Original Research Paper

Emergency Medicine

DIAGNOSTIC ACCURACY OF RAPID EMERGENCY MEDICINE SCORE (REMS) AS A PROGNOSTIC MARKER AND ITS COMPARISON WITH TRADITIONAL SCORING SYSTEMS IN TRAUMA

Dr.Thiruvanath Varriam Kunjulakshmy	Junior Resident -3
Dr. Sreekala Radhakrishnan*	Senior Resident *Corresponding Author
Dr. Sibgathullah G.K	Junior Resident -3
Dr D.B Bhusare	HOD Department of emergency medicine, MGM medical College Navi mumbai

ABSTRACT A Hospital-based screening test study was conducted at the Department of Emergency Medicine at Mahatma Gandhi Mission Medical College and Hospital, Kamothe, Navi Mumbai. The study aimed to compare the diagnostic accuracy of Rapid Emergency Medicine Score (REMS) with that of other traditional scoring systems like Injury Severity Score (ISS) and Revised Trauma Score (RTS). We also aimed to correlate in association with raised lactate values to predict in-hospital mortality in trauma patients as compared to REMS alone. The study included 100 consecutive trauma patients coming to our emergency department, fulfilling the eligibility criteria. Following observations were made during the study, Mean age of the study cases was 38.98 years with over half of them being between 21 to 40 years of age. Out of the 100 cases, 87% were males and 13% were females. Nature of trauma was a road traffic accident in the majority of the cases (63%). Other causes were falling (26%), assault (10%), and workplace injury (1%). Loss of consciousness was seen in 34% of cases while vomiting and seizures were seen in 21% and 6% cases respectively. Compromised airway was noted in 42% cases while the hypotensive and hypertensive state was observed in 68% and 3% cases respectively.Mortality rate in the present study was 11%.On ROC analysis, all the scores including REMS, ISS, and RTS were observed to be significant predictors of mortality among trauma cases.

KEYWORDS :

INTRODUCTION

Trauma and unintentional injury are the leading causes of death for all individuals less than 44 years of age which as a consequence lead to a huge monetary burden for the healthcare system [1] . Current literature recommends early diagnosis and appropriate treatment to improve outcomes in a cost-effective manner. Over the past decade, to assess injury severity and provide an objective measure for treatment and appropriate allocation of healthcare resources, many scoring systems have been employed. Commonly used scoring systems are APACHE II, Glasgow Coma Scale (GCS), Injury Severity Score (ISS), Abbreviated Injury Scale (AIS), and Revised Trauma Score (RTS). Every scale has its own pros and cons. The Acute Physiology and Chronic Health Evaluation (APACHE II) is a validated scale that assesses the severity of illness among non-surgical, surgical, and intensive care hospital patients [2]. The score comprises variables like serum sodium and potassium levels, serum creatinine, haematocrit, white cell count, body temperature, respiratory rate (RR), heart rate, mean arterial pressure (MAP), oxygenation of arterial blood, arterial pH and Glasgow Coma Scale (GCS) [3]. APACHE II scoring remains impractical for rapid injury severity assessment required in the emergency department (ED) or in the field due to its reliance on laboratory tests such as blood chemistry analysis. An attenuated version of APACHE II, the Rapid Emergency Medicine Score (REMS), allows for prompt calculation [2,4]. REMS is a composite score comprising of the GCS, HR, RR, oxygen saturation, MAP and age [5] . 2 The primary use of REMS was to predict the mortality rate among nonsurgical patients (the patients who were not candidates for surgical management) admitted to the ED. It has six parameters, as mentioned earlier, and a score ranging 0–26. The patients are divided into three major groups based on REMS: high (REMS > 13), medium (6 < REMS < 13), and low (REMS < 6) mortality risk. For each point

in which REMS is greater than 13, the patient's mortality rate increases by 7.8 up to 17.1% [2,6] . While there has been a substantial amount of publications that supported the acceptable predictive validity for this score among medical patients, the practicality of REMS in the trauma population has yet to be scrutinized. The core intent of this study was to inspect REMS as a risk stratification tool in traumatically injured patients and to predict in-hospital mortality. Secondary objectives included comparing REMS to the Revised Trauma Score (RTS) and the Injury Severity Score (ISS) to determine which scoring system was a superior predictor of mortality. In addition, we also aimed to examine the impact of the addition of raised serum lactate levels to REMS in predicting in-hospital mortality in trauma patients as compared to REMS alone.

MATERIAL AND METHODS

This study was conducted in the department of emergency medicine, MGM Medical College and Hospital, Navi Mumbai.

Prior approval of Institutional Ethics Committee was taken before start of the study.

A written signed informed consent was taken from the patients prior to enrolling the subjects in the study.

Ethical clearance was obtained from Ethical Clearance Committee of the institution for the study.

Duration Of Study
November 2019 to November 2021

Study Population
Patients with a history of trauma who have been triaged as red and yellow come to our hospital.

Inclusion Criteria
1. Patients giving informed consent
2. Age above 18
3. All patients with a history of trauma who have been triaged as red and yellow

Exclusion Criteria
1. Age below 18
2. Pregnant patients
3. Patients who have received previous medical care from outside the hospital.
4. Patients who have been triaged as green.
5. Patients who were dead on arrival or died < 24 hours.

Sample Size
The study included 100 consecutive trauma patients coming to our emergency department, fulfilling the eligibility criteria.

Stastical Analysis
All the data was recorded in a pre-designed study proforma. Qualitative data was represented in the form of frequency and percentage while Quantitative data was represented using Mean ± SD. The efficacy of screening tests was calculated using the ROC curve and using standard formulae for computing sensitivity and specificity. A p value < 0.05 was assigned as a level of significance. Results were graphically represented where deemed necessary. SPSS Version 21.0 was used for most analyses and Microsoft Excel 2010 for graphical representation..

RESULTS

Table 1. Diagnostic accuracy of REMS for prediction of mortality in trauma cases

REMS	Mortality		Total
	No	Yes	
</=7	73	1	74
> 7	16	10	26
Total	89	11	100

Parameters	%
Sensitivity	90.9%
Specificity	82.0%
PPV	38.5%
NPV	98.6%
Accuracy	83.0%

Sensitivity and specificity of REMS for prediction of mortality was 90.9% and 82% with overall accuracy of 83%.

Table 2. Diagnostic accuracy of lactate for prediction of mortality in trauma cases

Lactate levels (mmol/ L)	Mortality		Total
	No	Yes	
</=3.5	60	4	64
> 3.5	29	7	36
Total	89	11	100

Parameters	%
Sensitivity	63.6%
Specificity	67.4%
PPV	19.4%
NPV	93.8%
Accuracy	67.0%

Sensitivity and specificity of lactate for prediction of mortality was 63.6% and 67.4% with overall accuracy of 67%.

Table 3. Diagnostic accuracy of Injury Severity Score for prediction of mortality in trauma cases

ISS	Mortality		Total
	No	Yes	
</= 36	71	3	74
> 36	18	8	26
Total	89	11	100

Parameters	%
Sensitivity	72.7%
Specificity	79.8%
PPV	30.8%
NPV	95.9%
Accuracy	79.0%

Sensitivity and specificity of ISS for prediction of mortality was 72.7% and 79.8% with overall accuracy of 79%.

Table 4. Diagnostic accuracy of Revised Trauma Score for prediction of mortality in trauma cases

RTS	Mortality		Total
	No	Yes	
>/= 5.5	68	1	69
< 5.5	21	10	31
Total	89	11	100

Parameters	%
Sensitivity	90.9%
Specificity	76.4%
PPV	32.3%
NPV	98.6%
Accuracy	78.0%

Sensitivity and specificity of RTS for prediction of mortality was 90.9% and 76.4% with overall accuracy of 78%

Table 5. Diagnostic accuracy of combined REM score and lactate levels for prediction of mortality in trauma cases

| REMS + lactate	Mortality		Total
	No	Yes	
Low Risk	80	2	82
High Risk	9	9	18
Total	89	11	100

Parameters	%
Sensitivity	81.8%
Specificity	89.9%
PPV	50.0%
NPV	97.6%
Accuracy	89.0%

Sensitivity and specificity of combined REMS and lactate levels for prediction of mortality was 81.8% and 89.9% with overall accuracy of 89%. Graph 13: Combined REMS & Lactate level 0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0% 70.0% 80.0% 90.0% 100.0% SENSITIVITY SPECIFICITY PPV NPV ACCURACY 81.8% 89.9

Table 6. Comparison of diagnostic accuracy of various scores.

Parameters	REMS	Lactate	ISS	RTS	REMS + Lactate
Sensitivity	90.9%	63.6%	72.7%	90.9%	81.8%
Specificity	82.0%	67.4%	79.8%	76.4%	89.9%
PPV	38.5%	19.4%	30.8%	32.3%	50.0%
NPV	98.6%	93.8%	95.9%	98.6%	97.6%
Accuracy	83.0%	67.0%	79.0%	78.0%	89.0%

Among individual score, overall efficacy was best for REMS (83%) followed by ISS (79%) and RTS (78%). On adding lactate levels to REMS, the overall accuracy for prediction of mortality increased from 83% to 89%.

Accuracy of Various Scores
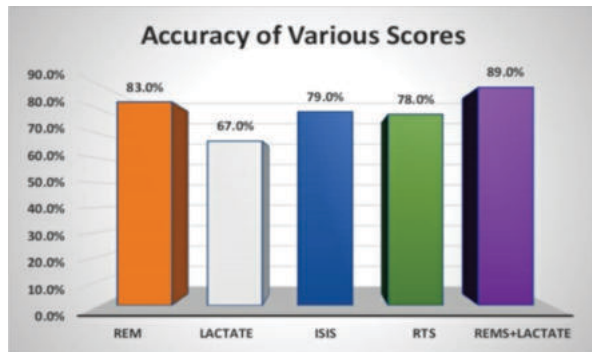
DISCUSSION
Trauma and unintentional injuries are the leading cause of death in people under 45 years of age. Also, trauma causes severe complications, disability, financial and social costs [1] . Risk stratification scores have been developed over the past decade to assess injury severity and provide an objective measure for treatment and appropriate allocation of healthcare resources. An ideal risk adjustment score for emergency care would provide a precise prediction of a clinically significant outcome such as mortality by using a fixed number of variables that are acquired during the presentation itself. Commonly used scoring systems are APACHE II, Glasgow Coma Scale (GCS), Injury Severity Score (ISS), Abbreviated Injury Scale (AIS), and Revised Trauma Score (RTS). There are advantages and limitations for each of the scales. An attenuated version of APACHE II, the Rapid Emergency Medicine Score (REMS), can be instantly evaluated [2,4]. REMS is a composite score consisting of the GCS, HR, RR, oxygen saturation, MAP, body temperature, and age [5]. The utility of REMS in the trauma population has yet to be analyzed and all the exhaustive publications available are about the sound predictive validity of the score among nonsurgical cases. In the present study, we aimed to compare the diagnostic accuracy of Rapid Emergency Medicine Score (REMS) with that of other traditional scoring systems like Injury Severity Score (ISS) and Revised Trauma Score (RTS). We also aimed to find the role of the addition of raised lactate values to predict in-hospital mortality in trauma patients as compared to REMS alone. 28 Baseline Data The mean age of the study cases was 38.98 years with over half of them being between 21 to 40 years of age. Out of the 100 cases, 87% were males and 13% were females. The nature of trauma was a road traffic accident in the majority of the cases (63%). Other causes were falling (26%), assault (10%), and workplace injury (1%). Heydari F et al. [10] observed the mean age of the patients as 38.54 ± 18.58 (18 –94) years with 78.9% males. Road injuries were the main cause of trauma (70.3%) followed by falls (16.5%). Imhoff BF et al. [9] in another similar study observed the mean age 36.5±17.0 years with 73.7% males to 26.3% females. Road injuries were the main cause of trauma (74%) followed by falls (20%). Goodacre S et al. [7] in a study of 17,950 patients admitted in the emergency ward observed the mean age as 48.4 years with 58% males and 42% females. Duc H et al. [8] observed the mean age in their study as 65.9 years with 52% males and 485 females. Efficacy of Rapid Emergency Medicine Score (REMS) On ROC analysis, all the scores including REMS, ISS, and RTS were observed to be significant predictors of mortality among trauma cases.

CONCLUSION
The present study was directed to appraise Rapid Emergency Medicine Score (REMS) as a risk stratification tool to predict in-hospital mortality in traumatically injured patients in comparison to the Revised Trauma Score (RTS) and the Injury Severity Score (ISS). In addition, we also aimed to examine the impact of the addition of raised serum lactate levels to REMS in predicting in-hospital mortality in trauma patients as compared to REMS alone. Study results showed that, among individual scores, overall accuracy to predict inhospital mortality was best for REMS (83%) followed by ISS (79%) and RTS (78%). On adding lactate levels to REMS, the overall accuracy for the prediction of mortality increased from 83% to 89%. Our study has some limitations. Firstly, a convenience sampling method was used and the researcher was present in the emergency department, which may have caused selection bias. Secondly, the patients who were excluded include the ones who died in less than 24 hours and those who were dead on arrival. A lack of adequate information on the above-mentioned group of patients may have caused a spectrum bias.

REFERENCES
1. Centers for Disease Control (CDC). Ten leading causes of death and injury (charts). 2006; 2010. http://www.cdc.gov/injury/wisqars/LeadingCauses.html
2. Olsson T, Terent A, Lind L. Rapid Emergency Medicine Score can predict longterm mortality in non-surgical emergency department patients. Acad Emerg Med 2004;11:1008–13.
3. Knaus WA, Draper EA, Wagner DP, et al. APACHE II: a severity of disease classification system. Crit Care Med 1985;13:818–29.
4. Olsson T, Lind L. Comparison of the rapid emergency medicine score and APACHE II in non-surgical emergency department patients. Acad Emerg Med2 003;10:1040–8.

5.   Olsson T, Terent A, Lind L. Rapid Emergency Medicine Score: a new prognostic tool for in-hospital mortality in non-surgical emergency department patients. J Intern Med 2004;255:579–87.
6.   Olsson T, Lind L. Comparison of the rapid emergency medicine score and APACHE II in nonsurgical emergency department patients. Acad Emerg Med. 2003;;10((10):):1040—1048.
7.   Goodacre S. Prediction of mortality among emergency medical admissions. Emerg Med J 2006;23(5):372–375.
8.   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 emergency department. Int J Emerg Med 2015;8(1).
9.   Imhoff BF, Thompson NJ, Hastings MA, et al. Rapid Emergency Medicine Score (REMS) in the trauma population: a retrospective study. BMJ Open 2014;4:e004738.
10. Heydari F, Azizkhani R, Ahmadi O, Majidinejad S, Nasr-Esfahani M, Ahmadi A. Physiologic Scoring Systems versus Glasgow Coma Scale in Predicting In-Hospital Mortality of Trauma Patients; a Diagnostic Accuracy Study. Arch Acad Emerg Med. 2021 Sep 23;9(1):e64.