ORIGINAL ARTICLE

Evaluation of pediatric trauma score and pediatric age-adjusted shock index in pediatric patients admitted to the hospital after an earthquake

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ABSTRACT

BACKGROUND: In our earthquake-prone country, it is crucial to gather data from regional hospitals following earthquakes. This information is essential for preparing for future disasters and enhancing healthcare services for those affected by earthquakes. This study aimed to evaluate the Pediatric Trauma Score (PTS) and the Shock Index, Pediatric Age-Adjusted (SIPA), in children affected by earthquakes, to provide clinicians with insights into the severity of trauma and hemodynamic stability.

METHODS: The study included patients admitted to our hospital's pediatric emergency service within the three weeks following the earthquake. We evaluated their age, sex, admission vital signs, mechanical ventilation requirements, development of crush syndrome, length of hospital stay, PTS, and SIPA.

RESULTS: Our study included 176 children (89 females and 87 males) with trauma. Fifty-eight (32.95%) children had crush syndrome, and 87 (49.43%) were hospitalized. The median PTS was 10 (ranging from -3 to 12), and the median SIPA was 1.00 (ranging from 0.57 to 2.10). We observed a negative correlation between the time spent under debris and PTS (r=-0.228, p=0.002) and a positive correlation with the SIPA score (r=0.268, p<0.001). The time spent under debris (p<0.001) and SIPA score (p<0.001) were significantly higher in hospitalized children. PTS was significantly lower in hospitalized children than in others. A PTS cutoff point of 7.5, and a SIPA cutoff point of 1.05, predicted hospitalization in all children. Time spent under debris and SIPA were significantly higher in children with crush syndrome than in others (p<0.001). PTS at a cutoff point of 8.5 and SIPA at a cutoff point of 1.05 predicted crush syndrome in all children.

CONCLUSION: PTS and SIPA are important practical scoring systems that can be used to predict the severity of trauma, hospitalization, crush syndrome, and the clinical course in pediatric patients admitted to the hospital due to earthquake trauma.

Keywords: Child; earthquake; pediatric age-adjusted shock index (SIPA); pediatric trauma score (PTS).

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INTRODUCTION

Türkiye is situated within an earthquake-prone belt, frequently experiencing disasters that result in widespread injuries, significant damage, and considerable loss of life. As a result, there is a substantial increase in the demand for health services to manage the consequences of these events. On February 6, 2023, two earthquakes, with their epicenter in Kahramanmaraş, struck, causing massive destruction and loss of life in 11 surrounding provinces. Following these earthquakes, patients were transferred to various hospitals across the country, primarily to those in the surrounding provinces, after having their vital signs stabilized in the provinces where they were located. Our tertiary university hospital in Mersin, one of the provinces closest to the most severely affected provinces, received many of these patients. Transportation of patients was managed by land, air, and sea. Given the sudden influx of mass injuries, which may surpass regional hospital capacities, it is crucial to prioritize the injured using appropriate scoring methods for evaluation, rather than indiscriminately providing care.[1]

No single value or discovery can precisely define shock in pediatric trauma patients. Hypotension is a very late sign of shock in children. Various trauma scoring systems have been developed to use resources efficiently and to reduce mortality rates in the treatment of traumatized children, such as the Pediatric Trauma Score (PTS) and Shock Index (SI). PTS is commonly utilized in our clinical practice. It is a scoring system based on the assessment of several factors: weight, airway status, systolic blood pressure, neurological status, skeletal integrity, and the presence or absence of an open wound.[2] The Pediatric Age-Adjusted Shock Index (SIPA) has proven valu-

Table 1. Trauma assessment scales

Glasgow Coma Scale[4,5*]

Eye Response
- 4: Spontaneous eyes opening
- 3: Eyes closed, open to verbal command
- 2: Eyes closed, open to painful stimulus
- 1: Eyes closed, no eye opening

Motor Response
- 6: Obeys commands
- 5: Localizes pain
- 4: Withdrawal from pain
- 3: Flexion response to pain
- 2: Extension response to pain
- 1: No motor response

Verbal Response
- 5: Oriented
- 4: Confused
- 3: Inappropriate words
- 2: Incomprehensible sounds
- 1: No verbal response

Pediatric Trauma Score[6-8**]

Clinical Parameter	-1	+1	+2
Weight (kg)	<10	10-20	≥20
Airway	Unmaintainable	Maintainable	Normal
Systolic Blood Pressure (mmHg)	<50	50-90	≥90
Central Nervous System	Coma or Decerebrate Posture	Obtunded/Loss of Consciousness	Awake
Open Wound	Major/Penetrating	Minor	None
Skeletal	Open/Multiple Fractures	Closed Fracture	None

*The Glasgow Coma Scale is evaluated with a minimum of 3 and a maximum of 15 points. **The Pediatric Trauma Score ranges from -6 to +12.

Table 2. Summary of variables

Age, Months	125 (4-214)
0-36 months	26 (14.8%)
37-72 months	22 (12.5%)
73-144 months	52 (29.5%)
>144 months	76 (43.2%)
Sex	
Female	89 (50.6%)
Male	87 (49.4%)
Stay Under the Debris	147 (83.5%)
Length of Stay, Minutes	240 (5-5760)
Trauma	176 (100.0%)
Glasgow Coma Score	15 (4-15)
Crush Syndrome	58 (33%)
Compartment Syndrome	17 (9.7%)
Surgery	44 (25.0%)
Pediatric Trauma Score	10 (-3-12)
SIPA Score	1.0 (0.57-2.10)
Hospitalization	87 (49.4%)
Length of Stay, Days	6 (2-50)
Intensive Care Unit Need	10 (5.7%)
Albumin Infusion	10 (5.7%)
Erythrocyte Suspension Infusion	24 (13.6%)
Fresh Frozen Plasma Infusion	11 (6.3%)
Intubation	8 (4.5%)
Hemodialysis	23 (13.1%)
Number of Sessions	1 (1-12)
Acute Kidney Injury at Admission	
No injury	161 (91.5%)
Recovery without Dialysis	14 (7.9%)
Partial Recovery, GFR 60-90 ml/min/1.73m^2	0
Partial Recovery, GFR 30-60 ml/min/1.73m^2	0
Partial Recovery, GFR 15-30 ml/min/1.73m^2	1 (0.6%)
Complete Recovery	0 (0.00%)
Continue to Dialysis	0 (0.00%)
Final Status	
Exitus	0 (0.00%)
Discharged with Recovery	170 (96.6%)
Continue to Stay in Hospital	0 (0.00%)
Referred to Another Hospital	6 (3.4%)

Data are presented as median (minimum - maximum) for continuous variables due to the non-normality of distribution, and as frequency (percentage) for categorical variables. GFR: Glomerular filtration rate; SIPA: Shock Index, Pediatric Age-Adjusted.

able in predicting the severity of injuries and outcomes following pediatric trauma. SIPA, derived from the SI, is calculated by dividing the patient's heart rate by their systolic blood pressure.[3] It reflects the ratio of the apex beat to systolic blood pressure and serves as an indicator of hemodynamic stability.[4] While PTS highlights the trauma's severity, prompting the transfer of suitable patients to trauma centers, the Shock Index aids in forecasting the injury's severity, the necessity for transfusion, intensive care requirements, and mortality risk in trauma patients.[4,5]

To prepare for future earthquakes in Türkiye and improve health services for earthquake victims, it is essential to gather data from regional hospitals in the aftermath of such catastrophes. The literature on the demographic and clinical profiles of earthquake victims is scant. Notably, no studies exploring PTS and SIPA in critically ill pediatric earthquake survivors have been found. This study aims to evaluate PTS and SIPA in children affected by earthquakes to alert clinicians about the trauma's severity and the patients' hemodynamic stability. Thus, it investigates the characteristics of pediatric earthquake survivors treated in our hospital after the 2023 earthquake. Employing a multidisciplinary approach, this research assesses their predictive value in determining the clinical trajectory of patients and can enrich the literature on managing critically injured pediatric patients.

MATERIALS AND METHODS

This study included patients aged over one month and under 18 years who were admitted to the pediatric emergency department of our tertiary university hospital for trauma within three weeks after the earthquake (February 6, 2023 – February 27, 2023). Patient data were collected retrospectively from medical records. This study excluded earthquake victims who applied after February 28, 2023, those who sought medical attention for non-traumatic reasons, and patients with incomplete data records in their files. The patient assessment covered a wide range of factors, including age, sex, anthropometric data, admission vital signs, the requirement for mechanical ventilation, the need for extracorporeal treatment methods, the necessity for blood and blood products, length of hospital stay, duration of stay in the intensive care unit, Glasgow Coma Score (GCS), PTS, and SIPA.

The GCS was utilized to assess the state of consciousness in patients admitted following trauma. This assessment involves evaluating eye opening, verbal, and motor responses (Table 1).[6,7] Evaluation and scoring for PTS include assessing the patient's airway patency, state of consciousness, body weight, systolic blood pressure, the presence of an open wound, and a preliminary evaluation of any skeletal system trauma. The total score ranges from -6 to +12, with scores below 8 indicating potential significant trauma and the need for follow-up in a trauma center. PTS is a crucial scoring system for predicting patient triage and outcomes (Table 1).[8-10] The SIPA has proven effective in predicting the severity of injuries and outcomes following trauma. It is calculated by dividing the patient's heart rate by their systolic blood pressure.[4,5]

Table 3. Correlations between PTS, SIPA score, and other variables

	PTS	SIPA Score
Age, months		
r	0.086	-0.294
p	0.258	<0.001
Length of stay under the debris, minutes[(1)]		
r	-0.228	0.268
p	0.002	<0.001
Glasgow Coma Score		
r	0.338	-0.288
p	<0.001	<0.001

r: Spearman correlation coefficient; PTS: Pediatric Trauma Score; SIPA: Shock Index, Pediatric Age-Adjusted. [(1)]Children who did not stay under the debris were included in the analysis as "0 minutes".

For the conduct of this study, we obtained ethical approval from our university's Non-Invasive Ethics Committee of the Faculty of Medicine (Date: April 26, 2024; Number: 2023/275). Parental consent was deemed unnecessary because the data were collected from retrospective file records.

Statistical Analysis

Analyses were conducted using the IBM Statistical Package for the Social Sciences (SPSS) Statistics for Windows, version 25.0 (IBM Corp., Armonk, NY, USA), and MedCalc Statistical Software, version 15.8 (MedCalc Software bvba, Ostend, Belgium). The Kolmogorov-Smirnov test was employed for the normality check. Continuous variables were presented as the median (minimum-maximum) due to the non-normal distribution of the data, while categorical variables were presented as frequency (percentage). Spearman correlation coefficients were used to analyze correlations between variables. The Mann-Whitney U test was employed for between-group analysis of continuous variables, and the chi-square test was used for between-group analysis of categorical variables.

RESULTS

Our study included 176 children (89 females and 87 males) with trauma. Their median age was 125 months (ranging from 4 to 214 months). Of these children, 147 (83.52%) were trapped under debris, with the median time spent under debris being 240 minutes (ranging from 5 to 5760 minutes). Fifty-eight (32.95%) children developed crush syndrome, and 87 (49.43%) were hospitalized. The median length of hospital stay was six days (ranging from 2 to 50 days). The median PTS was 10 (ranging from -3 to 12), and the median SIPA was 1.00 (ranging from 0.57 to 2.10). A summary of the variables is presented in Table 2. Six patients were referred to another hospital. After the earthquake, patients received first aid and were then transferred to the most appropriate hospitals, even in the absence of identification. In subsequent days, patients whose families were located in different hospitals or provinces were transferred from our hospital for social reasons.

We found a negative correlation between age and the SIPA score (r=-0.294, p<0.001), as well as a negative correlation between the time spent under debris and the PTS (r=-0.228, p=0.002), and a positive correlation between the time spent under debris and the SIPA score (r=0.268, p<0.001). Additionally, a positive correlation between the GCS and PTS (r=0.338, p<0.001), and a negative correlation between GCS

Table 4. Comparison of scores with relation to the need for intensive care, surgery, and erythrocyte suspension infusion

	n	PTS	SIPA score
Intensive Care Unit Need			
Yes	10	5.5 (-3-11)	1.39 (0.84-2.10)
No	166	10 (0-12)	1.0 (0.57-1.90)
p		0.009	0.001
Surgery			
Yes	44	7 (-3-12)	1.2 (0.6-2.1)
No	132	11 (0-12)	1.0 (0.57-1.80)
p		<0.001	<0.001
Erythrocyte Suspension Infusion			
Yes	24	5.5 (-3-11)	1.2 (0.8-2.1)
No	152	11 (0-12)	1.0 (0.57-1.80)
p		<0.001	<0.001

Data are presented as median (minimum - maximum) for continuous variables due to non-normality of distribution. PTS: Pediatric Trauma Score; SIPA: Shock Index, Pediatric Age-Adjusted.

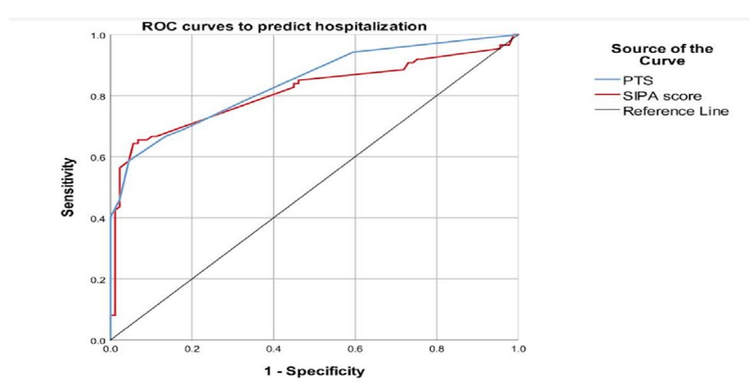
Table 5. Summary of variables concerning hospitalization and crush syndrome

	Hospitalization			Crush Syndrome		
	No (n=89)	**Yes (n=87)**	**p**	**No (n=118)**	**Yes (n=58)**	**p**
Age, months	124 (4-214)	126 (4-214)	0.838	129 (4-214)	122.5 (6-214)	0.922
Sex						
Female	49 (55.1%)	40 (46%)	0.228	60 (50.8%)	29 (50.0%)	0.916
Male	40 (44.9%)	47 (54%)		58 (49.2%)	29 (50.0%)	
Stay under the debris	62 (69.7%)	85 (97.7%)	<0.001	89 (75.4%)	58 (100.0%)	<0.001
Length of stay, minutes[(1)]	30 (0-4800)	312 (0-5760)	<0.001	48 (0-4800)	600 (5-5760)	<0.001
Pediatric Trauma Score	11 (6-12)	7 (-3-12)	<0.001	11 (1-12)	7 (-3-12)	<0.001
SIPA Score	0.90 (0.57-1.63)	1.20 (0.60-2.10)	<0.001	1.00 (0.57-1.90)	1.20 (0.60-2.10)	<0.001

Data are presented as median (minimum - maximum) for continuous variables due to the non-normality of distribution and as frequency (percentage) for categorical variables. SIPA: Shock Index, Pediatric Age-Adjusted. [(1)]Children who did not stay under the debris were included in the analysis as "0 minutes".

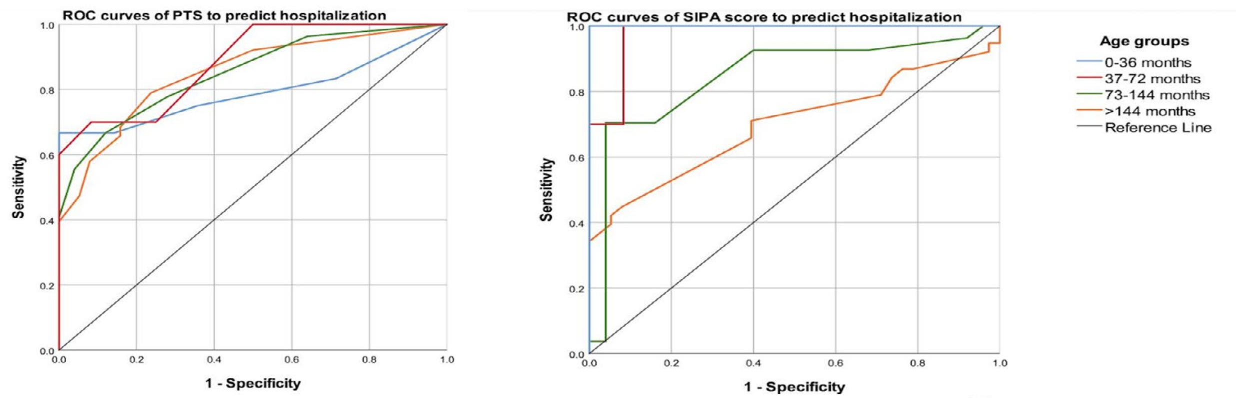
and SIPA score (r=-0.288, p<0.001) were observed (Table 3). Patients in need of intensive care, surgery, and erythrocyte suspension infusion exhibited significantly lower PTS scores compared to those who did not require these interventions (p=0.009, p<0.001, and p<0.001, respectively). Similarly, these patients had significantly higher SIPA scores compared to those without such needs (p=0.001, p<0.001, and p<0.001, respectively) (Table 4). No significant differences were observed between hospitalization groups in terms of age and sex. The percentage of time spent under debris (p<0.001), the actual time spent under debris (p<0.001), and SIPA scores (p<0.001) were significantly higher in hospitalized children than in others. Conversely, PTS (p<0.001) was significantly lower in hospitalized children compared to others (Table 5).

The PTS showed 58.62% sensitivity, 95.51% specificity, and 77.27% accuracy in predicting hospitalization with a cutoff point of 7.5 for all children (Area Under the Curve [AUC]: 0.841, 95% Confidence Interval [CI]: 0.783 - 0.899, p<0.001). The SIPA score demonstrated 65.52% sensitivity, 93.26% specificity, and 79.55% accuracy in predicting hospitalization with a cutoff point of 1.05 for all children (AUC: 0.812, 95% CI: 0.744 - 0.879, p<0.001). The predictive performance of PTS and SIPA for hospitalization was significant across age groups (Fig. 1). Specifically, the predictive performance of SIPA for hospitalization was excellent for a cutoff point of 1.15 in children aged 0-36 months (AUC: 1.000, 95% CI: 1.000 - 1.000, p<0.001), with the AUC of SIPA being significantly higher than that of the PTS in children aged 0-36 months



	Cut-off	Sensitivity	Specificity	Accuracy	PPV	NPV	AUC (95% CI)	p [(1)]	p [(2)]
PTS	<7.5	58.62%	95.51%	77.27%	92.73%	70.25%	0.841 (0.783 - 0.899)	**<0.001**	0.497
SIPA	>1.05	65.52%	93.26%	79.55%	90.48%	73.45%	0.812 (0.744 - 0.879)	**<0.001**	

Figure 1. Performance of the scores to predict hospitalization. PPV: Positive predictive value; NPV: Negative predictive value; AUC: Area under the ROC curve; CI: Confidence intervals; PTS: Pediatric Trauma Score; SIPA: Shock Index, Pediatric Age-Adjusted. [(1)] Analysis of AUC under the null hypothesis of H0: AUC=0.500; [(2)]Comparison of AUC between PTS and SIPA scores under the null hypothesis of H0: AUC(PTS)=AUC(SIPA Score).

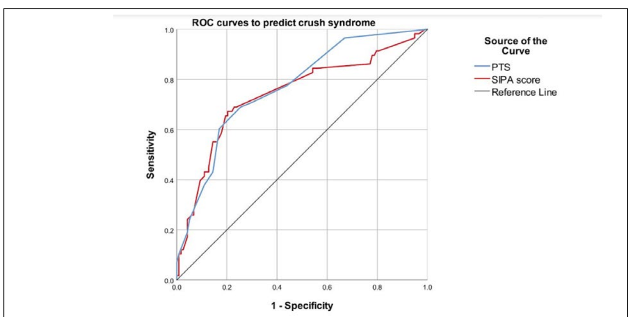


	Cut-off	Sensitivity	Specificity	Accuracy	PPV	NPV	AUC (95% CI)	p (1)	p (2)
0-36 months									
PTS	<7.5	66.67%	100.00%	84.62%	100.00%	77.78%	0.792 (0.594 - 0.989)	**0.012**	**0.039**
SIPA score	>1.15	100.00%	100.00%	100.00%	100.00%	100.00%	1.000 (1.000 - 1.000)	**<0.001**	
37-72 months									
PTS	<8.5	70.00%	91.67%	81.82%	87.50%	78.57%	0.883 (0.744 - 1.000)	**0.002**	0.210
SIPA score	>1.15	100.00%	91.67%	95.45%	90.91%	100.00%	0.975 (0.918 - 1.000)	**<0.001**	
73-144 months									
PTS	<9.0	66.67%	88.00%	76.92%	85.71%	70.97%	0.850 (0.748 - 0.953)	**<0.001**	0.961
SIPA score	>1.09	70.37%	96.00%	82.69%	95.00%	75.00%	0.847 (0.732 - 0.962)	**<0.001**	
>144 months									
PTS	<10.5	78.95%	76.32%	77.63%	76.92%	78.38%	0.849 (0.763 - 0.935)	**<0.001**	**0.033**
SIPA score	>1.00	44.74%	92.11%	68.42%	85.00%	62.50%	0.699 (0.577 - 0.820)	**0.003**	

Figure 2. ROC curves of PTS and SIPA scores to predict hospitalization with regard to age groups. bPPV: Positive predictive value; NPV: Negative predictive value; AUC: Area under the ROC curve; CI: Confidence intervals; PTS: Pediatric Trauma Score; SIPA: Shock Index, Pediatric Age-Adjusted. (1)Analysis of AUC under the null hypothesis of H0: AUC=0.500; (2)Comparison of AUC between PTS and SIPA scores under the null hypothesis of H0: AUC (PTS)=AUC (SIPA Score).

(p=0.039). The AUC of PTS was significantly higher than that of SIPA in children older than 144 months (p=0.033) (Fig. 2).

No significant difference was found between crush syndrome groups in terms of age and sex. The percentage of time spent under debris (p<0.001), the actual time spent under debris (p<0.001), and the SIPA score (p<0.001) were significantly higher in children with crush syndrome than in those without. Conversely, the PTS (p<0.001) was significantly lower in children with crush syndrome compared to those without (Table 5). PTS demonstrated 68.97% sensitivity, 74.58% specificity, and 72.73% accuracy in predicting crush syndrome with a cut-off point of 8.5 for all children (AUC: 0.768, 95% CI: 0.695 - 0.841, p<0.001). The SIPA score exhibited 67.24% sensitivity, 79.66% specificity, and 75.57% accuracy in predicting crush syndrome for a cutoff point of 1.05 in all children (AUC: 0.743, 95% CI: 0.660 - 0.826, p<0.001) (Fig. 3). The prediction performance of PTS for crush syndrome was insignificant in children younger than 73 months. Similarly, the prediction performance of the SIPA score for crush syndrome was insignificant in children older than 144 months. However, no significant differences were observed between the AUCs of PTS and SIPA scores across all children and age groups (Fig. 4).

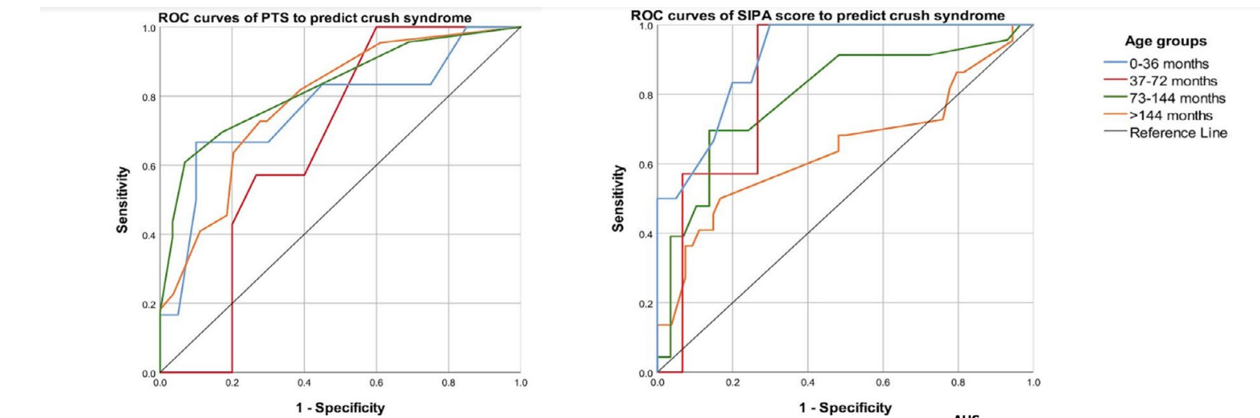


	Cut-off	Sensitivity	Specificity	Accuracy	PPV	NPV	AUC (95.0% CI)	p (1)	p (2)
PTS	<8.5	68.97%	74.58%	72.73%	57.14%	83.02%	0.768 (0.695 - 0.841)	**<0.001**	0.623
SIPA score	>1.05	67.24%	79.66%	75.57%	61.90%	83.19%	0.743 (0.660 - 0.826)	**<0.001**	

Figure 3. Performance of the scores to predict crush syndrome. PPV: Positive predictive value; NPV: Negative predictive value; AUC: Area under the ROC curve; CI: Confidence intervals; PTS: Pediatric Trauma Score; SIPA: Shock Index, Pediatric Age-Adjusted. (1)Analysis of AUC under the null hypothesis of H0: AUC=0.500; (2)Comparison of AUC between PTS and SIPA scores under the null hypothesis of H0: AUC(PTS)=AUC(SIPA Score).

DISCUSSION

This study aimed to evaluate PTS and SIPA in children affected by earthquakes, with the goal of providing clinicians with insights into the severity of trauma and hemodynamic stability. Utilizing a multidisciplinary approach, we examined the characteristics of pediatric earthquake survivors in our



	Cut-off	Sensitivity	Specificity	Accuracy	PPV	NPV	AUC (95.0% CI)	p (1)	p (2)
0-36 months									
PTS	<3.5	66.67%	90.00%	84.62%	66.67%	90.00%	0.763 (0.518 - 1.000)	0.055	0.238
SIPA score	>1.15	100.00%	70.00%	76.92%	50.00%	100.00%	0.908 (0.791 - 1.000)	**0.003**	
37-72 months									
PTS	<11.5	100.00%	40.00%	59.09%	43.75%	100.00%	0.667 (0.441 - 0.892)	0.217	0.139
SIPA score	>1.15	100.00%	73.33%	81.82%	63.64%	100.00%	0.848 (0.682 - 1.000)	**0.010**	
73-144 months									
PTS	<7.5	60.87%	93.10%	78.85%	87.50%	75.00%	0.826 (0.710 - 0.942)	**<0.001**	0.717
SIPA score	>1.09	69.57%	86.21%	78.85%	80.00%	78.13%	0.795 (0.666 - 0.923)	**<0.001**	
>144 months									
PTS	<8.5	72.73%	72.22%	72.37%	51.61%	86.67%	0.786 (0.676 - 0.895)	**<0.001**	0.094
SIPA score	>1.00	50.00%	83.33%	73.68%	55.00%	80.36%	0.644 (0.492 - 0.796)	0.051	

Figure 4. ROC curves of PTS and SIPA scores to predict crush syndrome with regard to age groups. PPV: Positive predictive value; NPV: Negative predictive value; AUC: Area under the ROC curve; CI: Confidence intervals; PTS: Pediatric Trauma Score; SIPA: Shock Index, Pediatric Age-Adjusted. (1)Analysis of AUC under the null hypothesis of H0: AUC=0.500; (2)Comparison of AUC between PTS and SIPA scores under the null hypothesis of H0: AUC(PTS)=AUC(SIPA Score).

hospital after the 2023 earthquake and assessed the utility of PTS and SIPA in forecasting the clinical trajectory of these patients. To the best of our knowledge, this study is the first to explore the potential utility of SIPA and PTS in assessing pediatric earthquake trauma. We evaluated 176 children who experienced earthquake trauma, with a mean age of 125 months. Of these children, 147 (83.52%) were trapped under debris, and the median time spent under debris was 240 minutes. Fifty-eight (32.95%) children developed crush syndrome, and 87 (49.43%) were hospitalized. The median hospital stay was six days (ranging from 2 to 50 days). The median PTS was 10 (ranging from -3 to 12), and the median SIPA score was 1.00 (ranging from 0.57 to 2.10).

Earthquakes are a leading cause of severe injuries, mortality, and morbidity in the pediatric population. To mitigate these outcomes, it is imperative for healthcare professionals and emergency departments to quickly and accurately identify patients with the most severe injuries to prioritize care and treatment accordingly. Assessment must simultaneously consider vital signs and the severity of trauma. The PTS is widely used in clinical practice for this purpose.[2] A systematic review that we included analyzed 12 studies with a total of 348,687 participants in the meta-analysis, revealing a fourfold increase in the risk of in-hospital mortality among adult trauma patients with an initial SI≥1 in the emergency department or trauma center.[11] The utility of SI in predicting outcomes of trauma and the necessity for blood product transfusion in adult trauma patients has been well established, often employing a single threshold value between 0.8 and 1.0 to classify patients as having normal or elevated levels.[3] SIPA, first proposed by Acker et al., accounts for age-specific variations in vital signs to define different thresholds for "elevated" values based on the patient's age.[4] SIPA has been utilized to identify and predict hemodynamic instability in children. The age-adjusted shock index cutoff values are set at 1.2 for ages 0-6 years, 1.0 for 7-12 years, and 0.9 for those over 12 years.[4] SIPA proves valuable in identifying the compensatory phase of shock, particularly when blood pressure is normal to low-normal. It is effective in predicting mortality and the severity of traumatic injuries in the pediatric population. However, SIPA was not found to be a significant predictor for the admission to pediatric intensive care units or the need for surgical intervention. In clinical outcome analyses, an elevated SIPA was associated with a higher in-hospital mortality rate.[12] When used for triage at the critical triage point, the Pediatric Triage Scale (PTS) demonstrated a sensitivity of 95.8% and a specificity of 98.6%.[13,14] An increased SIPA showed a sensitivity of 58% and a specificity of 89% in identifying severely injured children.[15,16]

We observed a negative correlation between age and the SIPA score, as well as a negative correlation between the time spent under debris and PTS. Conversely, there was a positive correlation between the time spent under debris and the SIPA score. Additionally, a positive correlation was found between GCS and PTS, and a negative correlation between GCS and SIPA scores. The relationship between GCS and trauma scores was contrary to expectations, which could be attributed to 88% of the GCS values being 15.

Vandewalle RJ et al. demonstrated that a normal SIPA becoming elevated within the first 48 hours of admission strongly correlates with adverse outcomes in pediatric patients. Furthermore, patients with an elevated SIPA that fails to normalize during this period require longer stays in the intensive care unit and extended mechanical ventilation.[17] Another study found that elevated SIPA is a predictor of injury severity and has proven useful in identifying severely injured pediatric patients.[18] Our study revealed that the percentage of time spent under debris, the actual time spent under debris, and the SIPA score were significantly higher in hospitalized children than in others. PTS was significantly lower in hospitalized children than in others. A PTS cutoff of 7.5 and a SIPA cutoff of 1.05 predicted hospitalization in all children.

Crush syndrome encompasses systemic damage caused by post-traumatic crushing, typically seen after muscle damage in disasters, such as earthquakes, or following severe exercise. Patients may experience acute renal failure, electrolyte imbalances, multiple organ failure, and complications like compartment syndrome.[19] In our PubMed-based review, no previous studies were found that examined the relationship between crush syndrome and both trauma score and shock index. To the best of our knowledge, our study is the first to explore the potential utility of SIPA and PTS in evaluating pediatric earthquake trauma and crush syndrome. The time spent under debris and the SIPA score were significantly higher in children with crush syndrome than in others. A PTS cutoff of 8.5 and a SIPA cutoff of 1.05 predicted crush syndrome in all children. The study by Jeong S et al. showed that PTS and SIPA are reliable predictors, with high scores for SIPA and PTS indicating severe injury in their cohort, thereby externally validating both tools with high specificities. The PTS has shown an increased likelihood of predicting outcomes and markers of injury severity. In settings where resources are plentiful, PTS may be favored. Conversely, SIPA appears to be an effective tool in prehospital settings with limited resources and time constraints, while PTS seems to serve as a better triage score in larger trauma centers with more resources to predict outcomes.[5]

Our study has several limitations. Given that our patients received first aid in the provinces where they were located immediately after trauma, SIPA and PTS were calculated upon their first admission to our hospital. The most significant limitation of our study is that it does not provide the initial evaluation immediately post-trauma. Additionally, our sample size was not large enough, and due to the absence of mortality in our cohort, we were unable to examine the relationship between the scores and mortality rates. Since conducting prospective studies during disasters is not feasible, there is a need for more extensive research on this subject, particularly by examining the records of the first admissions to health institutions related to crush syndrome.

CONCLUSION

Our study determined that a PTS cutoff point of 8.5 and a SIPA cutoff point of 1.05 successfully predicted crush syndrome in all children. PTS and SIPA are valuable and practical scoring systems for predicting the severity of trauma, hospitalization, crush syndrome, and the clinical course in pediatric patients admitted due to earthquake trauma. To our knowledge, this is the first study to explore the potential utility of SIPA and PTS in evaluating pediatric earthquake trauma and crush syndrome. Further large-scale studies involving a greater number of patients are required to delve deeper into this subject.

Ethics Committee Approval: This study was approved by the Mersin University Faculty of Medicine Ethics Committee (Date: 26.04.2023, Decision No: 2023/275).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Deprem sonrası hastaneye başvuran çocuk hastalarda pediatrik travma skoru ve pediatrik yaşa göre düzeltilmiş şok indeksinin değerlendirilmesi

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AMAÇ: Deprem kuşağı olan ülkemizde; gelecekte yaşanabilecek afetlere hazırlık yapabilmek ve depremzedelere yönelik sağlık hizmetlerini geliştirebilmek için deprem sonrası bölge hastanelerinden bildirilen verilere ihtiyaç duyulmaktadır. Bu çalışmada, 2023 depremi sonrası izlenmiş olan çocuk depremzede olguların özelliklerini inceleyerek travmanın ağırlığını ve hemodinamik stabilite durumu açısından klinisyenleri uyarması, klinik gidişatını tahmin etmede kullanılabilirliğini öngörmede pediatrik travma skoru (PTS) ve pediatrik yaşa göre düzeltilmiş şok indeksinin (SIPA) değerlendirilmesi amaçlanmıştır.
GEREÇ VE YÖNTEM: Bu çalışmaya depremden sonraki 3 hafta içinde hastanemiz çocuk acil servisine başvuran hastalar dahil edildi. Yaş, cinsiyet, göçük altında kalma süresi, başvuru vital bulguları, Crush sendromu gelişimi, hastanede kalış süresi ile PTS ve SIPA değerlendirildi.
BULGULAR: Deprem nedeniyle travma geçiren 176 çocuk (89 kız)mevcuttu. 58 (%32.9) çocukta Crush sendromu saptandı ve 87 (%49.4) çocuk hastaneye yatırıldı. Medyan PTS 10 (min -3, maks 12) ve SIPA 1.0 (min 0.5, maks 2.1) idi. Göçük altında kalış süresi ile PTS arasında negatif korelasyon (r=-0.228, p=0.002), SIPA skoru arasında pozitif korelasyon (r=0.268, p<0.001) bulundu. Göçük altında kalış süresi (p<0.001) ve SIPA skoru (p<0.001) hastanede yatan çocuklarda anlamlı derecede yüksekti. Hastanede yatan çocuklarda PTS diğerlerine göre anlamlı derecede düşüktü. PTS kesme noktası 7.5 ve SIPA kesme noktası 1.05 değerlerinin tüm çocuklarda hastaneye yatışı öngördüğü saptandı (Şekil 1). Göçük altında kalış süresi ve SIPA Crush sendromlu çocuklarda diğerlerine göre anlamlı olarak daha yüksekti (p<0.001). 8.5 kesme noktası için PTS ve 1.05 kesme noktası için SIPA tüm çocuklarda Crush sendromunu öngördüğü saptandı (Şekil 2).
SONUÇ: Deprem sonrası travma nedeniyle başvuran çocuk hastalarda PTS ve SIPA, travmanın ağırlığını, hastaneye yatışı, Crush sendromunu ve hemodinamik stabilite ile klinik gidişatı ön görme açısından kullanılabilecek önemli pratik skorlama sistemleridir.

Anahtar sözcükler: Çocuk, deprem, pediatrik travma skoru (PTS) ve pediatrik yaşa göre düzeltilmiş şok indeksi (SIPA).

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