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Comparison of MEWS, REMS and RAPS for Predicting Outcomes of Non-Surgical Patients in Emergency Room

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Abstract

Context: There are several scoring system in the literature to triage and predict prognosis of the patient using simple physiologic parameters. MEWS, REMS, RAPS are few among them. An appropriate scoring system is essential for risk stratification and hospitalisation in a busy Emergency Medicine department. *Aims:* We aim to compare the performance of MEWS, REMS, RAPS score in predicting mortality among the non-surgical patients presenting to the Emergency room. *Settings and design:* This prospective study was conducted in an ED of a teritary care hospital during a period of 2 months. *Statistical analysis:* ROC analysis was used to compare performance of all three scoring system in predicting mortality. *Methods and materials:* In this prospective study, all patients presenting to the ED with non-surgical complaints during a period of two months. MEWS, REMS, RAPS scores were calculated in the ED itself based on the physiologic parameters at the time of presentation. These patients were later followed up till discharge/death. *Results:* A total of 120 patients were included in our study, with mean age of 49.2±18.5. 60% of the study populations were males and 42.5% were females. The mortality in our study was around 16.7%. Though AUC of MEWS, REMS, RAPS were 0.73, 0.71, 0.69 respectively, but not significant difference were found between the three scoring system. *Conclusion:* All scores MEWS, REMS, RAPS performed equal in predicting in-hospital mortality among non- surgical patients presenting to the ED.

Keywords: MEWS; REMS; RAPS.

Introduction

Several scoring systems have been developed over the last few decades [1]. These scoring systems helps to determine critically I'll patients rapidly. The ease with which the scoring system helps to detect high risk patients has made it popular among Emegency physicians.It not only determine high risk patients but also helps in triaging and disposition of ED patients [2]. However, each scoring system has its own limitations. Early intervention and management in critical I'll patients in ED decreases morbidity and mortality rates [3]. Therefore by establishing an effective scoring system in an over crowded and under staffed ED helps to acess and triage patient to ICU/Ward/dispose in an effective manner [4].

Various scoring system have been developed after several modifications over the years with increased efficency. The most commonly used scoring system are Modified early warning score (MEWS), Rapid emergency medicine score (REMS), Rapid acute physiology score (RAPS), Mortality in emergency department sepsis score,(MEDS) [5,6,7,8]. Most of the scoring systems are based on the simple physiologic parameters like pulse, blood pressure, respiratory rate, GCS, oxygen saturation.All these parameters can be easily recorded by any trained person. Therefore these scoring systems have become popular because

of being simple, rapid, bedside parameters that can be calculated immediately allowing emergency physicians to quickly identify Ill patients who require immediate Care.

To the best of our knowledge, in literature there are no studies comparing performance of MEW, REMS, and RAPS. The present study aimed to access and compare performance of MEWS, REMS, and RAPS for predicting in-hospital mortality.

Materials and Methods

Study design

This prospective study was conducted in an ED of a teritary care hospital during a period of 2 months.

Study protocol and setting

Patient over 18 years of age who presented to the ED with medical complaints duringthe period of September 2018 to November 2018 were included in the study. Patient with trauma, minor health issues, cardiac arrest were excluded. Demographic characteristics of the patients like age, sex, physical examination findings and vital like pulse, blood pressure, temperature, respiratory rate, oxygen saturation, AVPU, GCS were documented. This information was used for the calculation of MEWS, REMS, and RAPS. Each patient was followed up in the ICU/Ward till the final out come of discharge/ death.

Measurements

MEWS is based on five parameters Systolic blood pressure, heart rate, respiratory rate, temperature, AVPU score [Table 1]. Number 0-3 points was assigned for each. High risk was considered as a score of >= 5 and low risk with score <5.

REMS is modification of RAPS obtained by adding SpO2 and age to RAPS, REMS is based on six parameters MAP, respiratory rate, blood pressure, oxygen saturation, GCS, age [Table 2]. Number 0-4 points is assigned to each except for the age 0-6 points. The maximum score is 26.

RAPS is developed by taking some parameters from APACHE II. RAPS is based on MAP, pulse rate, respiratory rate, GCS [Table 3]. Maximum RAPS score is 16.

Table 1: MEWS Score

Modified early warning score	3	2	1	0	1	2	3
Systolic blood pressure (mm Hg)	<70	71–80	81–100	101–199	≥200		
Heart rate (bpm)	<40	41–50	51–100	101–110	111–129		≥130
Respiratory rate (bpm)	<9	9–14	15–20	21–29	≥30		
Temperature (°C)	<35	35–38.4	≥38.5				
AVPU score	Alert Reacting tovoice ReactingtopainUnresponsive						

Table 2: REMS Score

Rapid emergency medicine score	0	1	2	3	4	5	6
Age	<45	45–54	55–64	65–74	>74		
Heart rate (bpm)	70–109 110–139	55–69 140–179	40–54 >179	<40			
Respiratory rate (bpm)	12–24 25–34	10–11	6–9	35–49 >49	<6		
Mean arterial pressure (mm Hg)	70–109 110–129	50–69	130–159 >159	<49			
Glasgow coma scale	>13	11–13	8–10	5–7	<5		
O2 sat.	>89	86–89	75–85	<75			

Table 3: RAPS Score

Rapid acute physiologic score	0	+1	+2	+3	+4
Pulse rate	70-109	55-69 110-139	40-54 140-179	<39 >180	
Mean arterial pressure	70-109	50-69 110-129	130-159 >160	<49	
Respiratory rate	12-24	10-11 25-34	6-9 >50	35-49	<5
GCS	>14	11-13	8-10	5-7	<4

Statistical analysis

Continuous variables we're expressed as mean±SD for normal distribution, otherwise median and inter quartile. Categorical variable were expressed as counts and percentages. ROC analysis was used to compare performance of all three scoring system in predicting mortality.

Results

Data from 120 patients were gathred and the mean age of the patients was 49.2±18.5 years. 57% of the patients were males (69) and 42.5% were females (51). The mortality in our study was 23.3% and 5.6% of those admitted ward and 26% of ICU patients succumbed to death. Sociodemographic and clinical characteristics of study participants are described in Table 4.

The ED patients were triaged and admitted to ward (30%), ICU (53.3%) and disposed (16.7%). The-morbidites in the study population we're Diabetes mellitus 31.7%, hypertension 27.5%, COPD 6.7%. When the patient were evaluated in terms of diagnosis pneumonia were seen in 20% of patients, while ARDS and UTI were seen in 6.7% and 5.8% of patients, respectively.

The median score of MEWS, REMS, RAPS was 3(2-5), 5(2-9), 2(1-5) respectively shown in [table 5]. MEWS score was categorized to high risk group (MEWS >=5) with 43.6% non survivors and low risk group (MEWS<5) with 86.4% patients discharged home and was statistically significant. REMS score had 3 groups with high risk group (REMS>13) with 53.8% non-survivours and intermediate group (REMS 6-13) with 28.6% while 86.2% of the low risk group (REMS<6) where discharged

Table 4: Sociodemographic and clinical characteristics of study participants

Sociodemographic characteristics	Mean N	SD %
Age in years	49.2	18.5
Gender		
Male	69	57.5
Female	51	42.5
Clinical characteristics		
Presence of diabetes mellitus	38	31.7
Presence of hypertension	33	27.5
Presence of chronic kidney disease	7	5.8
Presence of ischemic heart disease	7	5.8
Presence of COPD	8	6.7
Presence of other comorbidities	8	6.7
Event in emergency department		
Discharge	20	16.7
Ward admission	36	30.0
ICU admission	64	53.3
Diagnosis		
Acute gastro enteritis	6	5.0
ARDS	8	6.7
COPD exacerbation	5	4.2
Pneumonia	24	20.0
URTI	7	5.8
Viral fever	5	4.2
Others	65	54.2
Duration of hospital stay Median (IQR)	5	3-8
Outcome		
Discharge	92	76.7
Death	28	23.3

home. Median of RAPS was 4 (2-6) among non survivors compared to survivors 2 (0-4) and was statistically significant.

Association between score and event at emergency department is shown in [table 7]. 82% of high risk group (MEWS>=5) were admitted to ICU, 17.9% in ward and none of the patient among high risk group were discharged from the ED, whereas 24.7% of lowrisk group (MEWS<5) were discharged from ED. 92.3% of high risk group (REMS>13) were admitted to ICU, 7.7% in ward, whereas none of the patients were discharged from the ED, whereas 29.2% discharged from ED. Median RAPS score was 4 for ICU patients (1-4), 2 for ward (0-3) and 0 (0-1) for ED patients.

AUROC analysis [Table 8], [Figure 1] demonstrated the predictability of MEWS, REMS, RAPS as 0.73, 0.71, 0.69, respectively and no statistically significant difference was noted among the tests in predicting mortality.

Table 5: Score details

Score	Median N	IQR %
Total MEWS score	3	2-5
Total REMS score	5	2-9
Total RAPS score	2	1-5

Table 6: Association between patient characteristics and outcome of study participants:

Patient characteristics	Discharge		Death		P value
	Mean N	SD %	Mean N	SD %	
MEWS Score category					
High risk >5	22	56.4	17	43.6	<0.001
Low risk ≤5	70	86.4	11	13.6	
REMS score category					
High risk >13	6	46.2	7	53.8	0.005
Intermediate risk 6-13	30	71.4	12	28.6	
Low risk <6	56	86.2	9	13.8	
RAPS score Median (IQR)	2.0	0-4	4	2-6	0.002

Table 7: Association between score and event at emergency department of study participants

Patient characteristics	Discharge		Ward		ICU		P value
	Mean N	SD %	Mean N	SD %	Mean N	SD %	
MEWS Score category							
High risk >5	0	0.0	7	17.9	32	82.1	<0.001
Low risk ≤5	20	24.7	29	35.8	32	39.5	
REMS score category							
High risk >13	0	0.0	1	7.7	12	92.3	<0.001
Intermediate risk 6-13	1	2.4	12	28.6	29	69.1	
Low risk <6	19	29.2	23	35.4	23	35.4	
RAPS score Median (IQR)	0	0-1	2	0-3	4	1-4	<0.001

Table 8: Area under the curve for MEWS and REMS score

Score	Area under the score	P value
MEWS	0.73	
REMS	0.71	0.669
RAPS	0.69	

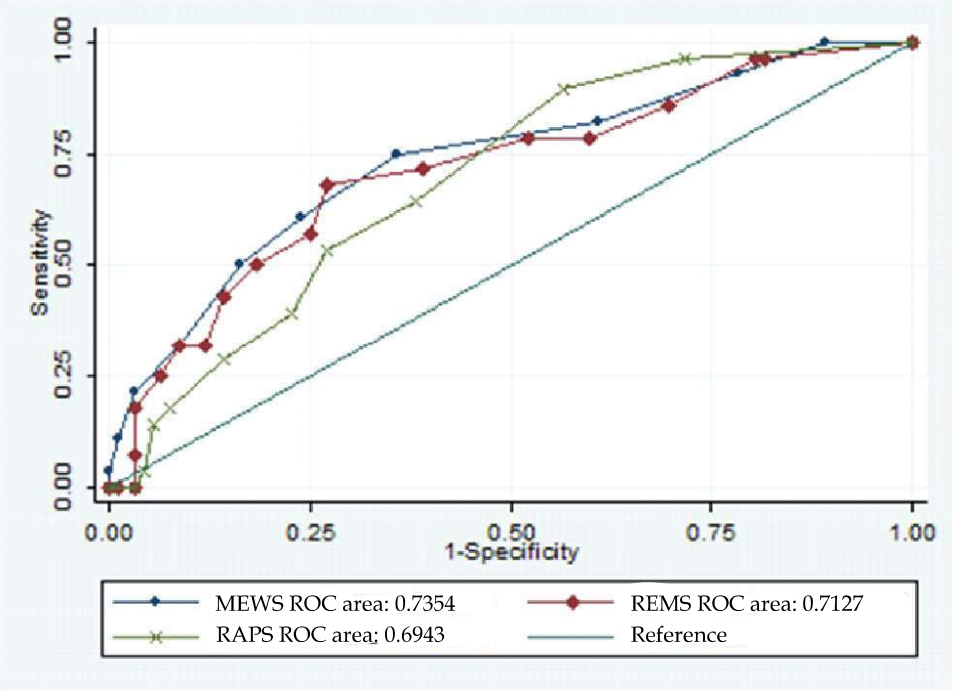

Fig. 1: The present study showed no statistically significant difference between three scores with AUC of MEWS.73, REMS .71, RAPS .69.

Discussion

A good scoring system helps to triage patient rapidly and predict the prognosis of the patient in an over crowded ED. These scoring system are either for a specific disease or special group. TIMI risk score for unstable angina and non-ST elevation myocardial infarction is disease specific score [9]. APACHE II for predicting out come ICU patients, FOUR score in traumatic brain injury, revised trauma score in traumatic patients are used in special group patients [10,11].

An ED scoring system used in ED should have few variables and easy to calculate. Most of the scoring system has many parameters like SpO_2, blood pressure, respiratory rate, GCS. At times it will be difficult to elecit history in an unconscious unaccompanied patient. Therefore MEWS, REMS, RAPS which includes only physiologic parameters were taken up in our study. There have been several studies showing comparison of scoring systems for their performance among ED patients.

In a study by olsson et al among non-surgical patients compared RAPS (AUC. 65) with REMS (AUC. 85) and found that REMS was a better predictor of in hospital mortality than RAPS [12]. Another study by osslon et al reported similar AUC values for APACHEII and REMS in predicting mortality [13]. Study by goodacre et al showed REMS (AUC.64) was better than RAPS (AUC.74) [14].

Study by M. Bulut et al. showed REMS (AUC.70) was better than MEWS (.63) [5], while study by Goodacre et al. showed REMS (AUC.85) was better than RAPS (AUC.65) [14]. RAPS, MEWS has been used to predict in hospital mortality in traumatic brain injury. Studies by Duckit et al. showed WPS was better than MEWS in predicting mortality [15], Whereas Ha et al. showed REMS and WPS both had acceptable performance with WPSS better than REMS in predicting mortality [16]. Study by Imhoiff et al. showed high REMS is associated with increased mortality in trauma patients [17].

MEDS score has been used to prognosticate sepsis patients in the ED, some studies has showen it performed better than other scores like APACHE II and SOFA in determining mortality of sepsis patients in ED [18]. Since MEDS score comprised more parameters and laboratory values this score was not included in our study.

Study by osslon showed mortality was 53.8% among high risk group and 13.8% among low risk group. Simillary, other studies have shown MEWS >5 is associated with increased mortality [19]. In our study mortality in high risk group 43.6% and 13.6 % among low risk group was statistically significant. Subbe et al. found that mortality was high among high risk groups. Median RAPS score was high 4 (2-0) and non survivor compared to survivors 2 (0-4) [19].

In our study majority of the patients 82.1% with MEWS score >=5 were admitted to ICU and majority of the low risk group were discharged 24.7% or admitted in ward 35.8%. Simillary, majority of patients in high and intermediate risk group were admitted to ICU 92.3%, 69.1%. Majority of the low risk group were either discharged 29.2% or admitted to ward 35.4%. Bulut M et al. showed median of MEWS, REMS in ward was more than discharge group [5]. The median RAPS score among ICU patients were 4 (1-4) and discharge patiey we're 0 (0-1).

Ghanem Zhabi et al. established AUC for MEWS, REMS, RAPS as .69, .77 respectively, which showed REMS predicted in hospital mortality more accurately [20]. Study by Bulut M et al. showed (AUC for MEWS .63, REMS.70) REMS performed better than MEWS [5], study by Goodacre S et al. showed (AUC of REMS .74 and RAPS .64) REMS performed better than RAPS [14]. Study by Shang-Kai et al showed predictability of mortality in descending order of MEDS .92, MEWS .76, RAPS .68 and REMS .67, MEDS was found to the most accurate tool followed by MEWS [21]. The present study showed no statistically significant difference between three scores with AUC of MEWS.73, REMS .71, RAPS .69.The variation in the scores may be atributed to the differences in the survey settings.

According to our study results all scoring system MEWS, REMS, RAPS were found to be effective in predicting mortality of non surgical patients presenting to ED and all scores were found to be performing equal in predicting mortality.

Limitations

Our study was single center based small study. We did not include all patients who to the ED, surgical patients, trauma and pediatric patients were excluded from our study. MEWS, REMS, RAPS werecalculated based on the parametes at the time of presentation and serial measuremets of the scores were not considered.

Conclusion

Although MEWS had highest AUC value among all the three scores, there was no statistically difference between the three scores.

Key Messages

Establishing an effective scoring system in an over crowded and under staffed ED helps to acess and triage patient to ICU/Ward/dispose in an effective manner.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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