive severity index for polytrauma patients, initially proposed and introduced in a study by Baker et al. [7]. It constitutes an anatomical scoring system, and the score is calculated by summing the squares of the three highest values from the Abbreviated Injury Scale (AIS), a standardized scale for assessing the severity of individual body regions. Specifically, six body regions are evaluated [8], and for each region, the highest AIS score is utilized. Subsequently, the values of the three most severely injured body regions are squared and then added together to yield the ISS score. Since its inception, the ISS has played a dual role, serving as both a clinical measure of polytrauma mortality and a functional indicator for patient triage. [Table 1] gives an example of an assessment of an injured person using the ISS.

Table 1: Example calculation of Injury Severity Score.

Region	Injury Description	AIS*	Square top 3
Head & Neck	Cerebral contusion	3	9
Face	No injury	0	
Chest	Flailed chest	4	16
Abdomen	Minor contusion of liver	2	
	Complex rupture spleen	5	25
Extremity	Fractured femur	2	
External	No injury	0	
Injury Severity Score:			**50**
*AIS represents Abbreviated Injury Scale.			

Furthermore, AIS which determines the involvement of more than one body region in the ISS calculation, is utilized to define patients as polytrauma cases. Consequently, a novel definition known as the 'Berlin definition' was developed, characterizing polytrauma as a patient with AIS ≥3 in two or more distinct body regions, accompanied by one or more additional characteristics from five physiological parameters, specifically age, consciousness, blood pressure, clotting, and acidosis [1,9]. The ISS scale can take values ranging from 0 to 75. In cases where a trauma receives an AIS score of 6 (indicating an injury from which the individual

cannot survive), the ISS scale automatically assigns a value of 75. Essentially, the ISS scale stands as the sole anatomical scoring system that exhibits a linear correlation with mortality, morbidity, hospital stay, and other indicators of trauma severity. According to the ISS scale, a trauma is considered severe when its score exceeds 15 [10]. The ISS scale possesses a significant limitation in that it considers only one injury per body region. This fact results in the oversight of a substantial number of injuries. Furthermore, it may include less severe injuries that happen to be localized to a specific body region [6]. The aim of this study is to investigate cases of multiple traumas (polytrauma) by recording age, gender, type of accident, on-scene condition, pre-hospital management, patient status upon arrival, management in the emergency department, duration of stay in the trauma emergency department, progression in the ICU, as well as outcomes and hospitalization days.

Material and Methods

Sample size

The study sample comprised a total of 71 patients who were presented at the ED and the ICU of Papageorgiou General Hospital in Thessaloniki.

Study area

The study was conducted at the ED Incidents and the ICU of Papageorgiou General Hospital in Thessaloniki.

Study population

The target population included 71 patients out of the 2,168 patients treated in the resuscitation unit, of which 328 cases were polytrauma incidents admitted to the ICU, with intubation not exclusively performed at the ICU. These cases were transferred either directly by EMS or from other hospitals, and their outcomes varied.

Study design

A retrospective cross-sectional study design was employed.

Study duration

The study was conducted from August 6, 2018, to August 31, 2020.

Inclusion criteria

The study included patients defined as polytrauma with an ISS>20. Patients of any nationality were considered eligible. Exclusion criteria involved patients who did not meet the polytrauma criteria or had an ISS<20.

Ethical issues

The study was conducted with approval from the Ethics and Deontology Committee of Papageorgiou General Hospital. Patient anonymity was preserved throughout the study.

Methods

The Department of Emergency Incidents and the ICU of Papageorgiou General Hospital participated in the study. The study period was defined as one month, specifically August 2020. The study was designed as an observational study, specifically a cross-sectional study. The sample included all patients admitted to the Department of Emergency Incidents and the Intensive Care Unit of Papageorgiou General Hospital, who were polytrauma cases and met the study's inclusion criteria. Data collected included gender, age, mode of transportation, intubation site, mechanism of injury, ISS, admitting unit, days in the ICU, days until extubation, days of hospital stay, and patient outcomes. The ISS was used to assess trauma severity.

Statistical analysis

A diverse array of statistical methods was employed for the analysis of the research data. Initially, the data was meticulously processed to ensure comprehensibility for subsequent analysis. Specifically, gender, mode of transportation, site of catheter insertion, mechanism of injury, admitting department, duration of hospital stays, and patient outcomes were treated as nominal variables, each assigned a code representing the respective category. Conversely, age, ISS, length of stay in the ICU, time until extubation, and time until hospital discharge were treated as continuous variables. To explore the relationships between various variables, Spearman's rank correlation analysis was utilized. This non-parametric method facilitated the examination of associations between variables without assuming specific distribution patterns. Regardless of the outcome of the correlation test, specific pairs of variables, which held the potential to provide insights into the research inquiries, were further investigated for influence or dependence using two supplementary statistical tests. The first test involved the chi-squared test ($\chi 2$), while the second entailed the analysis of variance (ANOVA) test. These additional tests allowed for a more nuanced understanding of any identified associations and their potential impact on the study outcomes.

Results

The study included a total of 71 patients, with 80.3% being male and 19.7% female. The average age of the patients was approximately 45 years, with a standard deviation of 22.335. Regarding hospital admission, 60.6% of the patients were admitted directly, while 39.4% were transferred from another hospital. The ISS distribution showed an average ISS of 32.5, with a standard deviation of 17.57. The ISS represents the average severity level of the patients' injuries, and the relatively large standard deviation indicates significant variation in ISS values around the mean. The average length of stay in the ICU was approximately 8.69 days, with a standard deviation of 9.86. The days until extubation ranged approximately 5 days, with a standard deviation of 4.413, while the days until hospital discharge were approximately 26.48, with a standard deviation of 22.95. In [Table 2], we provide a summary of the continuous variables observed in the study. The Mean represents the average value of each variable, while the Standard Deviation indicates the variability or dispersion around the mean. These statistics offer valuable insights into the central tendency and spread of the data, allowing for a better understanding of the characteristics of the study population.

Table 2: Presentation of measures of location and variability for continuous variables.

Variable	Mean	Standard Deviation
Age (years)	45	22.335
Injury Severity Score (ISS)	32.5	17.57
Intensive Care Unit (ICU) Stay (days)	8.69	9.86
Days until Extubation	5	4.413
Hospitalization Days	26.48	22.95

Analyzing the mechanism of injury, it was found that falls from a significant height were the most common cause (28.2%), followed by motor vehicle accidents (25.4%). Incidents involving motorcycles (14.1%), vehicle-pedestrian collisions, injuries from sharp objects, and burns (both chemical and non-chemical) accounted for 39.5% of the cases. The remaining categories of injuries comprised 12.6% of the cases and were described as unique categories. Regarding the distribution of patients requiring hospitalization, [Table 3] presents all the hospital departments. The neurosurgical department had the highest percentage of admissions (37%), followed by orthopedics (18.5%), general surgery (27.8%), plastic surgery (3.7%), and pulmonology (1.9%). Concerning patient outcomes, approximately 25.4% were ambulatory, 15.5% required assistance for walking, 8.5% were partially mobilized, and approximately 20.9% passed away. Additionally, 7% of the patients were transferred to another hospital, and 4.2% were transferred to a rehabilitation center [Table 4]. Correlation analysis revealed significant associations between various variables, such as hospital admission and mechanism of injury, hospital department and mechanism of injury, hospital department and age, ICU stay days and intubation department, among others. Furthermore, ANOVA tests indicated a statistically significant effect of the intubation department on the ISS, but no significant effects on ICU stay days, days until extubation, and days until discharge. The Pearson Chi-Square test showed a statistically significant relationship between the ISS variable and the other variables examined. However, the Likelihood Ratio and Linear-by-Linear Association tests did not support statistically significant relationships [Table 5]. Overall, the study provided valuable insights into the demographic characteristics, injury severity, treatment procedures, and patient outcomes of the sample population, highlighting the importance of understanding and addressing these factors in clinical practice.

Table 3: Distribution of Patients Requiring Hospitalization in Different Departments.

Hospital Department	Number of Patients	Percentage (%)
Surgical & Neurosurgical	1	1.4
Neurosurgical & Plastic	1	1.4
Neurosurgical & Pathological	1	1.4
Neurosurgical & Orthopedic	3	4.2
Plastic Surgery	3	4.2
Pulmonology	1	1.4
Orthopedic	13	18.5
Surgical	20	27.8
Neurosurgical	26	37

Table 4: Distribution of Patient Outcomes in the Study Population.

Patient Outcomes	Percentage (%)
Ambulatory	25.4
Requires Assistance	15.5
Partially Mobilized	8.5
Passed Away	20.9
Transferred to Another Hospital	7
Transferred to Rehabilitation Center	4.2

Table 5: Chi-Square between injury mechanism and ISS.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	247,075[a]	165	,000
Likelihood Ratio	106,871	165	1,000
Linear-by-Linear Association	1,931	1	,165
N of Valid Cases	71		

Discussion

The results of the present study reveal significant associations concerning patients' demographic characteristics, injury severity, therapeutic interventions, and outcomes. The notable preponderance of male patients in the sample is consistent with previous research indicating that certain injuries disproportionately affect males [11–13], which may be explained by the fact that men are more involved in activities or occupations that may increase the risk of injury (accidents at work, road accidents due to faster driving, sports injuries, etc.). However, it is worth mentioning a recent study in the United States, which showed that in terms of concussion incidents, in all gender-comparable sports, women had higher rates of both college and high school [14]. The average age of about 45 years reflects a relatively young population with traumatic injuries, when the corresponding value in a comparative study of injured people between the US and India was 48.03 and 38.7 respectively [15]. The fact of their young age may have implications for their long-term recovery and rehabilitation. In terms of the mechanism of injury observed in the study, the majority of injuries were due to falls from high altitude and vehicle accidents, followed by pedestrian drifts from vehicles, sharp injuries and burns (chemical and non-chemical). These findings are in line with recent studies in Iran [16] and Italy [17]. The mean ISS, which represents the average severity of the patients' injuries, was approximately 32.5, with a significant deviation of 17.57. The large discrepancy indicates considerable variation in the degree of severity of patients' injuries. This distribution highlights a wide range of injury severity levels, indicating the diversity of encountered injuries among patients. It is precisely this variability in ISS values that indicates the need for a differentiated clinical approach and therapeutic management. For this reason, ISS is an important indicator for healthcare professionals because it helps them to understand the severity of patients' injuries and to determine the appropriate treatment approach and timeframe. A recent study in Iran confirmed the close relationship between variations in ISS scores and the clinical condition of the injured [18].

The correlation between the mechanism of injury and hospital admission underscores the importance of timely and accurate patient assessment, particularly in instances of falls from height and road traffic accidents. This observation suggests that varying injury mechanisms can result in distinct types and severities of injuries, warranting individualized care and patient classification requirements. A recent study conducted in China on the evaluation of multiple injuries and preventable fatalities supports the conclusions drawn from our investigation [19]. Furthermore, the involvement of different hospital departments in the management of multi-injury patients underlines the need for a multidisciplinary approach. Multi-trauma presents heterogeneous injuries affecting multiple anatomical regions, which necessitates the collective expertise of different medical specialties to comprehensively address the complex nature of these injuries. International literature [20–23], clarifies that only by promoting collaborative efforts between different health disciplines, a multidisciplinary approach can promise to optimize the quality and effectiveness of care provided to patients with polytrauma, facilitating a more holistic and integrated treatment strategy. Regarding the relationship with ISS, it appears to be influenced by the intubation segment; however, such a conclusion is not practically feasible, but rather the opposite. The categorical nature of the intubation segment and the continuous nature of ISS preclude the possibility of statistical testing to identify any direct influence. Nevertheless, accepting a reverse causality approach, one could argue that the intubation segment is related to ISS, which partly makes sense. Moreover, it is reasonable to infer that ISS is dependent on the mechanism of injury, further supporting the argument of reverse causality mentioned earlier, with injury mechanisms potentially resulting in injuries with varying ISS scores.

Finally, through dependency checks, it is evident that ISS holds particular significance for various other variables related to hospitalization. Initially, it exhibits an absolute correlation with hospital outcome. However, it should be noted that in the present study, ISS=75, signifying non-survival, was not filterable, thus influencing the outcome correlation. Conversely, it appears that ISS can impact hospitalization and ICU stay. The former result is not entirely logical and cannot be supported even by the correlation test, suggesting it could be considered a chance finding. Conversely, it is entirely normal for a severely injured patient to require additional days in the ICU. However, a recent study in Switzerland on blunt chest trauma showed that ICU admission was directly related to ISS, but trauma severity was not associated with ICU length of stay, intubation days, complications or mortality [24].

Conclusion

In conclusion, this study provides valuable insights into the factors influencing the duration of ICU stay, intubation, and overall hospitalization days, as well as their association with injury severity. However, the study's modest sample size might limit the ability to detect more complex relationships. Future research with a larger sample size and prospective study designs would be beneficial in

confirming and expanding upon these findings. The data obtained in this study can be instrumental in guiding clinical decision-making and improving patient care and outcomes in traumatic injury cases.

Conflicts of Interest

No Conflict of Interest.

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References

1. Iyengar KP, Venkatesan AS, Jain VK, Shashidhara MK, Elbana H, et al. (2023) Risks in the Management of Polytrauma Patients: Clinical Insights. Orthop Res Rev 15(1): 27-38.
2. Van Breugel JMM, Niemeyer MJS, Houwert RM, Groenwold RHH, Leenen LPH, et al. (2020) Global changes in mortality rates in polytrauma patients admitted to the ICU-a systematic review. World J Emerg Surg: 15(1).
3. Larkin EJ, Jones MK, Young SD, Young JS (2022) Interest of the MGAP score on in-hospital trauma patients: Comparison with TRISS, ISS and NISS scores. Injury 53(9): 3059-3064.
4. Garoufali P, Karagianni C, Panoutsakopoulou A, Mihopoulos A (2023) Multi-trauma care in the Intensive Care Unit and the role of the nurse: A literature review. Int J Life Sci Res Archive 4(1): 178-188.
5. Çorbacioğlu ŞK, Aksel G (2018) Whole body computed tomography in multi trauma patients: Review of the current literature. Turk J Emerg Med 18(4): 142-147.
6. Javali RH, Krishnamoorthy, Patil A, Srinivasarangan M, Suraj, et al. (2019) Comparison of Injury Severity Score, New Injury Severity Score, Revised Trauma Score and Trauma and Injury Severity Score for Mortality Prediction in Elderly Trauma Patients. Indian J Crit Care Med 23(2): 73-77.
7. Baker SP, ONeill B, Haddon W, Long WB (1974) The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma 14(3): 187-196.
8. Tohira H, Jacobs I, Mountain D, Gibson N, Yeo A, et al. (2012) Systematic review of predictive performance of injury severity scoring tools. Scand J Trauma Resusc Emerg Med 20: 63.
9. Rau CS, Wu SC, Kuo PJ, Chen YC, Chien PC, et al. (2017) Polytrauma Defined by the New Berlin Definition: A Validation Test Based on Propensity-Score Matching Approach. Int J Environ Res Public Health 14(9): 1045.
10. Mehmood A, Hung YW, He H, Ali S, Bachani AM, et al. (2019) Performance of injury severity measures in trauma research: a literature review and validation analysis of studies from low-income and middle-income countries. BMJ Open: 9(1).
11. Orchard JW (2015) Men at higher risk of groin injuries in elite team sports: a systematic review. Br J Sports Med 49(12): 798-802.
12. Okamoto Y, Morikawa S, Okamoto F, Mitamura Y, Ishikawa H, et al. (2019) TRAFFIC ACCIDENT-RELATED OPEN GLOBE INJURIES. Retina 39(4): 779-785.
13. Fernández Londoño LL, Marchesini N, Espejo Ballesteros D, Álzate García L, Gómez Jiménez JA, et al. (2022) Epidemiological Review of Spinal Cord Injury due to Road Traffic Accidents in Latin America. Med Princ Pract 31(1): 11-19.
14. Pierpoint LA, Collins C (2021) Epidemiology of Sport-Related Concussion. Clin Sports Med 40(1): 1-18.
15. Amato S, Bonnell L, Mohan M, Roy N, Malhotra A, et al. (2021) Comparing trauma mortality of injured patients in India and the USA: a risk-adjusted analysis. Trauma Surg Acute Care Open 6(1).
16. Reihani H, Pirazghandi H, Bolvardi E, Ebrahimi M, Pishbin E, et al. (2017) Assessment of mechanism, type and severity of injury in multiple trauma patients: A cross sectional study of a trauma center in Iran. Chin J Traumatol 20(2): 75-80.
17. Magnone S, Ghirardi A, Ceresoli M, Ansaloni L (2019) Trauma patients centralization for the mechanism of trauma: old questions without answers. Eur J Trauma Emerg Surg 45(3): 431-436.
18. Dasdar S, Yousefifard M, Ranjbar MF, Forouzanfar M, Mazloom H, et al. (2023) Frequency of Post Trauma Complications during Hospital Admission and its Association with Injury Severity Score (ISS). Clin Exp Emerg Med.
19. Zhang GX, Chen KJ, Zhu HT, Lin AL, Liu ZH, et al. (2020) Preventable Deaths in Multiple Trauma Patients: The Importance of Auditing and Continuous Quality Improvement. World J Surg 44(6): 1835-1843.
20. Marklund N, Bellander BM, Godbolt AK, Levin H, McCrory P, et al. (2019) Treatments and rehabilitation in the acute and chronic state of traumatic brain injury. J Intern Med 285(6): 608-623.
21. Voss J, Thieme N, Doll C, Hartwig S, Adolphs N, et al. (2018) Penetrating Foreign Bodies in Head and Neck Trauma: A Surgical Challenge. Craniomaxillofac Trauma Reconstr 11(3): 172-182.
22. Welter S, Essaleh W (2020) Management of tracheobronchial injuries. J Thorac Dis 12(10): 6143-6151.
23. Schreyer C, Schwab R (2020) Management of thoracic trauma and intrathoracic injuries. Chirurg 91(6): 517-530.
24. Chrysou K, Halat G, Hoksch B, Schmid RA, Kocher GJ (2017) Lessons from a large trauma center: impact of blunt chest trauma in polytrauma patients-still a relevant problem?. Scand J Trauma Resusc Emerg Med: 25(1).