ORIGINAL ARTICLE

Evaluation of emergency department admissions of mass casualty patients using the revised trauma score, injury severity score, and trauma and injury severity score

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ABSTRACT

BACKGROUND: There is a need for studies evaluating prognostic scoring systems in mass trauma patients in conflict regions to predict patient prognosis for emergency surgical prioritization. In this study, we aimed to evaluate scoring systems such as the Revised Trauma Score (RTS), Injury Severity Score (ISS), and Trauma and Injury Severity Score (TRISS) in trauma patients admitted due to mass trauma in Northern Syria.

METHODS: This study was a retrospective evaluation of patients admitted due to mass trauma to the emergency departments of hospitals in Northern Syria. The diagnostic efficiency of RTS, ISS, and TRISS scoring systems was evaluated in these admissions in the first half of 2021.

RESULTS: The most common causes of mass trauma were bomb blast (67.3%), gunshot (28.8%), and 14 (3.9%) patients admitted with other causes. When the odds ratio (OR) was analyzed, a one-unit increase in the RTS score increased the odds of survival by a factor of 6.133, and a one-unit increase in the TRISS score increased the odds of survival by a factor of 1.057. Differently, it was found that each 1-unit increase in ISS decreased the patient's probability of survival by 0.856 units. When RTS, TRISS, and ISS scores were analyzed, the area under the ROC curve was statistically significant for all of them ($p<0.001$) and all of them had a diagnostic value for mortality with sensitivities of 99.0%, 94.8%, and 91.9%; specificities of 87.8%, 90.5%, and 88.6; AUC of 0.958, 0.975, and 0.958, respectively.

CONCLUSION: The use of trauma scoring systems, especially TRISS, may be useful for prioritizing patients in mass casualty settings in the presence of overcapacity.

Keywords: Emergency department; mass casualty; RTS; ISS; TRISS; Syria.

INTRODUCTION

Trauma is a major health burden in countries at high risk of conflict, where more than 90% of injury-related deaths occur globally.[1] In Syria, where the risk of war is the highest in the world, it is predicted that the conflicts that have been ongoing for approximately 15 years will continue.[2-5] World Health Organization bulletins state that epidemiological data on the trauma burden of the Syrian civil war are lacking, and there has been no systematic review of the issue.[6,7] These conflicts

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and uncertainties create the potential for mass trauma hospital admissions, particularly in northern Syria. Mass trauma admissions can lead to sudden hospital overcapacity. In the event of overcapacity, the aim is to provide as much care as possible with limited facilities. With this goal, predicting the trauma-specific clinical needs of patients for advanced treatments, prioritizing patients, and predicting prognosis is critical for emergency medical and surgical teams.[8,9]

There have been several studies investigating the effectiveness of trauma scoring systems in predicting prognosis and mortality using parameters such as vital signs, medical history, and laboratory results in patients with war and combat injuries.[10] Although these scoring systems are widely used in high-income countries, their effectiveness in low-income countries remains a subject of academic research.[11] The Revised Trauma Score (RTS), Injury Severity Score (ISS), and Trauma and Injury Severity Score (TRISS) are the most commonly used scoring systems for trauma and war injuries. Low RTS scores and ISS scores higher than 16 (between 16 and 75) are associated with high mortality rates.[12] This study evaluated the predictability of scoring systems such as RTS, ISS, and TRISS in trauma patients admitted due to mass trauma events in Northern Syria.

MATERIALS AND METHODS

Study Design This study was a retrospective evaluation of patients admitted to two hospitals in Northern Syria between January 1, 2021, and May 31, 2021. Hospital admissions to the emergency departments due to mass trauma were reviewed, and the diagnostic efficiency of the Glasgow Coma Scale (GCS), RTS, ISS, and TRISS systems were evaluated in these admissions.

Approval for the study was obtained from the Hatay Mustafa Kemal University Non-Interventional Research Ethics Committee (meeting date: 12.05.2022, decision number: 01) and the relevant hospital administrations. The study was conducted in accordance with the Ethical Principles of the World Medical Association Declaration of Helsinki.

Study Location

Türkiye has established several hospitals in Northern Syria as part of its humanitarian aid efforts. Syrian doctors, nurses, and other health professionals work in these hospitals and provide services to the local population in Northern Syria. The hospitals included in the study are Afrin Hospital and Rasulayn Hospital. Both are considered regional reference hospitals for trauma and accept referrals from other hospitals.

Patient Selection

Trauma patients admitted to the emergency departments of Afrin and Syria hospitals in Northern Syria due to mass trauma (defined as an incident with ten or more patients admitted per mass casualty event in a short period) were included in the study. Post mass trauma events, it is possible for emergency department admissions to exceed capacity. Accordingly, the exclusion criteria were as follows:

1. Incidents resulting in the admission of fewer than ten trauma patients,
2. Patients presenting to the emergency department in cardiopulmonary arrest,
3. Patients transferred to an external facility within the first 24 hours,
4. Patients referred by an external center following the provision of immediate care for the same event,
5. Patients whose clinical data were unavailable.

The methodology for patient selection included in the study is illustrated in Figure 1.

Data Collection

Demographic information, comorbidities, transportation method, initial symptoms, vital signs (temperature, pulse, blood pressure, saturation), injury mechanism, injury type, and physical assessments of patients presenting with mass trauma were retrieved from medical records. Additionally, diagnostic imaging results (X-rays, computed tomography [CT], and ultrasounds) were documented on case report forms through the hospital's digital system. Mortality within 24 hours post-admittance was utilized to categorize patients as deceased, while survival beyond this period was indicative of alive status. GCS, RTS, ISS, and TRISS scores were computed from these data. Exclusion from score calculation was applied to patients lacking comprehensive physical examination records, vital detailed data, or when a score estimation was not feasible. The patient outcomes were stratified into two cohorts: survivors and deceased.

Calculation of Prognostic Scores

Injury Severity Score (ISS)

The ISS stratifies the body into six domains corresponding to major injuries (head or neck, face, chest, abdomen, extremities, and external). An injury severity rating ranging from 0 to 6 is allocated to each domain. The ISS is calculated as the sum of the squares of the highest injury scores from the three most severely affected regions, yielding a total score between 1 and 75. Notably, any injury receiving a severity score of 6 necessitates an ISS of 75.[13]

Revised Trauma Score (RTS)

The RTS encompasses three physiological metrics: respiratory rate, systolic blood pressure, and the GCS. The aggregate of these parameters yields a score between 0 and 12.[14]

Trauma and Injury Severity Score (TRISS)

The TRISS adjusts for age and the nature of the trauma (penetrating or blunt). It amalgamates the RTS and ISS through a statistical model to ascertain the probability of survival. Scores range from 0 to 7,841, with higher scores correlating with an elevated probability of survival.[14,15]

Statistical Analysis

Statistical analyses were conducted utilizing the Statistical

Package for Social Sciences version 28.0 for Windows (IBM Corp., Armonk, NY, USA). The normality assumption for quantitative variables was evaluated using the Kolmogorov-Smirnov test. Descriptive statistics for the variables are expressed as medians (min-max) and frequencies (%). The Mann-Whitney U test was employed for comparisons between two groups, whereas the Kruskal-Wallis test was applied for comparisons among more than two groups. For groups demonstrating significant differences as per the Kruskal-Wallis test, paired comparisons were carried out utilizing the Mann-Whitney U test with a Bonferroni correction applied (0.05/group number). The chi-squared test was used to examine categorical variables. The efficacy of the scoring systems in predicting patient mortality was appraised through bivariate logistic regression analysis. Subsequent to the bivariate analysis, receiver operating characteristic (ROC) analysis was performed to ascertain if the scores that significantly determined the risk of patient mortality had a diagnostic threshold value. The interrelations among the scoring systems were investigated using Spearman's correlation analysis. A P-value of less than 0.05 was deemed indicative of statistical significance for all analyses.

RESULTS

Data from 364 patients fulfilling the inclusion criteria were subjected to analysis. The cohort presenting with mass trauma to the emergency department was predominantly male (86.6%), with around one in five patients (20.3%) succumbing to their injuries. Bombing blasts constituted the most frequent mechanism of mass trauma (67.3%), followed by gunshots (28.8%). Fourteen patients (3.9%) presented with other causes of mass trauma. Transport to the hospital was less frequently undertaken by ambulance (19.5%) than by vehicle (80.5%) (Table 1).

The clinical assessment at initial presentation of trauma patients revealed circulatory complications as the most prevalent (24.5%), succeeded by respiratory issues (20.3%), significant hemorrhage (16.2%), airway obstructions (11.3%), and hypothermia (0.5%). This distribution persisted amongst the patients who succumbed to their injuries (Table 1). Vital signs at the time of admission were notably diminished in the deceased cohort (except for elevated temperature), with GCS scores also being lower in comparison to those who survived (Table 1).

CT scans were performed on 12.6% (n=46) of patients, based on clinical indications, patient stabilization status, and the availability of hospital resources. Among those who received a CT, nineteen patients were identified with intracranial hemorrhage; of these, only nine survived. A single patient, presenting with a severe cervical spine injury, was diagnosed with a cervical spine fracture concomitant with a carotid artery injury. Pneumothorax and hemothorax were documented in seven patients within the thoracic region, with survival observed in five. Ultrasonography, feasible in the facilities for 28 patients, revealed intra-abdominal free fluid in 11 patients, great vessel injury in two, and pneumothorax in one. Radiography, conducted in 116 patients, detected no pathological findings in 26 cases. Emergency surgeries were performed on 97 patients admitted with mass trauma; of these, 15 passed away either during the intervention or within the initial 24 hours postoperatively. Overall, of the patients studied, 74 succumbed to their injuries, 60 were transferred post the first 24-hour window, 101 necessitated hospitalization, and 129 were discharged.

The data comparing lesion location, trauma type, transport modality to hospital, residential address, and gender in relation to the scoring outcomes across patient groups is detailed in Table 2. An assessment of patient mortality with respect to the injured body region underscored a significant association between mortality and injuries to the head and neck, thorax, and abdomen ($p<0.001$) (Table 3). A comparative analysis of the scores between the deceased and survivor cohorts revealed significantly elevated RTS, TRISS, and GCS scores among survivors, whereas the ISS was higher in the deceased cohort ($p<0.001$) (Table 3).

When the association between ISS trauma severity groups, RTS scores, and mortality was examined, a significant correlation was observed between trauma severity groups and mortality ($p<0.001$) (Table 3). These findings indicated that 64.1% of surviving patients were categorized within the mild ISS trauma group, while none of the deceased patients fell into this category. Regarding RTS, 0.7% of surviving patients had scores <3, in contrast to 66.2% of deceased patients within the same score range ($p<0.001$). Only 3.9% of patients with an RTS<3 survived.

The bivariate logistic regression analysis revealed that all four scoring systems were effective predictors of patient mortality. Analysis of the odds ratio (OR) showed that for each incremental point in the GCS, the likelihood of survival increased by a factor of 2.002 (OR: 2.002, 95% CI: 1.707–2.350, $p<0.001$), each point increase in the RTS score improved survival odds by a factor of 6.133 (OR: 6.133, 95% CI: 3.768–9.981, $p<0.001$), and each point increase in the TRISS score augmented survival odds by a factor of 1.057 (OR: 1.057, 95% CI: 1.046–1.068, $p<0.001$). Conversely, each unit increment in ISS was associated with a 0.856 decrease in survival probability, which translates to a 1.168 increase in the likelihood of death (OR: 0.856, 95% CI: 0.827–0.886, $P<0.001$) (Table 4).

The ROC analysis determined that the area under the curve (AUC) of the four scoring methods was statistically significant ($p<0.001$) (Fig.1). The GCS displayed a noteworthy AUC (AUC: 0.974, $p<0.001$) with a sensitivity of 99.0% and a specificity of 86.5%, using 9.5 as the diagnostic cut-off, signifying its predictive capacity for mortality. Likewise, the ISS exhibited a significant AUC (AUC: 0.958, $p<0.001$), with a sensitivity of 91.9% and a specificity of 88.6%, using 20.5 as the cut-off, confirming its diagnostic relevance for mortality. Similarly,

Table 1. Distribution of demographic characteristics, admission characteristics, and vital signs of patients by deceased and surviving patient groups

	Total n =364	**Deceased n=74 (20.3%)**	**Surviving n=290 (79.7%)**
Gender			
Male	316 (86.8)	64 (86.5)	252 (86.9)
Female	48 (13.2)	10 (13.5)	38 (13.1)
Age	26 (1-65)	26 (3-62)	25 (1-65)
Location			
Afrin	99 (27.2)	19 (25.7)	80 (27.6)
Rasulayn	265 (72.8)	55 (74.3)	210 (72.4)
Type of Trauma			
Gunshot	105 (28.8)	17(23.0)	88(30.3)
Bomb	245 (67.3)	54(73.0)	191(65.9)
Other	14 (3.9)	3(4.1)	11(3.8)
Transfer			
Ambulance	71 (19.5)	11 (14.9)	60 (20.7)
Own Vehicle	293 (80.5)	63 (85.1)	230 (79.3)
Massive Bleeding			
Not Present	305 (83.8)	44 (59.5)	261 (90.0)
Present	59 (16.2)	30 (40.5)	29 (10.0)
Airway Problems			
Not Present	323 (88.7)	38 (51.4)	285 (98.3)
Present	41 (11.3)	36 (48.6)	5 (1.7)
Respiratory Problems			
Not Present	290 (79.7)	17 (23.0)	273 (94.1)
Present	74 (20.3)	57 (77.0)	17 (5.9)
Hypothermia			
Not Present	362 (99.5)	72 (97.3)	290 (100.0)
Present	2 (0.5)	2 (2.7)	0 (0.0)
Circulation Problem			
Not Present	275 (75.5)	12 (16.2)	263 (90.7)
Present	89 (24.5)	62 (83.8)	27 (9.3)
Vitals			
Pulse	95 (0-130)	50 (0-115)	95 (60-130)
Temperature	36 (34-39)	36 (34-39)	36 (35-38)
Systolic Blood Pressure	110 (0-160)	60 (0-110)	110 (60-160)
Diastolic Blood Pressure	70 (0-100)	40 (0-70)	70 (40-100)
O2 Saturation	100 (0-100)	60 (0-100)	100 (70-100)
Respiratory Rate	16 (0-25)	8 (0-22)	16 (8-25)
State of Consciousness			
Conscious	258 (70.9)	3 (4.1)	255 (87.9)
Stuporous	39 (10.7)	6 (8.1)	33 (11.4)
Unconscious	67 (18.4)	65 (87.8)	2 (0.7)
GCS	15 (3-15)	3 (3-15)	15 (3-15)
Comorbidities			
None	318 (87.4)	69 (93.2)	249 (85.9)
Hypertension	25 (6.9)	3 (4.1)	22 (7.6)
DM	10 (2.7)	2 (2.7)	8 (2.8)
CAD	4 (1.1)		4 (1.4)
Asthma	4 (1.1)		4 (1.4)
Hypertension +DM	2 (0.5)		2 (0.7)
Hypertension +CAD	1 (0.3)		1 (0.3)

Table 2. Distribution of patients by gender, mode of transport, location and injured body part according to scoring systems

	n (%)	ISS Median (Min-Max)	RTS Median (Min-Max)	TRISS Median (Min-Max)	GCS Median (Min-Max)
Extremity					
Yes	241 (66.2%)	8.0 (1-75)	8.0 (0-8)	99.8 (0-100)	15.0 (3-15)
No	123 (33.8)	6.0 (0-75)	8.0 (0-8)	99.8 (0-100)	15.0 (3-15)
p*		0.105	0.651	0.514	0.216
Head/Neck					
Yes	160 (44.0%)	16.5 (1-75)	8.0 (0-8)	99.3 (0-100)	14.0 (3-15)
No	204 (56.0)	5.0 (0-75)	8.0 (2-8)	99.8 (0-100)	15.0 (3-15)
p*		<0.001	<0.001	<0.001	<0.001
Thorax					
Yes	120 (33.0%)	25.0 (1-75)	6.0 (0-8)	89.15 (0-100)	10.0 (3-15)
No	244 (67.0)	5.0 (0-75)	8.0 (1-8)	99.8 (0-100)	15.0 (3-15)
p*		<0.001	<0.001	<0.001	<0.001
Abdominal					
Var	87 (24.0%)	27.0 (3-75)	6.0 (0-8)	72.3 (0-100)	8.0 (3-15)
Yok	276 (76.0)	5.0 (0-75)	8.0 (0-8)	99.8 (0-100)	15.0 (3-15)
p*		<0.001	<0.001	<0.001	<0.001
Type of trauma					
Gunshot	105 (28.8)	9.0 (0-75)	8.0 (1-8)	99.9 (0-100) a	15.0 (3-15)
Bomb	245 (67.3)	6.0 (0-75)	8.0 (0-8)	99.8 (0-100) a	15.0 (3-15)
Other	14 (3.8)	7.0 (2-36)	8.0 (4-8)	99.7 (49-100) b	15.0 (5-15)
p&	0.707	0.633	0.001	0.215	
Mode of transport					
Ambulance	71 (19.5)	11.0 (0-75)	8.0 (1-8)	99.7 (0-100)	15.0 (3-15)
Own vehicle	293 (80.5)	6.0 (0-75)	8.0 (0-8)	99.8 (0-100)	15.0 (3-15)
p*	0.075	0.454	0.520	0.573	
Location					
Afrin	99 (27.2)	9.0 (0-75)	8.0 (0-8)	99.7 (0-100)	15.0 (3-15)
Rasulayn	265 (72.8)	8.0 (1-75)	8.0 (0-8)	99.8 (0-100)	15.0 (3-15)
p*	0.391	0.966	0.326	0.216	
Gender					
Male	316 (86.8)	8.0 (0-75)	8.0 (0-8)	99.8 (0-100)	15.0 (3-15)
Female	48 (13.2)	10.5 (0-43)	8.0 (1-8)	99.6 (1-100)	15.0 (3-15)
p*	0.507	0.526	0.680	0.791	

*: Mann-Whitney U Test, &: Kruskal-Wallis Test, Groups with no significant difference are shown with the same letter (p>0.05).

the RTS and TRISS scores presented significant AUCs (RTS AUC: 0.958, p<0.001; TRISS AUC: 0.975, p<0.001), with the RTS sensitivity and specificity calculated at 99.0% and 87.8%, respectively, using 5.5 as the cut-off, and TRISS at 94.8% and 90.5%, respectively, using 87.5 as the cut-off, demonstrating their diagnostic value for mortality (Table 4) (Fig. 2).

When the scoring systems were evaluated using Spearman's correlation analysis, a negative correlation was observed between the GCS and ISS (Rho=-0.704**, p<0.001), a strong positive correlation between the GCS and RTS (Rho=0.890**, p<0.001), and a positive correlation between the GCS and TRISS (Rho=0.726**, p<0.001). The relationships between the ISS and both RTS and TRISS were negatively significant (Rho=-0.741**, p<0.001 and Rho=-0.775**, p<0.001, respectively). Additionally, the relationship between RTS and TRISS was positive and statistically significant (Rho=0.771**, p=0.001) (Table 4).

Table 3. Descriptive statistics and mortality status according to injured body parts, trauma scores and subgroups of ISS and RTS

Injured Body Part		**Surviving n=290 (79.7%)**	**Deceased n=74 (20.3%)**	**p***
Extremity				
No		95 (32.8%)	28 (37.8%)	0.410
Yes		195 (67.2%)	46 (62.2%)	
Head Neck				
No		189 (65.2%)	15 (20.3%)	<0.001
Yes		101 (34.8%)	59 (79.7%)	
Thorax				
No		231 (79.7%)	13 (17.6%)	<0.001
Yes		59 (20.3%)	61 (82.4%)	
Abdominal				
No		246 (85.1%)	30 (40.5%)	<0.001
Yes		43 (14.9%)	44 (59.5%)	
Groups of Trauma Scores		**Surviving Median (Min-Max)**	**Deceased Median (Min-Max)**	**p#**
GCS		15 (3-15)	3 (3-15)	<0.001
TRISS Score		99.8 (0-100)	8.2 (0-99)	<0.001
ISS		5 (0-75)	34 (9-75)	<0.001
RTS Score		8 (3-8)	2 (0-8)	<0.001
	Total n=364	**Surviving n=290 (79.7%)**	**Deceased n=74 (20.3%)**	**p&**
ISS Trauma Score				
Mild (1-8)	186 (51.1)	186 (64.1)	-	<0.001
Moderate (9-14)	42 (11.5)	41 (14.1)	1 (1.4)	
Severe (15-24)	50 (13.7)	42 (14.5)	8 (10.8)	
Critical (≥25)	86 (23.6)	21 (7.2)	65 (87.8)	
RTS Score				
3<	51 (14.0)	2 (0.7)	49 (66.2)	<0.001
4>	313 (86.0)	288 (99.3)	25 (33.8)	

*: Chi-Square test, #: Mann-Whitney U test, &: Chi-Square test.

DISCUSSION

In Northern Syria, the simultaneous admission of a large number of trauma patients to the emergency departments of humanitarian hospitals per incident can lead to overcapacity. In this investigation, patients admitted due to mass trauma to the emergency departments of Afrin and Rasulayn hospitals were assessed. The prognostic utility of trauma scoring systems was examined in a region experiencing internal conflict and mass hospital admissions. The findings generally indicated that high ISS was associated with increased mortality, while lower RTS, TRISS, and GCS scores were indicative of higher mortality. The literature corroborates the prognostic significance of ISS and RTS systems, consistent with the results of this investigation and statistically significant.

The demographic profile revealed a predominance of male patients (86.5%) presenting to the emergency department due to mass trauma, aligning with the Major Trauma Outcome Study in the United States, which reported that 71% of trauma admissions were male.[14] Studies in middle- and low-income countries have similarly noted a higher incidence of male trauma admissions.[16-18] Sürek et al. also observed an elevated proportion of male trauma admissions during the

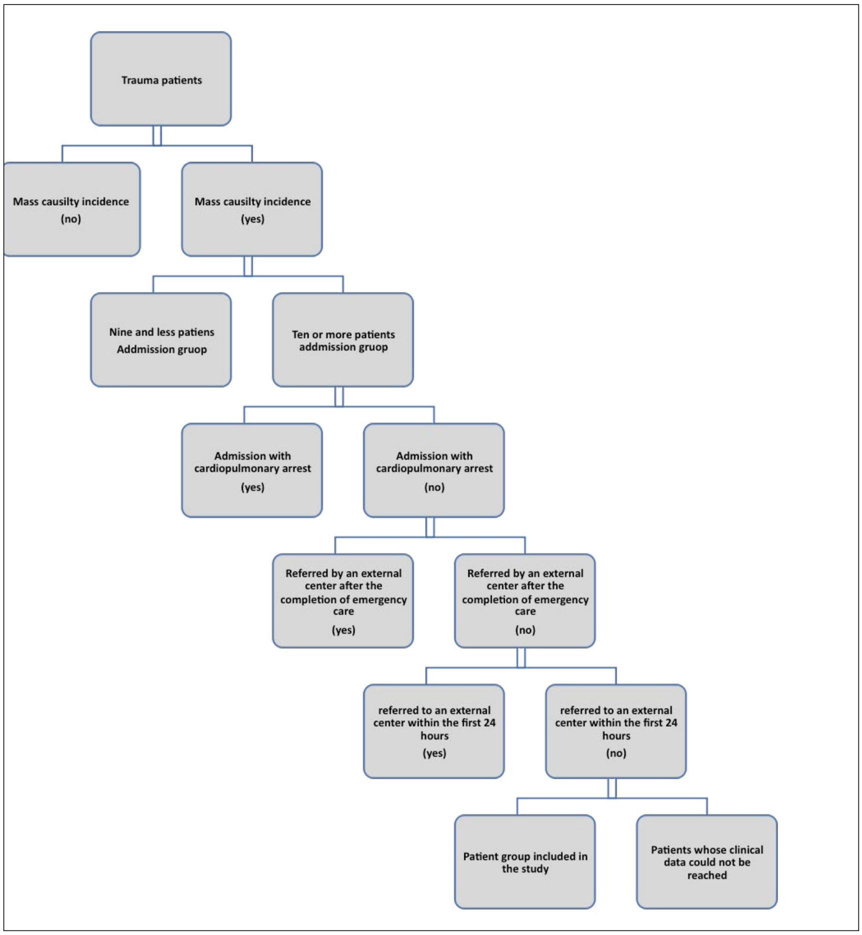

Figure 1. The selection process of the patient group included in the study.

Table 4. Results of bivariate logistic regression analysis, ROC analysis and Spearman Correlation analysis.

Variables for bivariate logistic regression	B	S.E.	Sig.	OR	95%C.I. Exp (B) Lower-Upper
ISS	-0.155	0.018	<0.001	0.856	0.827-0.886
GCS	0.694	0.082	<0.001	2.002	1.707-2.350
RTS	1.814	0.248	<0.001	6.133	3.768-9.981
TRISS	0.056	0.005	<0.001	1.057	1.046-1.068
Variables for ROC	**Cut-off**	**AUC**	**Sig.**	**Sensitivite %**	**Specifity%**
GKS	9.5	0.974	<0.001	99.0	86.5
ISS	20.5	0.958	<0.001	91.9	88.6
RTS	5.5	0.979	<0.001	99.0	87.8
TRISS	87.8	0.975	<0.001	94.8	90.5
Variables for Spearman	**GKS**	**ISS**	**RTS**	**TRISS**	
GKS	-				
ISS	-0.704**	-			
RTS	0.890**	-0.741**	-		
TRISS	0.726**	-0.775**	0.771**	-	

**: p<.01.

Table 4. Results of bivariate logistic regression analysis, ROC analysis and Spearman Correlation analysis.

Variables for bivariate logistic regression	**B**	**S.E.**	**Sig.**	**OR**	**95%C.I. Exp (B) Lower-Upper**
ISS	-0.155	0.018	<0.001	0.856	0.827-0.886
GCS	0.694	0.082	<0.001	2.002	1.707-2.350
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TRISS	0.056	0.005	<0.001	1.057	1.046-1.068
Variables for ROC	**Cut-off**	**AUC**	**Sig.**	**Sensitivite %**	**Specifity%**
GKS	9.5	0.974	<0.001	99.0	86.5
ISS	20.5	0.958	<0.001	91.9	88.6
RTS	5.5	0.979	<0.001	99.0	87.8
TRISS	87.8	0.975	<0.001	94.8	90.5
Variables for Spearman	**GKS**	**ISS**	**RTS**	**TRISS**	
GKS	-				
ISS	-0.704**	-			
RTS	0.890**	-0.741**	-		
TRISS	0.726**	-0.775**	0.771**	-	

**: p<.01.

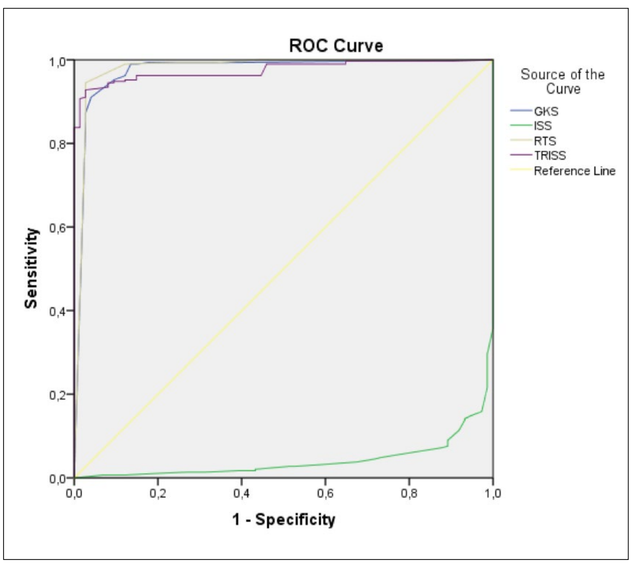

Figure 2. ROC Curve.

COVID-19 pandemic.[19] Factors such as the primary male composition of military and security forces, higher male susceptibility to violence, and the increased risks associated with men's occupational and social activities may contribute to this gender disparity in trauma admissions.

In this study, we observed that explosions (67.3%) and gunshots (28.8%) were the predominant causes of mass trauma, and a majority of patients self-referred to emergency departments (80.5%). In Northern Syria, a region recovering from civil war, terrorist acts and skirmishes are recurrent. During mass trauma incidents, victim and relative evacuations from the scene are often undertaken independently.

The literature contains several evaluations of the GCS's predictive value in trauma patients, a tool commonly used in emergency settings. Bilgin et al., in research focusing on head trauma, noted an average GCS score of 13.51 (SD=2.841) across all patients. The mean GCS score for survivors was 14.09 (SD=2.22), while it was 8.15 (SD=2.265) for non-survivors.[20] Galvagno et al., studying pre-hospital trauma patients, reported GCS scores of 7 to 12 in patients with a poor prognosis and scores below 7 for those requiring transfer to higher-level care.[21] Our study's median GCS score was 15 for survivors and 3 for the deceased. The discrepancy in mean and median values between our findings and the literature could stem from the differing trauma populations and the GCS's simplicity. Raygani et al.'s trauma prognosis research determined a GCS cut-off of 8.69, with low sensitivity (50.8%), high specificity (92.8%), and a sensitivity of 88.7%.[22] Our study's sensitivity (99.0%) and specificity (86.5%) at a GCS cut-off of 9.5 were comparable but higher than Raygani's study, suggesting that the GCS is a reliable diagnostic indicator for mortality. Variations in regional demographics and trauma profiles may explain these slight deviations. This study's exclusive focus on mass hospital admissions could also account for the differences observed. Additionally, patients with head and neck injuries had lower GCS scores, consistent with the literature, which correlates head trauma with a poorer prognosis.

Regarding ISS values, Indurkar et al. found an AUC of 0.230 and a cut-off of 22.50, with low sensitivity (36.8%) and specificity (5.2%), a NPV of 97.4, and a PPV of 31.6.[23] On the other hand, Rizk et al. documented higher ISS sensitivity, specificity, and AUC.[24] In Bilgin et al.'s study, the ISS exhibited a sensitivity of 85.7% and specificity of 99.2%, with a cut-off of 19, yielding a PPV of 93.8% and a NPV of 98.1%.[20] A study at Suez Canal University indicated ISS specificity, sensitivity, and NPV at 100%, 30%, and 70%, respectively.[25] Our study's ISS sensitivity (91.9%) and specificity (88.6%) at a cut-off of 20.5, with an AUC of 0.958, affirm its mortality diagnostic relevance.

Generally, in disaster-related mass trauma admissions, compared to individual admissions, disruptions in treatment and patient care due to factors like hospital facility constraints, an inadequate number of physicians, or the lack of equipment or materials at the time of the event are anticipated, secondary to the sudden surge in capacity. While trauma cases may be negatively affected when a hospital's capacity is exceeded, mass trauma cases may also entail more lethal injury mechanisms. However, the ISS diagnostic cut-off value in this study was higher than in other studies, indicating that the prognosis for mass trauma cases may be worse than for individual ones, even if they score higher on the scales. In the external examination used to calculate the score, the fact that physicians from different countries with varying cultural and educational backgrounds may have led to different results for the effectiveness of ISS.

When the other scoring system, RTS, was examined, the mean RTS of trauma patients in the study by Raygani et al. was 7.30, with an SD of 1.24. It was 7.63 (SD=0.61) for surviving patients and 4.23 (SD=1.23) for deceased patients.[22] Okasha et al. reported a mean RTS of 5.37 for surviving and 3.94 for deceased patients, respectively.[26] In a study by Hadisaputra et al. conducted in Bali, the mean RTS was 6.86 (SD=1.49), 4.56±1.63 for non-survivors, and 7.48±0.57 for survivors. The mortality rate was 100% when RTS was <3.[27] Ranti et al., evaluating RTS in trauma patients in Indonesia, found a cut-off score of 5.88, with a mortality rate of 81.92% for RTS scores between 5-6.[28] In our study, the sensitivity and specificity values were 99.0% and 87.8%, respectively, calculated at a cut-off point of 5.5, indicating that RTS has a diagnostic value for mortality with an AUC of 0.958. Moreover, only 3.9% of patients with RTS<3 survived.

TRISS is among the most extensively utilized trauma scoring systems and is frequently discussed in the literature. Hosseinpour et al. reported that the TRISS model predicted outcomes in 231 of 234 patients with a sensitivity of 98.7%; the specificity was 77.7% among 14 patients who died. ROC analysis suggested that the optimal TRISS cut-off was 36%, with the model achieving a high diagnostic accuracy (AUC=0.988).[29] In a Balinese study, the TRISS score's diagnostic value at 33.3% yielded sensitivity and specificity of 81.8% and 97.6%, PPV of 90%, and NPV of 95.2% with an AUC of 0.942.[27] Gunawanet et al. in a polytrauma cohort found sensitivity and specificity of 84.6% and 81.8%, respectively, with a 90% cut-off.[30] Siritongtaworn et al. demonstrated a sensitivity and specificity of 90.9% and 97.2%, respectively, with a 95% TRISS cut-off.[31] Indurkar et al. presented an overall mean TRISS of 60.71±32.80, with the mean ± SD (Ps) for survivors and non-survivors at 94.5±9.5 and 52.38±31.12, respectively, and documented a 100% mortality rate for patients with a TRISS below 26%, noting that survival chances improved with increasing TRISS values.[23] In this study, contrasting Indurkar et al. but aligning with the broader literature, the sensitivity and specificity were 94.8% and 90.5%, respectively, at a TRISS cut-off of 87.5, with an AUC of 0.975. Thus, the positive prognostic value of TRISS in trauma, as substantiated in the literature, was corroborated in this study.

Several studies have investigated the efficacy of scoring systems across various trauma populations. These investigations have appraised the GCS, RTS, ISS, and TRISS for predicting the severity of injuries, prognoses, and mortality rates. Notably, low GCS scores (particularly <5), low RTS, and ISS values exceeding 16 (especially within the 16–75 range) were correlated with increased mortality rates (32–39). Rozenfeld et al., discussing trauma patient standardization, posited that ISS ranges of 25–48 and 50–75 could be more informative in evaluating critical injuries across broad patient groups for ISS values between 25–75.[40] Karaca et al. observed that RTS and TRISS were significantly lower and ISS significantly higher in deceased patients, elucidating that particularly low GCS scores (<5) and elevated ISS values (>50) are indicative and predictive of prognosis and mortality in gunshot injuries.[12]

Höke et al. analyzed trauma scoring systems and ascertained that TRISS had the highest performance in determining mortality (AUC: 0.93, sensitivity 97.1%, specificity 76.7%), followed by NISS, BIG, ISS, RTS, and GCS. The authors also recognized RTS as the most specific system, with a specificity of 91.6%.[41] Eryılmaz et al., in a study focusing on fall injuries, compared ISS, RTS, NISS, and TRISS, with TRISS emerging as the most sensitive, specific, and best predictive system in terms of mortality.[39] Similarly, a geriatric trauma investigation compared RTS, ISS, and TRISS, and again, TRISS was the most sensitive, specific, and best predictive system for mortality.[42] TRISS was also underscored in the current study. The GCS, ISS, RTS, and TRISS were analyzed, revealing high AUC and sensitivity for all, with TRISS exhibiting the highest specificity.

The factors determining the prognosis in patients with multiple traumas are anatomical injury, physiological injury, and the patient's capacity to respond to trauma.[43] These elements may account for the limitations of purely anatomical or physiological trauma scores in predicting mortality, unlike comprehensive scoring systems. Notably, TRISS encompasses both age and trauma mechanism (thus integrating physiological and anatomical assessment), which elevates its prominence in research.

CONCLUSION

This investigation corroborates the diagnostic utility of TRISS and other trauma scoring systems in predicting outcomes during mass casualty events. As global conflicts and wars escalate, mass trauma is likely to overwhelm emergency services and hospital capacities. In such overcapacity situations, the implementation of trauma scoring systems, particularly TRISS, can aid in the prioritization of mass trauma patients.

Limitations

This study has some limitations. First, it was conducted in two hospitals in northern Syria. Second, patients with missing data could not be included as the study was retrospective. Finally, the time between a mass casualty event and patient admission to the emergency department was unknown.

Ethics Committee Approval: This study was approved by the Hatay Mustafa Kemal University Ethics Committee (Date: 12.05.2022, Decision No: 01).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Travma hastalarının acil servis başvurularında Revised trauma score, Injury severity score ve Trauma and injury severity score etkinliğinin değerlendirilmesi

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AMAÇ: Acil cerrahi önceliklendirmesinde hasta prognozunun tahmin edilebilmesi için çatışma bölgelerindeki kitlesel travma hastalarında prognostik tahmin skorlama sistemlerini değerlendiren çalışmalara ihtiyaç vardır. Bu çalışmada Suriye'nin kuzeyinde kitlesel travma nedeniyle başvuran hastalarda Revised Trauma Score (RTS), Injury Severity Score (ISS) ve Trauma and Injury Severity Score (TRISS) skalalarının değerlendirilmesi amaçlandı.
GEREÇ VE YÖNTEM: Bu çalışmada, Suriye'nin kuzeyindeki hastanelerin acil servislerine kitlesel travma nedeniyle başvuran hastaların retrospektif olarak değerlendirilmesi yapıldı. 2021 yılının ilk yarısında bu başvurularda RTS, ISS ve TRISS puanlama sistemlerinin tanısal etkinliği değerlendirildi.
BULGULAR: Kitlesel travmalarının en sık nedenleri bomba patlaması (%67.3), ateşli silah yaralanmaları (%28.8) ve diğer nedenlerdi (%3.9). Odds oranı (OR) analiz edildiğinde, RTS ve TRISS skorundaki bir birimlik artışın hayatta kalma ihtimalini 6.133 ve 1.057 kat arttırdığı, ancak ISS'deki her bir birimlik artışın, hastanın hayatta kalma olasılığını 0.856 birim azalttığı tespit edildi. RTS, TRISS ve ISS değerleri incelendiğinde ROC eğrisi altında kalan alanın istatistiksel olarak anlamlı olduğu ($p<0.001$) ve hepsinin sırasıyla %99.0, %94.8 ve % 91.9 duyarlılıklarla; %87.8, %90.5 ve 88.6 özgüllükle; 0.958, 0.975 ve 0.958 AUC değerleri ile mortalite açısından tanı değeri taşıdığı görüldü.
SONUÇ: Kapasite aşımlarında TRISS başta olmak üzere travma skorlama sistemlerinin kullanılması kitlesel travma hastalarının önceliklendirilmesinde faydalı olabilir.

Anahtar sözcükler: Acil servis; kitlesel travma; RTS; ISS; TRISS; Suriye.

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