Comparison of Emergency Trauma Score (EMTRAS) with Rapid Emergency Medicine Score (REMS) for Prediction of Early Mortality in Adult Trauma Patients

Gautam Kumar¹, Ranvinder Kaur², Rupesh Yadav¹*, Nisha Kachru¹

¹Department of Anesthesiology, Atal Bihari Vajpayee Institute of Medical Sciences and Dr RML Hospital, New Delhi, India
²Department of Critical Care Medicine, Atal Bihari Vajpayee Institute of Medical Sciences and Dr RML Hospital, New Delhi, India

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ABSTRACT

Background: Trauma is an injury to living tissue from an external source. The severity of traumatic injuries plays a crucial role in the determination of mortality in patients with trauma, thus a proper understanding of the severity of trauma is very important for improving trauma care. Several scoring systems are available for the objective, initial assessment of the severity of injury to help treatment strategy. Aim of the study was to compare Emergency Trauma Score (EMTRAS) with Rapid Emergency Medicine Score (REMS) for prediction of early mortality in adult trauma patients.

Methods: Study was conducted with 100 patients of either sex, age 18 years or above with history of trauma due to road accident, fall and assault. REMS and EMTRAS score was calculated from the laboratory and patient characteristics mentioned in the Trauma scoring datasheet, within 30 minutes of arrival of the patient in the hospital and 24 hours after hospitalization.

Results: Comparison of the REMS score within 30 mins of patient arrival and at 24 hrs was statistically significant (p=0.0099). Comparison of EMTRAS SCORE Within 30 mins of patient arrival and at 24 hrs was not statistically significant (p=0.0505). Comparison of REMS vs Outcome at 24 hrs (Non-Survivors and Survivors) was statistically significant (p<0.0001). Comparison of EMTRAS vs Outcome at 24 hrs (Non-Survivors and Survivors) was statistically significant (p<0.0001). Comparison of AUROC (Area Under the Receiver Operating Characteristics) of REMS and EMTRAS were 0.689 and 0.789 respectively, which was statistically significant.

Conclusion: We conclude that both REMS and EMTRAS are easy, accurate predictors of in-hospital early mortality in Adult Trauma Patients. But in our study, EMTRAS AUROC was greater than AUROC of REMS. Hence EMTRAS should have good prognostic power for predicting in-hospital early mortality in Adults Trauma patients.

Trauma is an injury to living tissue from an external origin. Despite improvements in trauma systems and the consequent reduction in preventable deaths, trauma and unintentional injury are the major cause of death which results in a major cost burden for the health system in the world [1]. Current literature supports that early diagnosis and proper treatment both enhance outcomes and economical. Hence, during the first hour of trauma management, assessment, resuscitation, and definitive care are play crucial role [2]. The severity of traumatic injuries plays a crucial role in the determination of mortality in patients with trauma, thus a proper understanding of the severity of trauma is very important for improving trauma care. Several

The authors declare no conflicts of interest.
*Corresponding author.
E-mail address: drrupesh.yadav98@gmail.com

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scoring systems are available for the objective, initial assessment of the severity of injury to help treatment strategy. Scoring systems are based on Anatomical description of injuries, physiological parameters and combined data. The ideal trauma scoring system should provide quick accurate, authentic and reproducible details of injuries and it should predict mortality and morbidity outcomes in any setting [3].

The Injury Severity Score (ISS), formulated in 1971 is anatomical scoring system use for patients with multiple injuries. It is calculated by using the Abbreviated Injury Scale (AIS) grades. These scores correlate with length of hospital stay, morbidity, and mortality [4]. A complete evaluation of patient’s injuries may take significant time following admission to the emergency room. This limits its usefulness in initial injury assessment [3,5-6].

The Revised Trauma Score (RTS), formulated in 1989 is physiological scoring systems in use which can be applied early in treatment, even in the prehospital phase. Although RTS Correlates with trauma mortality, its calculation is complex [7-8].

The Acute Physiology and Chronic Health Evaluation (APACHE) II, formulated in 1985, is a scale that assesses illness severity among critical care patients, nonsurgical, and surgical. The score has 12 variables such as body temperature, respiratory rate (RR), heart rate, mean arterial pressure (MAP), oxygenation of arterial blood, arterial pH, serum sodium and potassium levels, white cell count, haematocrit, serum creatinine, and Glasgow Coma Scale (GCS) [9]. However, its base on laboratory tests, such as blood chemistry analysis, the use of APACHE II remains not useful for the rapid assessment of injury severity required in the emergency department [8,10].

Emergency Trauma Score (EMTRAS) has been developed by Raum et al [3] for early estimation of mortality risk in adult trauma patients. The score is calculated using 4 variables – Age (yrs.), GCS, Base Excess (BE) [mmol/l], prothrombin time (PT) [%]. For each predictor, a sub-score of 0,1,2,3 points is assigned, based on the actual value of predictor The EMTRAS uses parameters that are available within 30 minutes of a patient presenting to the Emergency Department (ED), without need a knowledge of anatomic injuries and accurately predicts mortality. The lowest (best) is 0 and highest (worst) is 12. The strength of this score is probably related to the fact that each component is independently strongly related to mortality in trauma patients [3,11].

Rapid Emergency Medicine Score (REMS) is a simple version of APACHE II. REMS is a composite score consisting of the Glasgow coma scale (GCS), Respiratory Rate (RR), Oxygen Saturation, Mean Arterial Pressure (MAP), Heart Rate (HR) and Age. REMS was found to be a powerful predictor of in-hospital mortality for the trauma population. Age is assigned a value from 0 to 6 and remaining five variables assigned values from 0 to 4. The maximum value is 26; higher scores are associated with worse prognosis. In the trauma population, REMS appears to be a quick and reliable predictor of in-hospital mortality.

A study by HO Park et al [12] in compared the Emergency Trauma Score with Rapid Emergency Medicine Score in patients with trauma. Which showed that Emergency Trauma Score and Rapid Emergency Medicine Score tools are quick, accurate, authentic predictors of in-hospital mortality in patients with trauma. However, this study had limitations in being a retrospective analysis and had patient selection bias. Hence, they plan to conduct a cross-sectional observational study to Compare Emergency Trauma Score with Rapid Emergency Medicine Score for prediction of early mortality in adult trauma patients.

There is no single accepted standard scoring system for evaluating trauma severity. There has been only one study in 2017, comparing the EMTRAS and REMS for prediction of mortality among trauma population. Limited data is available. So, we planned a study to compare Emergency Trauma Score (EMTRAS) and Rapid Emergency Medicine Score (REMS) for prediction of early mortality in Adults trauma patients.

We hypothesise that rapid Emergency Medicine Score (REMS) is as accurate as Emergency Trauma Score (EMTRAS) in prediction of early mortality in emergency trauma patient. Aim of the study was to compare Emergency Trauma Score (EMTRAS) with Rapid Emergency Medicine Score (REMS) for prediction of early mortality in adult trauma patients.

**Methods**

This prospective cross-sectional observational study was conducted after approval from institutional ethics committee (IEC/2018/PGIMER/RMLH-1850) between 1st November 2018 to 31st March, 2020. Inclusion criteria were patients of either sex, age between 18 years or above with history of trauma due to road accident, fall and assault. Patients died on arrival, minor superficial soft tissue injuries, requiring hospitalization less than 24 hours and patients transfer from another hospital were excluded from the study.

Sample size was calculated based on a previous study by Hyun Oh Park, et al [11] The study observed AUC of Emergency Trauma Score for predicting mortality was 0.957 and AUC of Rapid Emergency Medicine Score was 0.9. Taking this value as reference, δ as 0.045, and 5% level of significance, calculated sample size is 95 patients. So the total sample size taken is 100. The formula used is:

\[
\frac{1 - AUC}{2} \left( \frac{Z_{0.025}}{\delta} \right)^2
\]
Where Zα is the value of Z at the two-sided alpha error of 5% and δ is 0.045. Calculations 1. \( N = \frac{(1 - 0.957)^2}{(1.96/0.045)^2} = 40.79 = 41 \) (approx.) 2. \( N = \frac{(1 - 0.9)^2}{(1.96/0.045)^2} = 94.85 = 95 \) (approx.)

A written informed consent taken from all patients or their relatives. REMS and EMTRAS score was calculated from the laboratory and patient characteristics mentioned in the Trauma scoring datasheet, within 30 minutes of arrival of the patient in the hospital and 24 hours after hospitalization. The Glasgow Coma Score was used to evaluate the neurological status of patients.

The outcome based on the score used within 30 minutes of the arrival of the patient in the hospital and 24 hours after hospitalization would be calculated and correlated with the actual outcome, as survivors or non-survivors.

The REMS and EMTRAS for each patient were calculated using the following tables:

### Table 1 - EMTRAS Scoring System

| Variable         | Category | Score |
|------------------|----------|-------|
| Age (years)      | <40      | 0     |
|                  | 41-60    | 1     |
|                  | 61-75    | 2     |
|                  | >75      | 3     |
| Glasgow Coma Scale (GCS) | 13-15    | 0     |
|                  | 10-12    | 1     |
|                  | 6-9      | 2     |
|                  | 3-5      | 3     |
| Base Excess (mile/L) | >-1      | 0     |
|                  | -1 to -5 | 1     |
|                  | -5.1 to -10 | 2 |
|                  | < -10    | 3     |
| Prothrombin      | >80      | 0     |
| Time (%)         | 50-80    | 1     |
|                  | 20-49    | 2     |
|                  | <20      | 3     |

Calculating the REMS requires the patient's Respiratory Rate, Heart Rate, Mean Arterial Pressure, Glasgow Coma Scale, age, and oxygen saturation; age is assigned a value from 0 to 6, and the remaining 5 variables are each assigned values from 0 to 6. The maximum REMS value is 26; higher scores are associated with a worse prognosis. The final score is a simple arithmetic sum of the integer sub scores.

The EMTRAS is calculated using 4 variables: age, Glasgow Coma Scale, Base Excess, and Prothrombin Time. These 4 factors are weighted equally to arrive at a final score. The final score is a simple arithmetic sum of the integer sub scores and ranges from 0 to 12.

In statistical analysis Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. The normality of data was tested by the Kolmogorov-Smirnov test. If the normality is rejected, then a non-parametric test was used. Qualitative variables were compared using the Chi-Square test /Fisher’s exact test. Receiver operating characteristic curve was used to find out area under the curve of Emergency Trauma Score (EMTRAS) and Rapid Emergency Medicine Score (REMS) for predicting mortality and comparison of AUC was performed to find out whether one is significantly better predictor than the other. Univariate and multivariate logistic regression will be performed to assess the significant risk factors of mortality. A p-value of <0.05 was considered statistically significant. The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS).

### Results

In our study, 37(37.0%) patients were female and 63(63.0%) patients were male. In our study, 13(13.0%) patients were ≤20 years old, 30(30.0%) patients were 21-30 years old, 19(19.0%) patients were 31-40 years old, 17(17.0%) patients were 41-50 years old, 11(11.0%) patients were 51-60 years old, 7(7.0%) patients were 61-
70 years old and 3(3.0%) patient was >70 years old. In our study, 6(6.0%) patients were Non-survivors and 94(94.0%) patients were Survivors.

Our study showed that, Comparison of Age REMS within 30 min of patient arrival and at 24 hrs was not statistically significant (p=0.9969). Comparison of Heart rate, Respiratory rate, MAP REMS within 30 min of patient arrival and at 24 hrs was statistically significant (p<0.0001). Comparison of ‘oxygen saturation’ REMS within 30 minutes of patient arrival and at 24 hrs was not statistically significant (p= 0.3485). Comparison of ‘GCS’ REMS within 30 minutes of patient arrival and at 24 hrs was statistically significant (p= 0.0044).

Comparison of Age EMTRAS within 30 minutes of patient arrival and at 24 hrs was not statistically significant (p= 0.9587). Comparison of GCS EMTRAS within 30mins of patient arrival and at 24 hrs was statistically significant (p= 0.0033). Comparison of base excess EMTRAS within 30mins of patient arrival and at 24 hrs was statistically significant (p= 0.0462). Comparison of base Prothrombin time EMTRAS within 30mins of patient arrival at 24 hrs was statistically significant (p= 0.0283).

Comparison of the REMS score within 30mins of patient arrival and at 24 hrs was statistically significant (p=0.0099) (Figure 1). Comparison of EMTRAS SCORE Within 30mins of patient arrival and at 24 hrs was not statistically significant (p=0.0505) (Figure 2).

Comparison of ‘Heart rate’ REMS vs Outcome at 24hrs was statistically significant (p=0.0032). Comparison of ‘Respiratory rate’, ‘MAP’, ‘oxygen saturation’, ‘GCS’ REMS vs Outcome at 24 hrs was statistically significant (p=0.0071) (Table 3).

Comparison of ‘Age’ EMTRAS vs Outcome at 24 hrs was statistically significant (p=0.0480). Comparison of ‘GCS’, ‘base excess’, ‘Prothrombin time’ EMTRAS vs Outcome at 24 hrs was statistically significant (p=0.0001).

Comparison of REMS vs Outcome at 24 hrs (Non-Survivors and Survivors) was statistically significant (p=0.0001) (Figure 3). Comparison of EMTRAS vs Outcome at 24 hrs (Non-Survivors and Survivors) was statistically significant (p=0.0001) (Figure 4).

Figure 1- Comparison of REMS within 30 min of Patient Arrival and at 24 hrs

Figure 2- Comparison of EMTRAS within 30 min of Patient Arrival and at 24 hrs

Figure 3- Comparison of REMS: Outcome at 24 hrs (Non-Survivors Vs Survivors)

Figure 4- Comparison of EMTRAS: Outcome at 24 hrs (Non-Survivors Vs Survivors)

Difference of mean ’Age’, ‘Oxygen Saturation’ REMS within 30 min of patient arrival and at 24 hrs was not statistically significant. Difference of mean ‘Heart rate’, ‘Respiratory rate’ ‘MAP’ REMS within 30 min of patient arrival and at 24 hrs was statistically significant (p=0.0001). Difference of mean ‘GCS’ REMS within 30 min of patient arrival and at 24 hrs was statistically significant (p=0.0071) (Table 3).

Difference of mean ‘Age’ EMTRAS within 30 min of patient arrival and at 24 hrs was not statistically significant (p=0.7542). Difference of mean ‘GCS’ EMTRAS within 30 min of patient arrival and at 24 hrs was statistically significant (p=0.0110). Difference of mean ‘base excess’ (mmol/L) EMTRAS within 30 min of patient arrival and at 24 hrs was not statistically significant (p=0.0916). Difference of mean
‘Prothrombin’ time (%) EMTRAS within 30 min of patient arrival and at 24 hrs was statistically significant (p=0.0284).

Difference of mean REMS within 30 min of patient arrival and at 24 hrs was statistically significant (p<0.0001). Difference of mean EMTRAS within 30 min of patient arrival and at 24 hrs was statistically significant (p=0.0185) (Table 4).

Difference of mean ‘Age’ REMS within 30 min of patient arrival and at 24 hrs was not statistically significant (p=0.1736). Difference of mean ‘Heart rate’ REMS within 30 min of patient arrival and at 24 hrs was statistically significant (p<0.0001), Difference of mean EMTRAS within 30 min of patient arrival and at 24 hrs was statistically significant (p=<0.0001).

Comparison of AUROC of REMS and EMTRAS were 0.689 and 0.789 respectively, which was statistically significant (Table 7, Figure 5-6).

Table 3 - Distribution of Mean ‘Age’ REMS, ‘Heart rate’ REMS, ‘Respiratory Rate’ REMS, ‘MAP’ REMS, ‘Oxygen Saturation’ REMS, ‘GCS’ REMS Within 30min and at 24 hrs

|                  | Number | Mean   | SD     | P value |
|------------------|--------|--------|--------|---------|
| ‘Age’ REMS       | Within 30 min | 100 | 0.9700 | 1.5983 | 0.8070 |
|                  | At 24 hrs | 94  | 0.9149 | 1.5357 |         |
| ‘Heart Rate’ REMS| Within 30 min | 100 | 0.6000 | 0.9211 | <0.0001|
|                  | At 24 hrs | 94  | 0.1064 | 0.4512 |         |
| ‘Respiratory Rate’REMS | Within 30 min | 100 | 0.2000 | 0.4020 |         |
|                  | At 24 hrs | 94  | 0.0213 | 0.1451 |         |
| ‘MAP’ REMS       | Within 30 min | 100 | 0.7300 | 1.0235 | <0.0001|
|                  | At 24 hrs | 94  | 0.0000 | 0.0000 |         |
| ‘Oxygen Saturation’REMS | Within 30 min | 100 | 0.1800 | 0.5752 | 0.0721 |
|                  | At 24 hrs | 94  | 0.0638 | 0.2458 |         |
| ‘GCS’ REMS       | Within 30 min | 100 | 0.4600 | 0.8810 | 0.0071 |
|                  | At 24 hrs | 94  | 0.1596 | 0.6274 |         |

Table 4 - Distribution of mean ‘Age’ EMTRAS, ‘GCS’ EMTRAS, ‘Base Excess’ (mmol/L) EMTRAS, ‘Prothrombin’ Time (%) EMTRAS, REMS, EMTRAS

|                  | Number | Mean   | SD     | P value |
|------------------|--------|--------|--------|---------|
| ‘Age’ EMTRAS     | Within 30 min | 100 | 0.5000 | 0.7317 | 0.7542 |
|                  | At 24 hrs | 94  | 0.4681 | 0.6832 |         |
| ‘GCS’ EMTRAS     | Within 30 min | 100 | 0.3400 | 0.6849 |         |
|                  | At 24 hrs | 94  | 0.1170 | 0.5050 |         |
| ‘Base Excess’ (mmol/L) EMTRAS | Within 30 min | 100 | 0.6700 | 0.6675 | 0.0916 |
|                  | At 24 hrs | 94  | 0.5213 | 0.5434 |         |
| ‘Prothrombin’ Time (%) EMTRAS | Within 30 min | 100 | 0.1800 | 0.3861 | 0.0284 |
|                  | At 24 hrs | 94  | 0.0745 | 0.2639 |         |
| ‘REMS’           | Within 30 min | 100 | 3.1400 | 3.1302 | <0.0001|
|                  | At 24 hrs | 94  | 1.2872 | 1.9211 |         |
| ‘EMTRAS’         | Within 30 min | 100 | 1.7000 | 1.7552 | 0.0185 |
|                  | At 24 hrs | 94  | 1.1702 | 1.3004 |         |

Table 5 - Distribution of Mean ‘Age’ REMS, ‘Heart Rate’ REMS, ‘Respiratory Rate’ REMS, ‘MAP’ REMS, ‘Oxygen Saturation’ REMS, ‘GCS’ REMS among Non-survivors and Survivors

|                  | Number | Mean   | SD     | P value |
|------------------|--------|--------|--------|---------|
| ‘Age’ REMS       | Non-survivors | 6    | 1.8333 | 2.4014 | 0.1736 |
|                  | Survivors  | 94  | 0.9149 | 1.5357 |         |
| ‘Heart rate’ REMS| Non-survivors | 6    | 1.6667 | 0.8165 | 0.0030 |
|                  | Survivors  | 94  | 0.5319 | 0.8884 |         |
| ‘Respiratory rate’REMS | Non-survivors | 6    | 1.0000 | 0.0000 | <0.0001|
|                  | Survivors  | 94  | 0.1489 | 0.3579 |         |
| ‘MAP’ REMS       | Non-survivors | 6    | 2.3333 | 0.8165 | <0.0001|

Difference of mean ‘Age’ EMTRAS within 30 min of patient arrival and at 24 hrs was not statistically significant (p=0.0843). Difference of mean ‘GCS’, ‘base excess’, ‘Prothrombin time’ EMTRAS within 30 min of patient arrival and at 24 hrs was statistically significant (p=<0.0001).
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Table 6- Distribution of Mean of ‘Age’ EMTRAS, ‘GCS’ EMTRAS, ‘Base Excess’ (mmol/L) EMTRAS, ‘Prothrombin Time (%)’ EMTRAS, REMS and EMTRAS among Non-survivors and Survivors

|                      | Number | Mean    | SD      | P value |
|----------------------|--------|---------|---------|---------|
| ‘Age’ EMTRAS         |        |         |         |         |
| Nonsurvivors         | 6      | 1.0000  | 1.2649  | 0.0843  |
| Survivors            | 94     | 0.4681  | 0.6832  |         |
| ‘GCS’ EMTRAS         |        |         |         |         |
| Nonsurvivors         | 6      | 1.6667  | 0.8165  | <0.0001 |
| Survivors            | 94     | 0.2553  | 0.5854  | <0.0001 |
| ‘Base Excess’ (mmol/L) EMTRAS | |         |         |         |
| Nonsurvivors         | 6      | 2.0000  | 0.0000  | <0.0001 |
| Survivors            | 94     | 0.5851  | 0.5940  | <0.0001 |
| ‘Prothrombin’ Time (%) EMTRAS | |         |         |         |
| Nonsurvivors         | 6      | 1.0000  | 0.0000  | <0.0001 |
| Survivors            | 94     | 0.1277  | 0.3355  | <0.0001 |
| REMS                 |        |         |         |         |
| Nonsurvivors         | 6      | 10.5000 | 3.5071  | <0.0001 |
| Survivors            | 94     | 2.6702  | 2.4600  |         |
| EMTRAS               |        |         |         |         |
| Nonsurvivors         | 6      | 5.6667  | 1.3663  | <0.0001 |
| Survivors            | 94     | 1.4468  | 1.4489  |         |

Table 7- ROC of REMS and EMTRAS

| Trauma Score | Area Under the Curve | Std. Error | Asymptotic Sig., b | Asymptotic 95% Confidence Interval | Confidence Interval |
|--------------|----------------------|------------|--------------------|------------------------------------|---------------------|
| REMS         | 0.689                | 0.088      | 0.155             | 0.517                              | 0.862               |
| EMTRAS       | 0.789                | 0.064      | 0.030             | 0.664                              | 0.915               |

*Under the nonparametric assumption, bNull hypothesis: true area = 0.5

Discussion

In our study, the indications for admission to the resuscitation room were age greater than 18yrs, RTA (37%), history of fall (53%), history of assault (10%). In contrast to our study, Park et al [12] reported age >15 years, RTA (>23.3%), history of fall (>19%) were the most common indication for admission to the resuscitation room.

We found that Mean age of patients with trauma admitted to the trauma resuscitation room was 41.039 ± 16.102 years. The mean age of trauma patients were admitted as reported by Raum et al4 was (40 ± 18 yrs), Imhoff et al [5] (36.5 ± 17.0 yrs), Park et al [12] (57.42 ± 18.51yrs), Joosse et al [11] (42.3 ± 19.2yrs). Hence, our patients were of similar age at the time of admission to the Trauma resuscitation room as compared to the above-mentioned studies.

In our study, male patients (63%) outnumbered female patients (37%). This finding are in correspondence with other studies conducted by Raum MR et al [3] (males 73.4%; females 26.6%), Imhoff et al [5] (males 62.5%, females 37.5%) and Park et al [12] (males 62.2%; females 31.8%) in which there was male preponderance.

Evaluation of REMS within 30 min of patient arrival vs at 24hours was statistically significant (p=0.0099). Imhoff et al [5] showed that REMS appears to be a
simple, accurate predictor of in-hospital mortality in the Trauma population.

Evaluation of EMTRAS within 30 min of patient arrival vs at 24 hours was not statistically significant (p=0.0505). Raum MR et al [3] found that in the EMTRAS the strongest predictors of mortality. Among 100 patients, 6 (6%) patients were nonsurvivors and 94 (94%) patients were survivors at first 24 hrs after hospitalization (6% mortality). This was comparable to what was observed by Imhoff et al [5] (5.2% mortality) and Park et al [11] (3.1% mortality). Evaluation of REMS score vs outcome at 24 hrs was statistically significant (p<0.0001). Seak CJ et al [13] found that REMS is superior in predicting the mortality of these patients compared to Rapid acute physiology score (RAPS) and Modified Early Warning Score (MEWS). They recommend that REMS be used for outcome prediction and risk stratification of adult patients presenting with Hepatic venous pressure gradient (HVPG) in the emergency department. Nakhjavan-Shahraaki B et al [14] found that REMS could be used for predicting mortality and poor outcome of trauma patients in emergency settings.

Evaluation of EMTRAS score vs outcome at 24 hrs was statistically significant (p<0.0001). In the present study survivors were younger (mean age 37.2447± 15.2673 yrs) as compared to non-survivors (mean age 44.8333 ± 29.7820 yrs). This finding was consistent with the reported by Imhoff et al [5] (mean age 36.5±17.0 yrs in survivors vs 43.7±21.0 yrs among nonsurvivors), Park et al [11] (mean age 57.17±18.52 yrs in survivors v/s 65.55±16.34 yrs among non survivors), and Raum et al [3] (mean age 40±18 yrs in survivors vs 50±22 yrs among non survivors).

In our study mean REMS showed 3.14 ± 3.13 and 1.2872 ± 1.9211 within 30 min of admission and at 24 hrs after hospitalization respectively, whereas among survivors the mean REMS showed 2.6702 ± 2.46 and among nonsurvivors the mean showed 10.5 ± 3.5071 at 24 hrs after hospitalization. The score was significantly less among survivors than nonsurvivors (p<0.0001). Therefore, according to our study higher REMS were associated with higher mortality in trauma patients. Similar to our study, Imhoff BF et al [5] found that the predictive ability of REMS was evaluated hospital mortality in trauma patients with mean s of 3.4 ± 3.2 in survivors and 11.8 in nonsurvivors (p<0.0001). Olsson et al [15] found that the REMS was a strong predictor of in-hospital mortality in patients seen in the Emergency Departments (ED) and their research showed that all six parameters were predictive of mortality with a mean of 5.5 ± 3.4 in survivors and 10.5 ± 4.9 in nonsurvivors (p<0.0001) but the association between mean arterial pressure and mortality was not significant on multivariate analysis.

Similar to our study Goodcare et al [16] study found that the REMS components correlated with mortality were Age, GCS, Oxygen saturation and MAP but HR and RR were associated with mortality on univariate analysis. Nolan B et al [17] found that the REMS has the necessary measurement properties to be both a predictive and evaluative clinical index to measure the prehospital severity of illness; however, no studies have adequately addressed the intra or inter reliability of the score. There is evidence to support the use of the REMS as a predictive or evaluative instrument. Ha DT et al [18] found that Both REMS and Worthing Physiological Scoring (WPS) system have good prognostic value in the prediction of death in ED patients. The WPS appeared to have a better prognostic performance than the REMS system.

In our study mean EMTRAS showed 1.7000 ± 1.7552 and 1.1702 ± 1.3004 within 30 min of admission and at 24 hrs after hospitalization respectively (p<0.0185), whereas among survivors the mean EMTRAS showed 1.4468 ± 1.4489 and among nonsurvivors, the mean showed 5.6667 ± 1.3663 at 24 hrs after hospitalization. This was significantly less among survivors than nonsurvivors (p<0.0001). Similar to our study, Raum et al [3] also found that EMTRAS accurately predicts mortality based on 4 parameters assessed early in the emergency room (p<0.0001). Joosse P et al [11] found that the Emergency Trauma model performs well in discriminating between trauma patients who will survive and who will not. If applied to all trauma patients, predicted mortality risks are too high in the low-risk category.

Similar to our study Raum et al [3] found that the strongest predictors of mortality were age, prehospital Glasgow Coma Scale, base excess (mmol/L), and prothrombin time (% of reference). EMTRAS combines four early parameters from the emergency room and accurately predicts mortality. Mangini M et al [19] found that the Predictive value of the EMTRAS was compared with the Injury Severity (ISS), Revised Trauma (RTS), Trauma Injury Severity (TRISS), and Simplified Acute Physiology (SAPS) II. In particular, patients with EMTRAS of 5, 6 and 7 had a more major risk of death (odds ratio) of 2.3, 4, and 16, respectively, than patients with EMTRAS below 5. Their preliminary results confirm that EMTRAS has a good correlation with mortality risk. Difference of mean REMS score within 30 min of patient arrival and at 24 hrs was statistically significant (p<0.0001). Difference of mean EMTRAS SCORE within 30 min of patient arrival and at 24 hrs was statistically significant (p<0.0001).

In our study area under the Receiver operating characteristics (ROC) curve for REMS was 0.689 ± 0.088 and EMTRAS was 0.789 ± 0.064. We found that the area under the ROC curve of the REMS was less than that
of the EMTRAS. The EMTRAS showed good prognostic power for predicting hospital mortality in severely injured patients. Similar to our study Raum et al [3] found that higher EMTRAS and REMS scores were associated with hospital mortality (P<.001). The ROC curve demonstrated adequate discrimination (AUC = 0.957 for EMTRAS and 0.9 for REMS). The EMTRAS and the REMS are simple, accurate predictors of in-hospital mortality in patients with trauma. Our study has certain limitations; first the sample size was small. The study has been done in a single center. The study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

**Conclusion**

We conclude that both REMS and EMTRAS are easy, accurate predictors of in-hospital early mortality in Adult Trauma Patients. But in our study, EMTRAS Area Under the Receiver Operating Characteristics (AUROC) was greater than AUROC of REMS. Hence EMTRAS should have good prognostic power for predicting in-hospital early mortality in Adults Trauma patients.

**References**

[1] Haddon W Jr. Advances in epidemiology of injuries as a basis for public policy. Public Health Resp. 1980; 95(5):411-21.
[2] World Health Organization. Injuries and violence: the facts. Geneva: World Health Organization; 2010.
[3] Raum MR, Nijsten MW, Vogelzang M, Schuring F, Lefering R, Bouillon B, et al. Emergency trauma score: an instrument for early estimation of trauma severity. Crit Care Med. 2009; 37(6):1972–7.
[4] Baker SP, O’Neill B, Haddon W Jr, Long WB. The injury severity score: a method for describing patients with multiple injuries and evaluating emergency care. J Trauma. 1974; 14(3):187-96.
[5] Imhoff BF, Thompson NJ, Hastings MA, Nazir N, Moncure M, Cannon CM. Rapid emergency medicine score (REMS)in the trauma population: a retrospective study. BMJ Open. 2014; 4:e004738.
[6] Solanki SL, Bharti N, Batra YK, Jain A, Kumar P, Nikhar SA. The analgesic effect of intrathecal dexmedetomidine or clonidine, with bupivacaine, in trauma patients undergoing lower limb surgery: a randomised, double-blind study. Anaesth Intensive Care. 2013; 41(1):51-6.
[7] Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the trauma score. J Trauma. 1989; 29:623–9.
[8] Olsson T, Terent A, Lind L. Rapid Emergency Medicine score: a new prognostic tool for in-hospital mortality in nonsurgical emergency department patients. J Intern Med. 2004; 255:579–87.
[9] Bahtouee M, Eghbali SS, Maleki N, Rastgou V, Motamed N. Use of the APACHE II Score for the Assessment of Outcome and Mortality Prediction in an Iranian Medical-Surgical Intensive Care Unit. Arch Anesth & Crit Care. 2018; 4(4):521-526
[10] Lee SH, Park JM, Park JS, Kim KH, Shin DW, Jeon WC, et al. Utility of the Rapid Emergency Medicine Score (REMS) for predicting hospital mortality in severely injured patients. J Korean SocEmerg Med 2016; 27:199–205.
[11] Joosse P, de Jong WJ, Reitsma JB, Wendt KW, Schep NW, Goslings JC. External validation of the Emergency Trauma Score for early prediction of mortality in trauma patients. Crit Care Med. 2014; 42:83–9.
[12] Park HO, Kim JW, Kim SH, Moon SH, Byun JH, Kim KN, et al. Usability verification of the Emergency Trauma Score (EMTRAS) and Rapid Emergency Medicine Score (REMS) in patients with trauma: A retrospective cohort study. Medicine(Baltimore).2017; 96:44(e8449).
[13] Seak CJ, Yen DH, Ng CJ, Wong YC, Hsu KH, Seak JC, et al. Rapid Emergency Medicine Score: A novel prognostic tool for predicting the outcomes of adult patients with hepatic portal venous gas in the emergency department. Plos one. 2017; 12(9):e0184813.
[14] Nakhjavan-Shahrazi B, Baikpour M, Yousefi Fard M, Nikseresht ZS, Abiri S, Razaz JM, et al. Rapid acute physiology score versus rapid emergency medicine score in Trauma Outcome Prediction; a comparative study. Emerg (Tehran). 2017;5(1):e30.
[15] Olsson T, Terent A, Lind L. Rapid Emergency Medicine Score can predict long-term mortality in non-surgical emergency department patients. Acad Emerg Med 2004; 11:1008–13
[16] Goodcare S, Turner J, Nicholl J. Prediction of mortality among emergency medical admissions. J Emerg Med. 2006; 23:372–5
[17] Nolan B, Tien H, Haas B, Saskin R, Nathens A. The Rapid Emergency Medicine Score: A Critical Appraisal of Its Measurement Properties and Applicability to the Air Retrieval Environment. Air Med J. 2019; 38(3):154-60.
[18] Ha DT, Dang TQ, Tran NV, Vo NY, Nguyen ND, Nguyen TV. Prognostic performance of the Rapid Emergency Medicine Score (REMS) and Worthing Physiological Scoring system (WPS) in the emergency department. Int J Emerg Med. 2015; 8(1):18.
[19] Mangini M, Di Valvasone S, Greco C, Ognibene A, Cappuccini G, Spina R, Tartaglia R, Zagli G, Peris A. Validation of the new proposed Emergency Trauma Score (EMTRAS). Crit Care. 2010;14(1):1-2.