ORIGINAL ARTICLE

Reverse shock index multiplied by simplified motor score as an indicator of clinical outcomes in patients with abdominal trauma in the emergency department: a retrospective cohort study

İlker Şirin,[1] Tuğba Sanalp Menekşe,[1] Muzaffer Akkoca[2]

[1]Department of Emergency Medicine, Ankara Etlik City Hospital, Ankara-*Türkiye*

[2]Department of General Surgery, Ankara Etlik City Hospital, Ankara-*Türkiye*

ABSTRACT

BACKGROUND: This study aimed to determine the diagnostic value of the product of the reverse Shock Index (rSI) and the simplified Motor Score (sMS) (rSIsMS) as a predictor of clinical outcomes in patients with abdominal trauma.

METHODS: Patients who presented with abdominal trauma to the emergency department of a tertiary care hospital between 2023 and 2024 were included in the study. Using the patients' data, we calculated the Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), Revised Trauma Score (RTS), and Trauma and Injury Severity Score (TRISS). Additionally, the rSIsMS and the product of the rSI and Glasgow Coma Scale (GCS) (rSIG) were calculated.

RESULTS: A total of 270 patients were included in the study. The diagnostic validity of the TRISS, rSIsMS, and rSIG, which had the highest area under the curve (AUC) values for mortality outcomes, was examined; the AUC values were 0.928, 0.908, and 0.886, respectively. The AUC values of the TRISS and rSIsMS concerning intensive care unit (ICU) needs were 0.844 and 0.852, respectively. With regard to surgical intervention needs, the AUC values of the TRISS and rSIsMS were 0.774 and 0.881, respectively. The diagnostic validity of the rSIsMS for surgical intervention needs was significantly higher than that of the TRISS ($p<0.001$, DeLong test). Concerning massive transfusion protocol (MTP) requirements, the AUC values of the TRISS and rSIsMS were 0.799 and 0.930, respectively. The diagnostic validity of the rSIsMS for MTP requirements was significantly higher than that of the TRISS ($p<0.001$, DeLong test).

CONCLUSION: The rSIsMS is superior to other trauma scores in predicting MTP and surgical intervention needs in patients with abdominal trauma, and it performs similarly to other trauma scores in predicting mortality and ICU needs. The ease of calculation and its ability to be obtained at the bedside may further enhance the clinical utility of the rSIsMS in the emergency department.

Keywords: Abdominal injuries; injuries; mortality; traumatic shock.

INTRODUCTION

Trauma remains a significant cause of morbidity and mortality.[1] Abdominal trauma patients comprise 6% of all trauma cases.[2] The management of such patients varies depending on the mechanism and severity of the injury. Therefore, the rapid and accurate referral of patients with abdominal trauma to the appropriate trauma center is crucial, as it significantly reduces mortality.[3] In the initial assessment of abdominal trauma patients, history, physical examination, vital signs, and trauma scores derived from these factors can be utilised.[4,5] The most widely used trauma scoring systems include the

Cite this article as: Şirin İ, Sanalp Menekşe T, Akkoca M. Reverse shock index multiplied by simplified motor score as an indicator of clinical outcomes in patients with abdominal trauma in the emergency department: a retrospective cohort study. Ulus Travma Acil Cerrahi Derg 2025;31:332-340.

Address for correspondence: İlker Şirin

Department of Emergency Medicine, Ankara Etlik City Hospital, Ankara, Türkiye

E-mail: sirinilkerr@gmail.com

Ulus Travma Acil Cerrahi Derg 2025;31(4):332-340 DOI: 10.14744/tjtes.2025.23798

Submitted: 20.11.2024 Revised: 22.11.2024 Accepted: 25.02.2025 Published: 28.03.2025

Abbreviated Injury Scale (AIS), the Injury Severity Score (ISS), the Revised Trauma Score (RTS), and the Trauma-Related Injury Severity Score (TRISS).[6] Equally important in the initial assessment of trauma patients is the shock index (SI), which is calculated by dividing the heart rate (HR) by the systolic blood pressure (SBP).

The SI has become one of the tools used to assess the severity of trauma patients.[7] It can be easily calculated at first contact or at the bedside, effectively in indicating shock status, the need for massive transfusion protocol (MTP), and mortality.[8-10] Several studies have shown that the reverse shock index (rSI), which is obtained by dividing the SBP by the HR and then multiplying the result by the Glasgow Coma Scale (GCS), is a better predictor of mortality and MTP requirements in trauma patients.[11-13] However, accurately calculating the GCS without tools can be challenging.[14,15] For this reason, instead of the GCS, the simplified motor score (sMS) has been used in combination with the rSI as an indicator of clinical outcomes in various conditions.[16] It has been found that the sMS is as accurate as the GCS.[17] Although there are some studies on the validity of this new value in different conditions, its role in the cohort of abdominal trauma patients is not yet clearly understood.

This study aimed to investigate the effectiveness of the reverse shock index multiplied by simplified motor score (rSIsMS) in predicting mortality, surgical intervention, intensive care unit (ICU) admission, and MTP requirements in patients with abdominal trauma.

MATERIALS AND METHODS

Study Design and Participants

This study was designed as a single-centre, retrospective study. Patients aged 16 years or older who presented to the emergency department (ED) with abdominal trauma between July 1, 2023, and July 1, 2024, were included. The study was approved by the local ethics committee (decision no: AEŞH-BADEK-2024-666; date: July 10, 2024). The study was conducted following the Helsinki Declaration throughout the research process. The ED where the study was conducted receives approximately 2,000 patient visits per day.

Patients with blunt or penetrating abdominal injuries who arrived at the hospital by ambulance or by their own means were included in the study. The abdominal region was defined differently for blunt and penetrating injuries. The area between the neck and the nipple line was considered the anterior thorax; the area between the lower scapular corners and the cervical region was defined as the posterior thorax in the lateral midaxillary lines, and the area between the lower scapular corners, the iliac crest, and the midaxillary lines was designated as the posterior abdomen. Pregnant patients, patients transferred from other centres with trauma occurring more than six hours before arrival, and patients who were found to be without vital signs upon arrival and considered deceased were excluded from the study. Patients with severe head trauma (patients with head AIS >2) were excluded due to the potentially significant influence on the sMS. Patients with amputations, severe arterial or venous injuries of the extremities, and those with blood alcohol levels exceeding 50 mg/dL were also excluded due to the significant potential influence on consciousness. Finally, patients with missing data in the hospital information system were excluded from the study.

Data Collection and Variables

The data were obtained from the hospital's records. The demographic characteristics of the patients, their vital signs upon arrival at the ED, and the GCS scores were recorded. The sMS was calculated based on the neurological examination findings as follows: obeys commands = 3, localizes pain = 2, and withdraws from pain or less = 1. Since the lowest score for the sMS cannot be 0, it was accepted as 1. The indices were calculated as follows: SI = HR/SBP, rSI = SBP/HR, rSIG = (SBP/HR) × GCS, and rSIsMS = (SBP/HR) × sMS. The imaging studies of the patients, all reported by radiologists, were reviewed through the hospital information system. By using the images, reports, and all other relevant information in the system, the AIS, ISS, RTS, and TRISS scores of the patients were calculated and recorded in the data form. The six body regions defined for the AIS were scored as required. Then, the ISS was calculated by summing the squares of the highest AIS scores from the three most severely injured body regions and noted in the data form.[18] The RTS was calculated using the components of the GCS as well as the patients' SBP values and respiratory rates.[19] The TRISS was calculated by combining the ISS, RTS, and age to determine the probability of survival.[20] The number of units of packed red blood cells (pRBC) obtained from the blood bank and the time it took to administer them to the patients were noted. Whether the patients underwent surgery was documented through the hospital information system. Both negative and positive laparotomy outcomes were considered as having undergone surgery. The length of hospital stay for both surgical and non-surgical patients was recorded in days on the data form. The patients' 30-day in-hospital mortality was documented. For patients discharged within 30 days, mortality was assessed using the death notification system.

Definition of MTP

MTP was defined as the use of at least 10 units of packed red blood cells (pRBC) within 24 hours, the use of four units of pRBC within the first hour, or the replacement of 50% of the blood volume with pRBC within four hours.

Outcomes

The primary outcome of our study was to determine the ability of the rSIsMS to predict in-hospital mortality within 30 days. The secondary outcomes included assessing the efficacy of the rSIsMS to predict surgical interventions, ICU admissions, and MTP use, as well as comparing this power with that of existing scoring systems. Another secondary outcome was the comparison of the diagnostic validity of the TRISS and rSIsMS.

Sample Size

Based on the analysis of the results of a similar study, a power analysis was conducted with a 5% margin of error and 95% power. Thus, it was determined that 240 patients were needed, with 120 patients in the group requiring emergency intervention and 120 in the one not requiring emergency intervention.[21]

Statistical Analysis

Data analysis was performed using SPSS Statistics for Windows, version 26 (IBM, Armonk, NY, USA). The normality

Table 1. Demographic and clinical data of patients

	Penetrating injury N=85	Blunt trauma N=185
Demographic Data		
Age	29 (22-41)	36 (25-50)
Sex: Female	8 (9.4)	66 (35.7)
Vital Signs		
SBP	115 (100-120)	112 (100-124)
DBP	70 (65-80)	75 (66-80)
HR	88 (78-105)	88 (78-98)
RR	14 (12-16)	16 (14-20)
GCS	15 (15-15)	15 (15-15)
sMS	3 (3-3)	3 (3-3)
Trauma scores and indices		
ISS	20 (9-30)	25 (16-34)
TRISS	99 (96.4-99.4)	97.8 (92.8-99.3)
SI	0.76 (0.66-1.05)	0.77 (0.65-0.96)
rSI	1.31 (0.95-1.51)	1.31 (1.04-1.55)
rSIsMS	3.93 (2.86-4.54)	3.88 (2.86-4.58)
rSIG	19.41 (14.29-22.5)	19.41 (15.14-22.88)
Outcome parameters		
pRBC requirement (unit)	0 (0-3)	0 (0-2)
MTP requirement	17 (20)	37 (20)
ED outcome		
Discharge	10 (11.8)	14 (7.6)
Inpatient Admission	23 (27.1)	92 (49.7)
Surgical/ICU Admission	52 (61.2)	77 (41.6)
Death	0 (0)	2 (1.1)
30th day outcome		
Discharge	39 (45.9)	95 (51.4)
Surgical/ICU Admission	45 (52.9)	75 (40.5)
Death	1 (1.2)	15 (8.1)
Length of Hospital Stay	3 (1-5)	2 (2-7)
Surgical Requirement	48 (56.5)	56 (30.3)

The table contains, means with SD, median with interquartiles, percentages and number of patients (n). SBP: Systolic blood pressure, DBP: diastolic blood pressure, HR: Heart rate, RR: Respiratory rate, GCS: Glasgow coma scale, sMS: Simple motor score ISS: Injury Severity Score, RTS: Revised Trauma Score, TRISS: Trauma Score and Injury Severity Score, pRBC: packed red blood cells, MTP: Massive blood transfusion, ED: Emergency department SI: shock index rSI: Reverse Shock Index rSIsMS: Reverse Shock Index ×Simple Motor Score rSIG: Reverse Shock Index ×Glasgow Coma Scale ICU: Intensive Care Unit

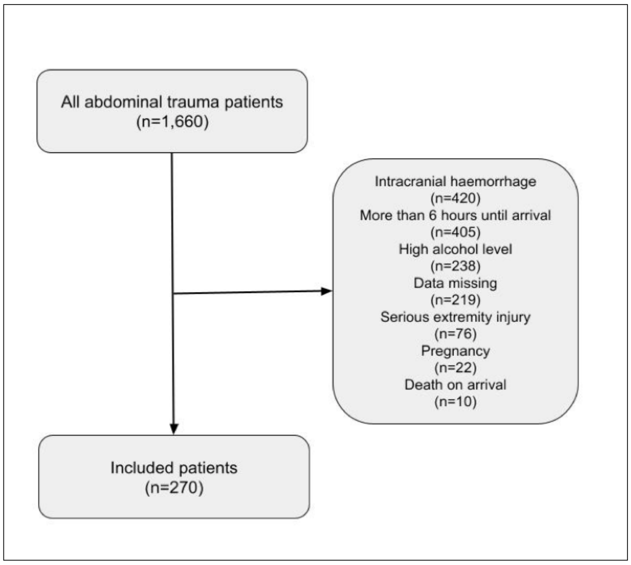

Figure 1. Flow diagram of the inclusion process.

of the data distribution was assessed using the Kolmogorov-Smirnov test and histograms. Normally distributed numerical data were presented as means ± standard deviations, while non-normally distributed numerical data were presented as medians and interquartile range (IQR 25%–75%) values. Categorical variables were presented as counts (n) and percentages (%). Categorical variables were compared using the chi-square test or Fisher's exact test. Continuous variables were compared using the Student's t-test or Mann-Whitney U test. Diagnostic validity was assessed using receiver operating characteristic (ROC) analysis. The results of the ROC analysis were presented using the area under the curve (AUC) and p-value. Diagnostic validity parameters were provided with 95% confidence intervals. The differences in diagnostic validity among the scores were evaluated using the DeLong test. Regarding the correlation analysis, the Pearson correlation test was used for normally distributed data, and the Spearman correlation test was employed for non-normally distributed data. A p-value of less than 0.05 was considered statistically significant for all the tests.

RESULTS

Between January 1, 2023, and July 1, 2024, a total of 1,660 patients aged 16 years or older presented to the ED with blunt or penetrating abdominal trauma. Among these, 1,390 patients met the exclusion criteria. A total of 270 patients were included in the final analysis. The patient enrollment process is shown in Figure 1.

Of the patients, 85 (31.5%) had penetrating trauma (PT), and 185 (68.5%) had blunt trauma (BT). The median age of the patients was 34 years (min.: 16; max.: 79). In the PT group, the distribution of trauma mechanisms was as follows: 67 (78.8%) stab wounds, 17 (20%) gunshot wounds, and 1 (1.2%) traffic accident. In the BT group, the distribution was 156 (84.3%) traffic accidents, 24 (13%) falls from height, and 5 (2.7%) assaults. The comparative characteristics of the patients with PT and BT are presented in Table 1.

The diagnostic validity of the TRISS, rSIsMS, and rSIG, which had the highest AUC values for predicting mortality outcomes, was evaluated. The AUC value for the TRISS was 0.928 (95% CI: 0.858–0.998, p<0.001). The AUC value for the rSIsMS was 0.908 (95% CI: 0.853–0.964, p<0.001), with an optimal cutoff of 3.125. Other diagnostic validity parameters for the mortality outcome are provided in Table 2. No significant difference in diagnostic validity was found between the TRISS and rSIsMS regarding mortality (p=0.654, DeLong test) (Figure 2-A).

Table 2. ROC analysis data and diagnostic values for mortality

	TRISS	rSIsMS	rSIG
AUC	0.928 (0.858-0.998)	0.908 (0.853-0.964)	0.886 (0.823-0.950)
P Value*	<0.001	<0.001	<0.001
Cut off	92.2	3.125	12.5
Sensitivity (%)	93.7 (69.7-99.8)	93.7 (69.7-99.8)	75 (47.6-92.7)
Specificity (%)	85.8 (90.9-89.9)	75.2 (69.4-80.3)	87 (82.2-90.8)
NPV (%)	99.5 (97.0-99.9)	99.4 (96.6-99.9)	98.2 (95.9-99.2)
PPV (%)	29.4 (23.0-36.6)	19.2 (15.6-23.3)	26.6 (19.1-35.7)
PLR	6.6 (4.7-9.1)	3.7 (2.9-4.8)	5.7 (3.7-8.8)
NLR	0.07 (0.01-0.4)	0.08 (0.01-0.5)	0.2 (0.12-0.6)
Accuracy	86.3 (81.6-90.1)	76.3 (70.7-81.2)	86 (81.6-90.1)

TRISS: Trauma Score and Injury Severity Score; rSIsMS: Reverse Shock Index × Simple Motor Score; rSIG: Reverse Shock Index × Glasgow Coma Scale; AUC: Area Under the Curve; NPV: Negative Predictive Value; PPV: Positive Predictive Value; NLR: Negative Likelihood Ratio; PLR: Positive Likelihood Ratio. *Receiver Operating Characteristic (ROC) analysis p value.

Table 3. ROC analysis data and diagnostic values for surgical requirement

	TRISS	rSIsMS	rSIG
AUC	0.774 (0.714-0.833)	0.881 (0.837-0.924)	0.877 (0.833-0.922)
P Value*	<0.001	<0.001	<0.001
Cut off	97.8	3.79	12.8
Sensitivity (%)	71.1 (61.4-79.6)	84.6 (76.2-90.9)	40.3 (30.8-50.4)
Specificity (%)	77.7 (70.6-83.7)	80.1 (73.2-85.9)	96.9 (93.1-99)
NPV (%)	81.1 (75.8-85.4)	89.2 (84-92.9)	72.2 (68.8-75.3)
PPV (%)	66.6 (59.4-73.1)	72.7 (66-78.5)	89.3 (77.4-95.3)
PLR	3.1 (2.3-4.3)	4.2 (3.1-5.8)	13.4 (5.4-32.7)
NLR	0.3 (0.2-0.5)	0.19 (0.1-0.3)	0.6 (0.5-0.7)
Accuracy	75.1 (69.5-80.2)	81.8 (76.7-86.2)	75.1 (69.5-80.2)

TRISS: Trauma Score and Injury Severity Score; rSIsMS: Reverse Shock Index × Simple Motor Score; rSIG: Reverse Shock Index × Glasgow Coma Scale; AUC: Area Under the Curve; NPV: Negative Predictive Value; PPV: Positive Predictive Value; NLR: Negative Likelihood Ratio; PLR: Positive Likelihood Ratio. *Receiver Operating Characteristic (ROC) analysis p value.

Table 4. ROC analysis data and diagnostic values for ıcu requirement

	TRISS	rSIsMS	rSIG
AUC	0.844 (0.795-0.893)	0.852 (0.805-0.900)	0.848 (0.800-0.896)
P Value*	<0.001	<0.001	<0.001
Cut off	97.6	3.79	12.8
Sensitivity (%)	67.9 (59.2-75.8)	75.5 (67.3-82.6)	34.3 (26.2-43.1)
Specificity (%)	87.7 (81.1-92.7)	84.1 (77-89.8)	98.5 (94.9-99.8)
NPV (%)	74.3 (69.2-78.9)	78.5 (72.8-83.2)	61.4 (58.4-64.3)
PPV (%)	83.9 (76.7-89.2)	81.8 (75.1-86.9)	95.7 (84.7-98.9)
PLR	5.5 (3.5-8.8)	4.7 (3.2-7.0)	23.8 (5.9-96.4)
NLR	0.3 (0.2-0.4)	0.2 (0.2-0.4)	0.6 (0.5-0.76)
Accuracy (%)	78.1 (72.7-82.9)	80 (74.7-84.)	67.4 (61.4-72.9)

TRISS: Trauma Score and Injury Severity Score; rSIsMS: Reverse Shock Index × Simple Motor Score; rSIG: Reverse Shock Index × Glasgow Coma Scale; AUC: Area Under the Curve; NPV: Negative Predictive Value; PPV: Positive Predictive Value; NLR: Negative Likelihood Ratio; PLR: Positive Likelihood Ratio. *Receiver Operating Characteristic (ROC) analysis p value.

For the outcome of surgical intervention, the AUC value for the TRISS was 0.774 (95% CI: 0.714–0.833, p<0.001). The AUC value for the rSIsMS was 0.881, with an optimal cutoff of 3.79. The AUC value for the rSIG was 0.877 (95% CI: 0.833–0.922, p<0.001). Other diagnostic validity parameters for the surgical intervention outcome are provided in Table 3. The diagnostic validity of the rSIsMS in predicting surgical intervention was found to be significantly higher than that of the TRISS (p<0.001, DeLong test) (Figure 2-B).

Concerning the ICU admission outcome, the AUC value for the TRISS was 0.844. The AUC value for the rSIG was 0.848. Other diagnostic validity parameters for the ICU admission outcome are provided in Table 4. No significant difference in diagnostic validity was found between the TRISS and rSIsMS about this outcome (p=0.800, DeLong test) (Figure 2-C).

For the MTP requirement outcome, the AUC value for the TRISS was 0.799. The AUC value for the rSIsMS was 0.930, with an optimal cutoff of 3.29. The AUC value for the rSIG was 0.934. Other diagnostic validity parameters for the MTP requirement outcome are provided in Table 5. The diagnostic validity of the rSIsMS in predicting MTP requirements was found to be significantly higher than that of the TRISS (p<0.001, DeLong test) (Figure 2-D).

Finally, the correlations of these scores with the pRBC re-

Table 5. ROC analysis data and diagnostic values for massive transfusion protocol

	TRISS	rSIsMS	rSIG
AUC	0.799 (0.736-0.861)	0.930 (0.894-0.966)	0.934 (0.900-0.969)
P Value*	<0.001	<0.001	<0.001
Cut off	97.8	3.29	12.8
Sensitivity (%)	77.7 (64.4-87.9)	92.5 (82.1-97.9)	68.5 (54.4-80.4)
Specificity (%)	68.0 (61.3-74.2)	84.2 (78.7-88.8)	95.3 (91.6-97.7)
NPV (%)	92.4 (88.0-95.3)	97.8 (94.6-99.1)	92.3 (89-94.7)
PPV (%)	37.8 (32.3-43.6)	59.5 (51.7-66.8)	90 (85.7-93.3)
PLR	2.4 (1.9-3.0)	5.8 (4.2-8.0)	14.8 (7.8-27.8)
NLR	0.3 (0.2-0.5)	0.09 (0.03-0.2)	0.3 (0.2-0.4)
Accuracy	70 (64.1-75.4)	85.9 (81.2-89.8)	90 (85.7-93.3)

TRISS: Trauma Score and Injury Severity Score; rSIsMS: Reverse Shock Index × Simple Motor Score; rSIG: Reverse Shock Index × Glasgow Coma Scale; AUC: Area Under the Curve; NPV: Negative Predictive Value; PPV: Positive Predictive Value; NLR: Negative Likelihood Ratio; PLR: Positive Likelihood Ratio. *Receiver Operating Characteristic (ROC) analysis p value. *Receiver Operating Characteristic (ROC) analysis p value.

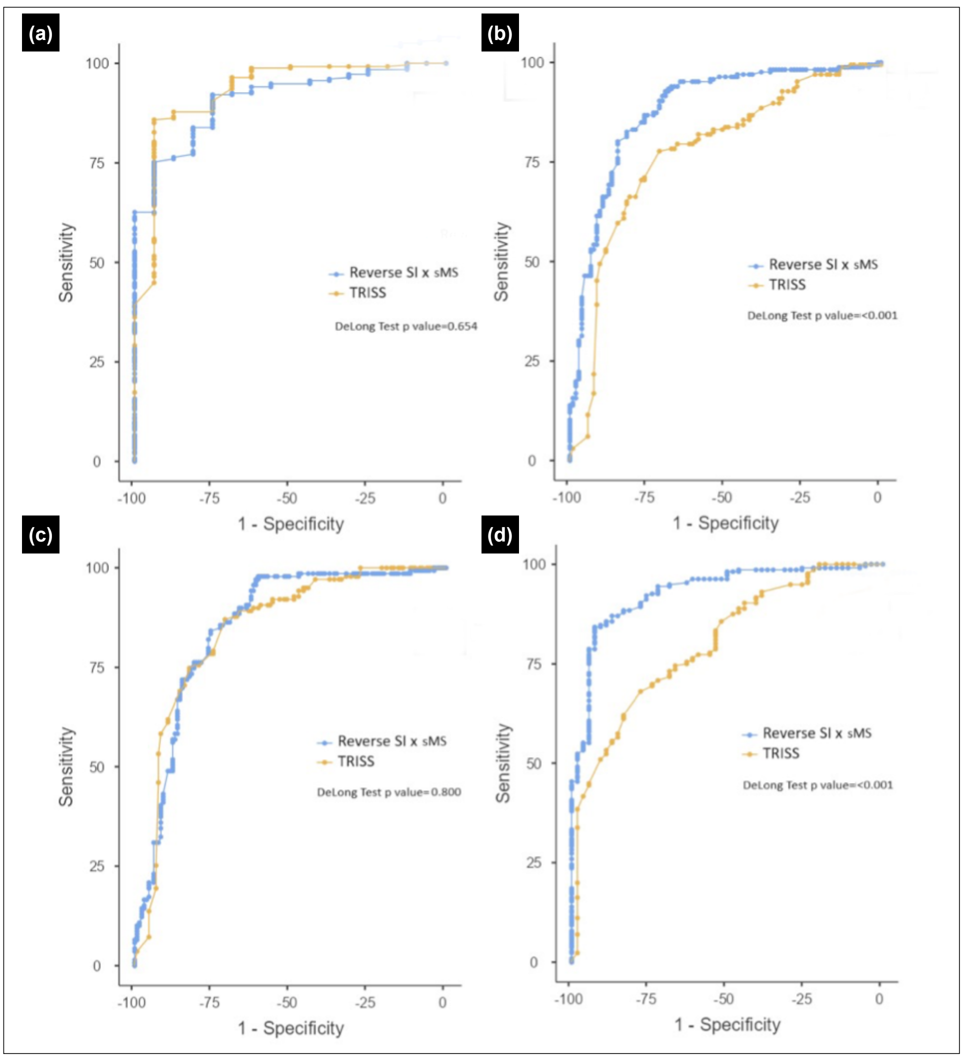

Figure 2. ROC Curves for TRISS and rSI × sMS Based on Outcomes **(a)** Mortality, **(b)** Surgical intervention, **(c)** Intensive care unit admission, **(d)** Massive transfusion requirement.

quirement (unit) and the length of hospital stay (day) were examined. There was a significant negative correlation between the TRISS and the pRBC requirement ($p<0.001$, $R=-0.500$) as well as the length of hospital stay ($p<0.001$, $R=-0.532$). There was also a significant negative correlation between the rSIsMS and the pRBC requirement ($p<0.001$, $R=-0.667$) as well as the length of hospital stay ($p<0.001$, $R=-0.576$).

DISCUSSION

This study examined the effectiveness of the rSIsMS in predicting clinical outcomes such as mortality, surgical intervention, ICU admission, and MTP requirements in patients with abdominal trauma. It found that the rSIsMS was more effective than the TRISS in anticipating the need for surgery and MTP, while it performed similarly to the TRISS in predicting mortality and ICU admission. Since the rSIsMS is an index that can be easily calculated at the bedside using the SBP, HR, and sMS values, we believe that it could be particularly useful in the rapid assessment of situations requiring MTP or surgical intervention in patients with abdominal trauma.

In the literature, the effectiveness of the rSIsMS in predicting mortality in trauma patients has been supported in other studies.[13,22,23] In the present study, the sMS was used instead of the GCS because it is easier to calculate, and there is a meta-analysis in the literature that suggests that the sMS can be used as a substitute for the GCS in trauma patients.[24] Moreover, the rSIsMS demonstrated superior AUC values compared to the rSIG when predicting mortality, surgical intervention, and ICU admission. We believe that this may be since the GCS is not always accurately calculated or that small changes in the GCS may not have significant clinical impacts.

Some patients with abdominal trauma require surgical intervention, but in some cases, determining the need for surgery is challenging.[25] However, it is well-known that a negative laparoscopy can shorten the length of hospital stay for patients with abdominal trauma.[26] Therefore, it is crucial to accurately determine the need for surgical intervention. Our findings demonstrate that the rSIsMS is effective in predicting the need for surgical intervention in these patients. Similarly, Lin et al.[27] found that the rSIsMS could anticipate outcomes across various clinical endpoints. In their study, the cutoff value for the rSIsMS was determined to be 4, whereas in our study, the cutoff values for predicting mortality, surgical intervention, ICU admission, and MTP requirements were identified as 3.125, 3.79, 3.79, and 3.29, respectively. This difference could be attributed to the lower proportion of patients with high TRISS values in Lin et al.'s[27] study compared to ours or to the inclusion of both abdominal trauma and other types of trauma patients in their study population.

Accurately assessing the severity of trauma in patients with abdominal injuries, either in the field or at the initial hospital contact, is crucial. Significant blood volume loss can lead to poor outcomes in a short period, making it essential for patients to have rapid access to blood products at the appropriate trauma center.[28] We found that the rSIsMS was superior to the TRISS in predicting the need for MTP in patients with abdominal trauma. This suggests that the rSIsMS could be a valuable tool for anticipating the need for MTP in patients with abdominal trauma.

In the present study, a significant negative correlation was observed between the rSIsMS and the length of hospital stay. Although the performance of the rSIsMS and TRISS in terms of predicting ICU admission was similar ($p=0.800$, DeLong test), we believe that the rSIsMS may have a slight advantage in clinical practice for anticipating ICU needs and hospital stay duration due to its ease of calculation.

Limitations

This study has several limitations. First, it was subject to the inherent limitations of all retrospective, single-centre studies. Second, the intravenous treatments administered to patients in ambulances on their way to the hospital were not examined. We chose to overlook this aspect because prehospital treatments provided in ambulances in our region are generally very limited. Nevertheless, this could have impacted our results.

Third, the analysis of surgical intervention needs was conducted independently of the surgical outcomes. This could have influenced our findings. However, even in cases of negative laparotomy, patients were included in the surgical intervention group because the attending physician deemed surgical intervention necessary due to the patient's condition.

Fourth, patients with blood alcohol levels above 50 mg/dL were excluded. We made this decision because levels above this threshold could affect the patient's consciousness and motor score. However, although similar studies have also excluded patients with high blood alcohol levels, there is no universally agreed-upon threshold for exclusion.

Fifth, we used the broadest definitions for the MTP criteria. This might have increased the number of patients classified as needing MTP, potentially skewing our results. Different studies have used various definitions of MTP. Our rationale for using broad definitions was that MTP is one of the most critical indicators affecting mortality.

Sixth, patients' medication use was excluded from our data. This could have heavily impacted the mortality outcomes. However, to minimize the potential influence of this factor on our findings, we analyzed the patients who had died and found that none of them were using medications that could significantly affect mortality, such as anticoagulant agents.

CONCLUSION

The rSIsMS is superior to other trauma scoring systems in predicting the need for MTP and surgical intervention in patients with abdominal trauma. It performs similarly to such systems in anticipating mortality and ICU admission. The ability to calculate the rSIsMS quickly and easily at the bedside using BP, HR, and sMS values further enhances its practical advantages.

Acknowledgements: We would like to thank Assoc. Prof. Dr. Gülşah Çıkrıkçı Işık for her valuable guidance and support throughout this project.

Ethics Committee Approval: This study was approved by the Ankara Etlik City Hospital Ethics Committee (Date: 10.07.2024, Decision No: AEŞH-BADEK-2024-666).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: İ.Ş.; Design: İ.Ş., M.A.; Supervision:M.A.; Resource:İ.Ş., T.S.M.; Materials: İ.Ş., T.S.M., M.A.; Data collection and/or processing: İ.Ş., T.S.M.; Analysis and/or interpretation: İ.Ş., M.A.; Literature review: İ.Ş., T.S.M.; Writing: İ.Ş. T.S.M., M.A.; Critical review:İ.Ş., T.S.M., M.A.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

REFERENCES

1. Davidson GH, Hamlat CA, Rivara FP, Koepsell TD, Jurkovich GJ, Arbabi S. Long-term survival of adult trauma patients. JAMA 2011;305:1001–7. [CrossRef]
2. Wiik Larsen J, Søreide K, Søreide JA, Tjosevik K, Kvaløy JT, Thorsen K. Epidemiology of abdominal trauma: an age- and sex-adjusted incidence analysis with mortality patterns. Injury 2022;53:3130–8. [CrossRef]
3. MacKenzie EJ, Rivara FP, Jurkovich GJ, Nathens AB, Frey KP, Egleston BL, et al. A national evaluation of the effect of trauma-center care on mortality. N Engl J Med 2006;354:366–78. [CrossRef]
4. Sasser SM, Hunt RC, Faul M, Sugerman D, Pearson WS, Dulski T, et al. Guidelines for field triage of injured patients: recommendations of the National Expert Panel on Field Triage, 2011. MMWR Recomm Rep Morb Mortal Wkly Rep Recomm Rep 2012;61:1–20. [CrossRef]
5. Fuller G, Baird J, Keating S, Miller J, Pilbery R, Kean N, et al. The accuracy of prehospital triage decisions in English trauma networks – a case-cohort study. Scand J Trauma Resusc Emerg Med 2024;32:47. [CrossRef]
6. Galvagno SM, Massey M, Bouzat P, Vesselinov R, Levy MJ, Millin MG, et al. Correlation between the Revised Trauma Score and Injury Severity Score: implications for prehospital trauma triage. Prehosp Emerg Care 2019;23:263–70. [CrossRef]
7. Allgöwer M, Burri C. [Shock index]. Dtsch Med Wochenschr 1946 1967;92:1947–50. [CrossRef]
8. Cannon CM, Braxton CC, Kling-Smith M, Mahnken JD, Carlton E, Moncure M. Utility of the shock index in predicting mortality in traumatically injured patients. J Trauma 2009;67:1426–30. [CrossRef]
9. Vandromme MJ, Griffin RL, Kerby JD, McGwin G, Rue LW, Weinberg JA. Identifying risk for massive transfusion in the relatively normotensive patient: utility of the prehospital shock index. J Trauma 2011;70:384–8; discussion 388–90. [CrossRef]
10. McNab A, Burns B, Bhullar I, Chesire D, Kerwin A. A prehospital shock index for trauma correlates with measures of hospital resource use and mortality. Surgery 2012;152:473–6. [CrossRef]
11. Kimura A, Tanaka N. Reverse shock index multiplied by Glasgow Coma Scale score (rSIG) is a simple measure with high discriminant ability for mortality risk in trauma patients: an analysis of the Japan Trauma Data Bank. Crit Care Lond Engl 2018;22:87. [CrossRef]
12. Wan-Ting C, Chin-Hsien L, Cheng-Yu L, Cheng-Yu C, Chi-Chun L, Keng-Wei C, et al. Reverse shock index multiplied by Glasgow Coma Scale (rSIG) predicts mortality in severe trauma patients with head injury. Sci Rep 2020;10:2095. [CrossRef]
13. Wu SC, Rau CS, Kuo SCH, Chien PC, Hsieh HY, Hsieh CH. The reverse shock index multiplied by Glasgow Coma Scale score (rSIG) and prediction of mortality outcome in adult trauma patients: a cross-sectional analysis based on registered trauma data. Int J Environ Res Public Health 2018;15:2346. [CrossRef]
14. Emejulu J, Nkwerem S, Ekweogwu OC. Assessment of physicians' knowledge of Glasgow coma score. Niger J Clin Pract 2014;17:729–34. [CrossRef]
15. Marion DW, Carlier PM. Problems with initial Glasgow Coma Scale assessment caused by prehospital treatment of patients with head injuries: results of a national survey. J Trauma. 1994;36:89–95. [CrossRef]
16. Wu MY, Hou YT, Chung JY, Yiang GT. Reverse shock index multiplied by simplified motor score as a predictor of clinical outcomes for patients with COVID-19. BMC Emerg Med 2024;24:26. [CrossRef]
17. Caterino JM, Raubenolt A. The prehospital simplified motor score is as accurate as the prehospital Glasgow coma scale: analysis of a statewide trauma registry. Emerg Med J EMJ 2012;29:492–6. [CrossRef]
18. O'Neill B, Zador P, Baker SP. Indexes of severity: underlying concepts – a reply. Health Serv Res 1979;14:68–76. [CrossRef]
19. Gilpin DA, Nelson PG. Revised trauma score: a triage tool in the accident and emergency department. Injury 1991;22:35–7. [CrossRef]
20. Boyd CR, Tolson MA, Copes WS. Evaluating trauma care: the TRISS method. Trauma Score and the Injury Severity Score. J Trauma 1987;27:370–8. [CrossRef]
21. Uemura T, Kimura A, Matsuda W, Yamamoto H, Sasaki R. Reverse shock index multiplied by Glasgow Coma Scale score as a point-of-care severity assessment for initial trauma management: a nationwide cohort study. Injury 2024;55:111267
22. Park JS, Choi SJ, Kim MJ, Choi SY, Kim HY, Park YS, et al. Cutoff of the reverse shock index multiplied by the Glasgow coma scale for predicting in-hospital mortality in adult patients with trauma: a retrospective cohort study. BMC Emerg Med 2024;24:55. [CrossRef]
23. Jung E, Ryu HH, Heo BG. The reverse shock index multiplied by Glasgow coma scale (rSIG) is predictive of mortality in trauma patients according to age. Brain Inj 2023;37:430–6. [CrossRef]
24. Chou R, Totten AM, Carney N, Dandy S, Fu R, Grusing S, et al. Predictive utility of the total Glasgow Coma Scale versus the motor component of the Glasgow Coma Scale for identification of patients with serious traumatic injuries. Ann Emerg Med 2017;70:143–57.e6. [CrossRef]
25. Özpek A, Canbak T. Non-operative management of civilian abdominal gunshot wounds. Ulus Travma Acil Cerrahi Derg 2020;26:227–34. [CrossRef]
26. Karateke F, Özdoğan M, Özyazıcı S, Daş K, Menekşe E, Gülnerman YC, et al. The management of penetrating abdominal trauma by diagnostic laparoscopy: a prospective non-randomized study. Ulus Travma Acil Cerrahi Derg 2013;19:53–7. [CrossRef]
27. Lin PC, Wu MY, Chien DS, Chung JY, Liu CY, Tzeng IS, et al. Use of reverse shock index multiplied by simplified motor score in a five-level triage system: identifying trauma in adult patients at a high risk of mortality. Med Kaunas Lith 2024;60:647. [CrossRef]
28. 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. J Trauma Acute Care Surg 2022;93:e49–60. [CrossRef]

ORİJİNAL ÇALIŞMA - *ÖZ*

Acil serviste abdominal travmalı hastalarda klinik sonuçların bir göstergesi olarak basitleştirilmiş motor skor ile çarpılmış ters şok indeksi: Retrospektif bir kohort çalışması

AMAÇ: Bu çalışmada, abdominal travmalı hastalarda klinik sonuçların bir öngörücüsü olarak ters şok indeksi (rSI) ile basitleştirilmiş motor skor (sMS) çarpımının (rSIsMS) tanısal değerinin belirlenmesi amaçlanmıştır.

GEREÇ VE YÖNTEM: Çalışmaya, 2023-2024 yılları arasında üçüncü basamak bir hastanenin acil servisine karın travması nedeniyle başvuran hastalar alındı. Hastaların verileri kullanılarak kısaltılmış yaralanma skalası (AIS), yaralanma şiddet skoru (ISS), revize edilmiş travma skoru (RTS) ve travmaya bağlı yaralanma şiddet skoru (TRISS) hesaplandı. Ayrıca, rSIsMS ile ters şok indeksi ve Glasgow koma skalası (GKS) çarpımı olan rSIG hesaplandı.

BULGULAR: Çalışmaya toplam 270 hasta alındı. Mortalite sonlanımı açısından TRISS, rSIsMS ve rSIG'in tanısal değerlilikleri incelendi; sırasıyla AUC değerleri 0.928; 0.908 ve 0.886 olarak bulundu. Yoğun bakım ünitesi (YBÜ) ihtiyacı için TRISS ve rSIsMS'in AUC değerleri sırasıyla 0.844 ve 0.852 olarak hesaplandı. Cerrahi müdahale ihtiyacı açısından TRISS ve rSIsMS'in AUC değerleri sırasıyla 0.774 ve 0.881 olup, bu sonlanımda rSIsMS'nin tanısal değerliliği TRISS'ten anlamlı düzeyde yüksekti ($p<0.001$; DeLong testi). Masif kan transfüzyonu (MKT) gereksinimi açısından TRISS ve rSIsMS'in AUC değerleri sırasıyla 0.799 ve 0.930 olarak bulundu. Bu sonlanım için de rSIsMS'nin tanısal değerliliği TRISS'ten anlamlı olarak yüksekti ($p<0.001$; DeLong testi).

SONUÇ: rSIsMS, abdominal travmalı hastalarda masif kan transfüzyonu ve cerrahi müdahale ihtiyaçlarını öngörmede diğer travma skorlarına göre üstündür ve mortalite ile YBÜ ihtiyaçlarını öngörmede benzer performans göstermektedir. Kolay hesaplanabilir olması ve yatak başında hızlıca elde edilebilmesi, rSIsMS'nin acil servisteki klinik kullanım değerini artırabilir.

Anahtar sözcükler: Abdominal yaralanmalar; yaralanmalar; mortalite; travmatik şok.

Ulus Travma Acil Cerrahi Derg 2025;31(4):332-340 DOI: 10.14744/tjtes.2025.23798