DOI: https://doi.org/10.54393/pjhs.v6i1.2209

PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (E): 2790-9352, (P): 2790-9344
Volume 6, Issue 01 (January 2025)

Original Article

OPEN ACCESS

Association of Age Shock Index with Mortality among Trauma Patients in the Emergency Department

Areej Zehra[1*], Inayat Ali Khan[2], Muhammad Khan[3], Shahid Pervez Shaikh[4], Padma Rathore[5] and Ghazal Irfan[3]

[1]Department of Accident and Emergency, Ziauddin University, Karachi, Pakistan
[2]Department of Medicine Emergency, Ziauddin University, Karachi, Pakistan
[3]Department of Pathology, Baqai Medical College, Baqai University, Karachi, Pakistan
[4]Department of Anatomy, Baqai Medical College, Baqai University, Karachi, Pakistan
[5]Department of Physiology, Jinnah Sindh Medical University, Karachi, Pakistan

ARTICLE INFO

Keywords:

Age Shock Index (ASI), Mortality Rate, Emergency Department (ED), Trauma

How to Cite:

Zehra, A., Khan, I. A., Khan, M., Shaikh, S. P., Rathore, P., & Irfan, G. (2025). Association of Age Shock Index with Mortality among Trauma Patients in the Emergency Department: Association of Age Shock Index with Mortality. Pakistan Journal of Health Sciences, 6(1), 209-213. https://doi.org/10.54393/pjhs.v6i1.2209

***Corresponding Author:**

Areej Zehra
Department of Accident and Emergency, Ziauddin University, Karachi, Pakistan
dr.areejzehra@gmail.com

Received date: 4th September, 2024
Acceptance date: 17th January, 2025
Published date: 31st January , 2025

ABSTRACT

Trauma injuries cause significant global morbidity and mortality. While current scoring systems like ISS and TRISS are complex, the Age Shock Index (ASI) offers a simpler, potentially more effective method for estimating patient outcomes. **Objective:** To evaluate the association of Age Shock Index with 48-hour in-hospital mortality in a trauma population in an Emergency Department (ED). **Methods:** A comparative cross-sectional study was conducted over eight months in the Emergency Department of Ziauddin University, focusing on pre-selected trauma patients aged 18-65 years. Patients were divided into two groups: the exposed group and non-exposed group, with an Age Shock Index (ASI) ≥ 50, and < 50 respectively. Data analysis was carried out using descriptive statistics, the chi-square test, and independent t-tests with the Statistical Package for Social Sciences (SPSS) version 21.0. **Results:** Patients with an Age Shock Index (ASI) ≥ 50 had significantly higher 48-hour in-hospital mortality (72%) compared to those with an ASI < 50 (12%) ($p < 0.001$). The exposed group also received more intravenous fluids, inotropic support, and blood products. No deaths occurred in the emergency room among the exposed group, but a trend towards higher overall mortality was observed (hazard ratio 48.584, 95% CI: 0.511 - 4622.17, $p = 0.095$). **Conclusions:** The Age Shock Index (ASI) ≥ 50 is associated with significantly higher 48-hour in-hospital mortality in trauma patients. The exposed group required more intensive interventions, indicating a higher severity of injury. ASI may serve as an effective predictor of patient outcomes in emergency settings.

INTRODUCTION

Trauma-related injuries are the leading cause of fatalities and disabilities, resulting in a significant amount of the global health burden . Medical technicians and doctors must rapidly recognize trauma patients who are at a significant risk of death . Despite being a well-known and critical issue, the rapid mortality rate following injury has not altered much over the past few years . Several methodologies have been used in past research to assess the severity and predict the death of people with serious injuries. However, traditional approaches such as the Injury Severity Score (ISS), Trauma Score (TRISS), and New Injury Severity Score (NISS) are regularly used, but they frequently require complicated computations or the need for extensive clinical and laboratory data. Many of these scoring techniques are challenging for their initial implementation in an emergency department (ED) . Currently, a variety of clinical measures, including heart rate (HR), respiration rate/pulse rate (PR), blood pressure (BP), shock index (SI), and age shock index, are used to assess the severity of patients who are seen in the emergency room . Recent study data indicates that ASI is an useful measures for assessing outcomes for patients in

DOI: https://doi.org/10.54393/pjhs.v6i1.2209

emergency situations . The Age Shock Index (ASI) appears to have the potential of becoming a more precise predictor for patient outcome emergencies. The ASI is calculated by taking the product of age with the Shock Index, making this measure a much better reflection because it includes the factors of age and physiological variation with respect to the age. Higher studies show at the ASI; thus, it was known to be related to mortality and further intervention, making it a pertinent point for treatment modalities in various patients.Consequently, the study aimed to compare the relationship of ASI with 48h in-hospital mortality in trauma patients at the ED.

METHODS

The current research was conducted on the trauma cases managed at the Emergency Department at Ziauddin University. Informed consent was obtained from the parents or guardians of the patient. The trauma patients were categorized into two groups with Shock indices into exposed and non-exposed. This study used a non-probability sequential sampling approach and took place over a duration of 6 months period, from April, 2019 to September, 2019. The Ethical Approval was obtained from the Ethical Review Committee of Ziauddin University (Reference Code: 0591118AZEMD). Patients of both genders between the ages of 18 and 65 who had experienced trauma were eligible. The exceptions were isolated traumatic brain injuries, patients who died on presentation, individuals with metabolic disorders or hypertension, pregnant women, and those who were in shock because of non-trauma reasons such as burns, food poisoning, or drug toxicity. The sample size for this study was calculated using WHO sample size calculator, based on statistics from an article that showed a 59.5% mortality rate in the group that was exposed and a 3.1% death rate in the non-exposed group.The computed sample size for each group was 13 people, for a total of 26, with a 95% confidence interval and 80% study power. In order to compensate for probable data loss, the sample size was expanded to 25 in each group, for a total of 50 participants. Data collected included patients' Age, Sex, Intravenous fluids, inotropic support, Blood product, Death in emergency room, and Age Shock Index (ASI) recorded on a pre-designed form. The Age Shock Index (Age SI) was calculated using the initial vital signs recorded in the emergency department. This index, determined as the product of age and the Shock Index (SI), incorporates both the patient's age and physiological parameters. An Age SI value exceeding 50 has been strongly associated with increased mortality rates in trauma patients, highlighting its utility in accurately predicting outcomes.The various hemodynamic instability cut-off values for Age Shock Index was determine the various hemodynamic stability based on other study . Patients with ASI > 50 were classified as the Exposed Group, while those with ASI < 50 were classified as the Non-Exposed Group. Patients were monitored for 48 hours, with all variables measured hourly. Any parameter exceeding its cut-off limits during monitoring was recorded for further evaluation. Admitted patients were tracked for 48 hours using their medical record or reference number, while discharged patients were followed up via the contact number provided on the emergency form. Data were collected using a pre-designed form, and confounders and biases were minimized by adhering strictly to the study protocols. SPSS version 21.0 was used for data analysis. Quantitative parameters, such as age, were calculated as mean ± SD, while qualitative factors, including sex, intravenous fluid administration, inotropic support, use of blood products, death in the emergency room, and 48-hour in-hospital mortality, were assessed for frequency and percentage. Post stratification was identified by applying chi-square test. Probability ratio was determined by Cox regression with a significance level set at $p < 0.05$.

RESULTS

All 50 patients either male or female having age in between 18 to 65 years who meets the inclusion standard for research was incorporate in research for the evaluation of associated 48 hours mortality people with Age SI in traumatic patients admitted at emergency department of hospital. People categorized into two classes according to treatment, in first group 25 patients who Exposed to medicines whereas, in second group 25 patients those were Unexposed to medicines. The age distribution between the exposed and unexposed groups showed a statistically significant difference, with mean ages of 48.32 and 38.44 years, respectively ($p = 0.016$). Gender distribution was similar across both groups, with no significant difference ($p = 0.774$) (Table 1).

Table 1: Age and Gender Distribution of Patients

Variable	Exposed (n=25)	Unexposed (n=25)	p-value
Gender Distribution			
Male	14 (56%)	13 (52%)	0.774
Female	11 (44%)	12 (48%)	
Age (Years)			
Mean ± SD	48.32 ± 10.89	38.44 ± 13.61	0.016

Gender distribution was assessed using chi-square test; age was analyzed using independent t-test.

Table 2 shows significantly higher proportion of exposed patients received intravenous fluids (96%) and inotropic support (96%) compared to the unexposed group (36% and 20%, respectively). Blood product usage was also more common among the exposed group (56%) compared to the unexposed group (8%). No deaths occurred in the emergency room among the exposed group, while one

DOI: https://doi.org/10.54393/pjhs.v6i1.2209

death occurred in the unexposed group (4%). However, 48-hour in-hospital mortality was significantly higher in the exposed group (72%) compared to the unexposed group (12%).

Table 2: Frequency Distributions of Clinical Variables among Trauma Patients

Variable	Exposed	Unexposed	p-value
Intravenous Fluid			
Yes	24 (96%)	9 (36%)	<0.001
No	1 (4%)	16 (64%)	
Inotropic Support			
Yes	24 (96%)	5 (20%)	<0.001
No	1 (4%)	20 (80%)	
Blood Products			
Yes	14 (56%)	2 (8%)	<0.001
No	11 (44%)	23 (92%)	
Death in Emergency Room			
Yes	0 (0%)	1 (4%)	0.13
No	25 (100%)	24 (96%)	
48 Hour In-Hospital Mortality			
Yes	18 (72%)	3 (12%)	<0.001
No	7 (28%)	22 (88%)	

p-values were calculated using chi-square tests to determine the statistical significance of differences between exposed and unexposed groups

Patients with an Age Shock Index (ASI) ≥ 50 had a higher mortality rate (72%) compared to those with an ASI < 50 (12%)(p=0.000)(Table 3).

Table 3: Impact of Age Shock Index on 48-Hour In-Hospital Mortality

Index	Category	Exposed	Non-Exposed	Total	Chi-Square P-Value
Age Shock Index	< 50	3 (12%)	22 (88%)	25	0.000*
	≥ 50	13 (72%)	7 (22%)	25	
	Total	21	29	50	

Percentages are calculated based on the total number of individuals in each category. Chi-square p-values indicate statistical significance. An asterisk (*) denotes a statistically significant result (p<0.05).

Table 4 showed hazard ratio for mortality among the exposed group was 48.584, with a 95% confidence interval of 0.511 to 4622.17, and a Cox regression p-value of 0.095. This indicates a trend towards significance, suggesting a higher mortality risk in the exposed group compared to the unexposed group.

Table 4: Hazard Ratios for Mortality among Exposed versus Unexposed Groups

Group	Hazard Ratio	95% Confidence Interval (CI)	Cox Regression P-Value
Exposed	48.584	0.511 - 4622.17	0.095
Unexposed	1.000	-	-

Hazard ratio for the exposed group compared to the unexposed group. The p-value indicates the statistical significance of the difference in mortality risk.

DISCUSSION

It is commonly known that as patients ages, their physiological compensatory systems decrease and their baseline vital sign features change. Elderly people typically have worse outcomes following injury, a lower physiological tolerance, and a higher frequency of complications.15 Given how aging affects vital signs and results, it makes sense that the SI's effectiveness as a predictor would vary with age. The study found that higher ASI values were associated with increased mortality and a higher need for intensive interventions. This aligns with previous research indicating that ASI accounts for age-related physiological variations, offering a more nuanced assessment compared to traditional scoring systems. A recent study revealed a strong positive correlation between mortality in the hospital and the Age Shock Index (ASI) with patients with stroke.In another study, it was observed that the value of the Age Shock Index (ASI) in patients older than 55 years may be useful for early mortality prediction.In addition, elevated ASI score was correlated with the odds of having blood transfusions, suggesting its value as a predictor in the identification of patients who would require more extensive medical intervention. The significant correlation established in the current research has applied better classification of such indices for risk groups and the creation of the triage and therapeutic paradigms. Another study mentioned that, age SI alone predicts a worse outcome for AMI patients receiving PCI.Current study aligns with these findings, showing that ASI is significantly associated with mortality rates in trauma patients. Particularly, the patients which were having elevated ASI values were found to have increased mortality. Earlier studies have proven that these indices can evaluate the severity of trauma and predict outcomes.The ASI, which is the result of adding age to the shock index, seems to increase the mortality prediction accuracy.This is consistent with recent research indicating that SI × age is a highly significant variable that adds more data to the usual prognostic factors and helps predict death in Acute heart Failure patients . Kim *et al.*, applied the Age Shock Index(SI) in projecting fatality risks for older people through cross-sectional data from a nationwide injury surveillance system. The findings showed that Age SI increase in non-survivor patients than in survivors. In particularly, out of all the subjects, 69.4% of high-risk or insecure according to Age SI died. Moreover, the incorporation of ASI into clinical practice could improve triage and promote further and more specific interventions at the ED. The study noted that using age adjusted parameters in the assessment of trauma risk leads to more effective identification of patients with a high risk of deterioration and such patient

DOI: https://doi.org/10.54393/pjhs.v6i1.2209

receiving treatments quicker leading to an improvement in the general prognosis of the disease. In our study, a significantly higher proportion of exposed patients received intravenous fluids and inotropic support compared to the unexposed group. Blood product usage was also more common among the exposed group compared to the unexposed group. This trend highlights the increased need for intensive medical interventions in patients with elevated ASI, reflecting the severity of their hemodynamic compromise and the urgency of their clinical condition. A study on Elevated Shock Index, Pediatric Age-Adjusted (SIPA) demonstrated its association with higher rates of hospital admissions, prolonged lengths of stay, and increased critical interventions such as ventilatory support, fluid boluses, and intravenous medications. These findings emphasize SIPA's utility in identifying high-risk pediatric patients requiring intensive medical care . Moreover, the international guidelines have been developed for the management of shock that emphasize on the importance of prompt initiation of IV fluids, and inotropes .

CONCLUSIONS

The use of ASI as the tools for predicting mortality in trauma patients is evident from the study. Findings of this study support their use in the ED in order to improve risk assessment and management. Future studies should persist in refining these indices and expand their application to patients of different types and in the course of different kinds of treatment. The study was carried out at a single hospital with a relatively small sample in an urban region, which limits the findings' application to larger populations.

Authors Contribution

Conceptualization: AZ
Methodology: IAK, MK, PR, GI
Formal analysis: SPS
Writing, review and editing: AZ

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

[1] Jung E, Ro YS, Ryu HH, Kajino K, Do Shin S. Pediatric Age-Adjusted Shock Index as A Predictor of Mortality by Sex Disparity in Pediatric Trauma: A Pan-Asian Trauma Outcome Study. Yonsei Medical Journal.2023 Apr; 64(4): 278. doi: 10.3349/ymj.2022.0370.

[2] Newgard CD, Fischer PE, Gestring M, Michaels HN, Jurkovich GJ, Lerner EB *et al.* National Guideline for the Field Triage of Injured Patients: Recommendations of the National Expert Panel on Field Triage, 2021. Journal of Trauma and Acute Care Surgery.2022 Aug; 93(2): e49-60.DOI:10.1097/TA.0000000000003627.

[3] Vang M, Østberg M, Steinmetz J, Rasmussen LS. Shock Index as a Predictor for Mortality in Trauma Patients: A Systematic Review and Meta-Analysis. European Journal of Trauma and Emergency Surgery.2022 Aug; 48(4): 2559-66. doi: 10.1007/s00068-022-01932-z.

[4] Lin PC, Liu CY, Tzeng IS, Hsieh TH, Chang CY, Hou YT *et al.* Shock Index, Modified Shock Index, Age Shock Index Score, and Reverse Shock Index Multiplied by Glasgow Coma Scale Predicting Clinical Outcomes in Traumatic Brain Injury: Evidence From a 10-Year Analysis in a Single Center. Frontiers in Medicine. 2022 Nov; 9: 999481. doi: 10.1186/s40621-019-0217-8.

[5] Shi J, Shen J, Zhu M, Wheeler KK, Lu B, Kenney B *et al.* A New Weighted Injury Severity Scoring System: Better Predictive Power for Adult Trauma Mortality. Injury Epidemiology.2019 Dec;6:1-0.doi:10.3389/fmed.2022.999481.

[6] Kim MJ, Park JY, Kim MK, Lee JG. Usefulness of Shock Index to Predict Outcomes of Trauma Patient: A Retrospective Cohort Study. Journal of Trauma and Injury.2019 Mar; 32(1):17-25.doi:10.20408/jti.2018.034.

[7] Koch E, Lovett S, Nghiem T, Riggs RA, Rech MA. Shock Index in the Emergency Department: Utility and Limitations. Open Access Emergency Medicine.2019 Aug 14: 179-99. doi: 10.2147/OAEM.S178358.

[8] Nazar M, Kumar H, Krishnegowda M, Unki P, Veerappa N, Srinivas BK. Validation of the Shock Index, Modified Shock Index, and Shock Index-Paediatric Age-Adjusted (SIPA) for Predicting Length of Stay and Outcome in Children Admitted at a Paediatric Intensive Care Unit. Egyptian Pediatric Association Gazette.2022 Apr; 70(1): 12. doi:10.1186/s43054-022-00103-4.

[9] Avci M and Doganay F. Prognostic Performance of Shock Index, Diastolic Shock Index, Age Shock Index, and Modified Shock Index in COVID-19 Pneumonia. Disaster Medicine and Public Health Preparedness. 2023 Jan; 17: e189. doi: 10.3389/fmed.2022.999481.

DOI: https://doi.org/10.54393/pjhs.v6i1.2209

[10] Montoya KF, Charry JD, Calle-Toro JS, Núñez LR, Poveda G. Shock Index as a Mortality Predictor in Patients with Acute Polytrauma. Journal Of Acute Disease.2015 Aug; 4(3): 202-4. doi: 10.1016/j. joad.2015. 04.006.
[11] Uluç K. Prognostic Value of Shock Index, Modified Shock Index, and Age Shock Index in Patients with Sepsis in the Intensive Care Unit. Kocaeli Üniversitesi Sağlık Bilimleri Dergisi.2024 Sep; 10(3): 96-100.doi: 10.30934/kusbed.1518819.
[12] Aleka P, Van Koningsbruggen C, Hendrikse C. The Value of Shock Index, Modified Shock Index and Age Shock Index to Predict Mortality and Hospitalisation in a District Level Emergency Centre. African Journal of Emergency Medicine.2023 Dec; 13(4): 287-92. doi: 10. 1016/j.afjem.2023.09.007.
[13] Shibahashi K, Sugiyama K, Okura Y, Hoda H, Hamabe Y. Can the Shock Index be a Reliable Predictor of Early Mortality after Trauma in Older Patients? A Retrospective Cohort Study. Acute Medicine & Surgery.2019 Oct; 6(4): 385-91. doi: 10.1002/ ams2.427.
[14] Carsetti A, Antolini R, Casarotta E, Damiani E, Gasparri F, Marini B, Adrario E, Donati A. Shock Index as Predictor of Massive Transfusion and Mortality in Patients with Trauma: A Systematic Review and Meta-Analysis. Critical Care.2023 Mar; 27(1):85.doi:10.1186/ s13054-023-04386-w.
[15] Demir A and Eren F. The Relationship Between Age Shock Index, and Severity of Stroke and In-Hospital Mortality in Patients with Acute Ischemic Stroke. Journal Of Stroke and Cerebrovascular Diseases. 2022Aug;31(8):106569.doi:10.1016/j.jstrokecerebrovb asdis.2022.106569.
[16] Costa YC, Cáceres L, Mauro V, Fairman E, Fernández A, Soricetti J *et al.* Shock Index, Modified Shock Index, and Age-Adjusted Shock Index as Predictors of In-Hospital Death in Acute Heart Failure. Sub Analysis of the ARGEN IC. Current Problems in Cardiology.2022 Oct1;47(10):101309.doi:10.1016/j.cpcardiol.2022.10130 9.
[17] Rau CS, Wu SC, Kuo SC, Pao-Jen K, Shiun-Yuan H *et al.* Prediction of Massive Transfusion in Trauma Patients with Shock Index, Modified Shock Index, and Age Shock Index. International Journal of Environmental Research and Public Health.2016 Jul; 13(7): 683.doi :10. 3390/ijerph13070683.
[18] Yu T, Tian C, Song J, He D, Sun Z, Sun Z. Age Shock Index is Superior to Shock Index and Modified Shock Index for Predicting Long-Term Prognosis in Acute Myocardial Infarction. Shock. 2017 Nov; 48(5): 545-50. Doi: 10.1097/SHK.0000000000000892.
[19] Colarusso L, Brahmbhatt DH, Scolari FL, Keon KA, Shin E, De Pellegrin Overgaard *et al.* Decoding Cardiogenic Shock: Assessing Shock Index and its Variants aas Prognostic Indicators for In-Hospital Mortality.ESC Heart Failure. 2024. doi: 10.1002/ehf2.14853.
[20] Günlü S, Kayan F, Karahan MZ. The Predictive Effect of Shock Index on Mortality in Patients with Acute Heart Failure. Journal Of Xiangya Medicine. 2023 Nov 20; 8. doi: 10.21037/jxym-23-20.
[21] Kim SY, Hong KJ, Do Shin S, Ro YS, Ahn KO, Kim YJ *et al.* Validation of the Shock Index, Modified Shock Index, and Age Shock Index for Predicting Mortality of Geriatric Trauma Patients in Emergency Departments.Journal of Korean Medical Science. 2016 Dec; 31(12): 2026-32.
[22] Aleka P. The Value of Shock Index, Modified Shock Index and Age Shock Index to Predict Critical Outcomes in a District Level Emergency Centre.
[23] Levkowitz E, Gibson R, Xu H, Zhang LF, Eskine K, Buck B *et al.* Optimizing Triage: Assessing Shock Index, Pediatric Age-Adjusted as an Adjunct to Improve Emergency Severity Index Mistriage. Pediatric Emergency Care.2024 Dec: 10-97. doi:10.1097/PEC. 00 00000000003171.
[24] Iramain R, Ortiz J, Jara A, Bogado N, Morinigo R, Cardozo L *et al.* Fluid Resuscitation and Inotropic Support in Patients with Septic Shock Treated in Pediatric Emergency Department: An Open-Label Trial.Cureus.2022 Oct; 14(10). doi: 10.7759/cureus.30 029.