A Study of Initial Assessment of Emergency Patients Using REMS Score and HOTEL Score

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Abstract

Aims: To assess the prognostic values and predicting in-hospital mortality of patients admitted to ED by Rapid Emergency Medicine Score (REMS) and Hypotension, oxygenation, temperature, ECG abnormality, loss of independence (HOTEL) scores. *Methods and Material:* Patient presenting to ED were evaluated at admission with detailed history and physical examination. The data of the patients fulfilling the study inclusion criteria were recorded as follows: age; sex; blood pressure; pulse rate; respiratory frequency; temperature; oxygen saturation; Glasgow Coma Scale; ECG findings; and loss of independence. *Statistical analysis used:* mean and standard deviation for quantitative variables, Chi Square test, a comparison of the diagnostic abilities for each test was performed using the area under the curves (AUC). SPSS for Windows Version 22.0 Released 2013 was used. *Results:* 100 patients were included in the study, of which 26 died and 74 survived. In predicting the in-hospital mortality, the AUC values of the REMS and HOTEL scores 0.808, (95% CI=0.719-0.879) were (p<0.001) and 0.874, (95% CI=0.794-0.931) were (p<0.001) respectively. *Conclusions:* The HOTEL score demonstrated the largest AUC (area under curve) of the studied scoring systems for the outcome of mortality.

Keywords: HOTEL; REMS; Survivors; Nonsurvivors; ED-Emergency Department

Introduction

It is vital to determine which patients shall be hospitalized and which have higher mortality risks upon admission [1]. The scoring system employed for triage in the ED should be based on rapidly obtainable and direct prognosis related parameter [2]. REMS is a emergency scoring systems modified by Olsson et al from Rapid Acute Physiological Score in 2003. HOTEL is a novel scoring system developed by Kellett et al in 2008 for patients in the EDs [2].

This study, aimed to determine the prognostic values and in-hospital mortality of REMS and HOTEL score.

Objectives

1. To assess the prognostic values of Rapid Emergency Medicine Score (REMS) and Hypotension, oxygenation, temperature, ECG abnormality, loss of independence (HOTEL) scores in non-surgical Patients admitted to Emergency Department.

2. To compare Rapid Emergency medicine (REMS) and Hypotension, oxygenation, temperature, ECG abnormality, Loss of independence score in predicting in-hospital mortality

Subjects and Methods

A prospective study was undertaken.

All the patients admitted to emergency ward are being prognosticated based on HOTEL and REMS score.

Table 1: REMS Score

Point	Age	Pulse Rate (bpm)	Respiratory Rate	Map (mmHg)	Gcs Score	Oxygen Saturation %
4		<40	<6	<49	<5	<75
3		40-54			5-7	75-85
2		55-69	6-9	50-69	8-10	
1			10-11		11-13	86-89
0	<45	70-109	12-24	70-109	>13	>89
1			25-34			
2	45-54	110-139		110-129		
3	55-64	140-179	35-49	130-159		
4		>179	>49	>159		
5	65-74					
6	>74					

REMS score more than 8 is significant.

HOTEL [3] and REMS [4] Score are calculated on day of admission. The predicted mortality rate was calculated based on this score.

Table 2: HOTEL Score

Variables	Point
Systolic Blood Pressure <100 MmHg	1
Oxygen Saturation <90%	1
Temperature <35.0^{0}C	1
Abnormal Electrocardiogram	1
Loss of Independence	1

HOTEL score more than 2 is significant.

We are analyzing various profiles between two groups; survivor group which include the patients who are successfully discharged after recovery and non-survivor group which include the patients who died.

Inclusion criteria

1. Patients >18 years age admitted with acute medical complaints.

Exclusion criteria

1. Patients on intravenous fluids, inotropic support for hemodynamic stability prior coming to Emergency Department.
2. Patients who had undergone cardiopulmonary resuscitation outside hospital.
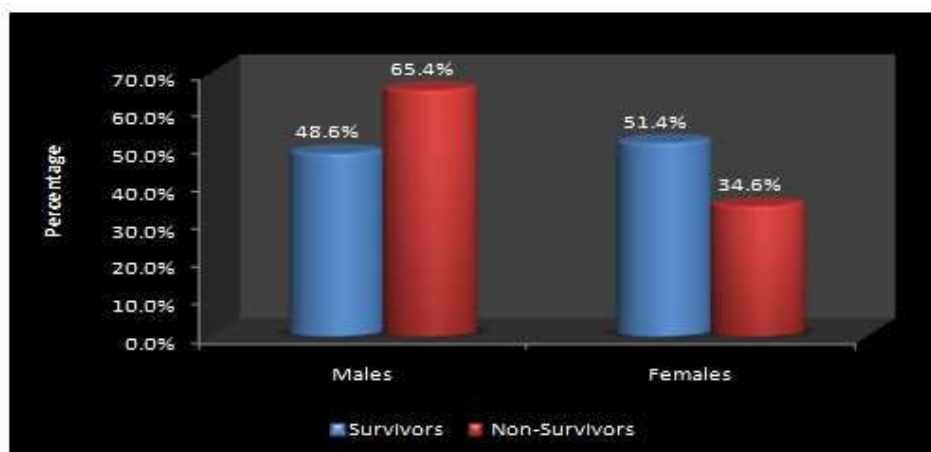3. Surgical patients.

The SPSS software was used for statistical analysis in this study.

Results

In our study maximum number of subjects was in the age group of 20 to 60 years, 65.4% were Male and 34.6% were females (Graph 1).
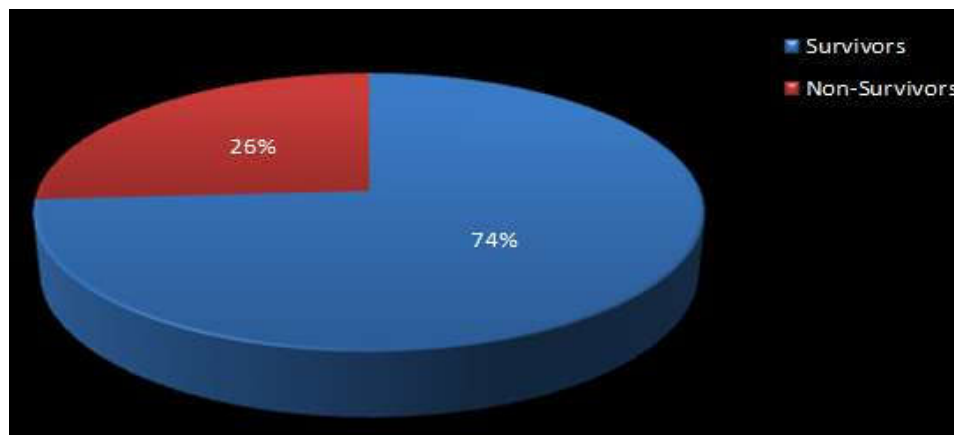
Table 3: Distribution of study patients based on outcomes

Outcomes	n	%
Survivors	74	74%
Non-Survivors	26	26%

Graph 1: Gender distribution

Shabbir Shekhli, Saikiran G, Rajanikanth S Malapur / A Study of Initial
Assessment of Emergency Patients Using REMS Score and HOTEL Score

263

The Graph 2 shows the outcome among total study population, survivor were 74 (74%) and non-survivor 26 (26%).

The Table 4 and Graph 3 shows, patients with fever, toxic ingestion, breathlessness, vomiting, altered sensorium in decreasing order. But breathlessness was more statistically significant in predicting the in-hospital mortality outcome.

Graph 2: Distribution of study patients based on outcomes

Table 4: Comparison of chief complaints between Survivors and Non-survivors

Complaints	Survivors		Non-Survivors		c^2 Value	p-Value
	n	%	n	%		
Fever	26	35.1%	10	38.5%	0.092	0.76
Toxic Ingestion	25	33.8%	5	19.2%	1.940	0.16
Breathlessness	16	21.6%	11	42.3%	4.177	0.04*
Vomiting	10	13.5%	5	19.2%	0.493	0.48
Loose Stools	9	12.2%	2	7.7%	0.393	0.53
Non-surgical –RTA	1	1.4%	1	3.8%	0.61	0.43
Abdominal Distension	2	2.7%	2	7.7%	1.247	0.26
Altered Sensorium	9	12.2%	3	11.5%	0.007	0.93
Hematemesis	0	0.0%	1	3.8%	2.875	0.09
Abdominal Pain	2	2.7%	1	3.8%	0.086	0.77
Convulsions	0	0.0%	1	3.8%	2.875	0.09
Other	21	28.4%	5	19.2%	0.837	0.36
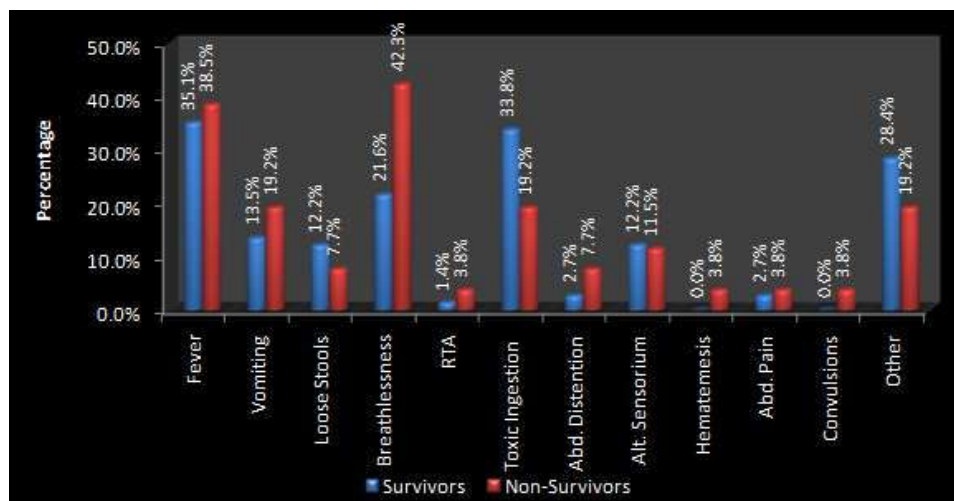
Graph 3: Comparison of chief complaints between Survivors and Non-survivors

The Table 5 and Graph 4 shows RR, SpO$_2$ & GCS are statically significant in predicting the outcome.

The Table 6 shows, Loss of independence among survivor 37.8% and Non-survivors was 88.5% with P value <0.001. Abnormal ECG among survivors 47.3% and non-survivor 88.5% with p value <0.001 (P value less than 0.05 are statically significant).

The Table 7 and Graph 5 shows, Mean REMS score was higher among non-survivors than survivors (8.46 vs 3.50) which is statically significant (p<0.001). Mean HOTEL score on the day of admission was high among non-survivors (2.92 vs 1.05). It is also statically significant (p< 0.001). The mean duration of hospital stay was less in non-survivors compared to survivors (4.23 vs 5.82) which were statically not significant.

Table 5: Comparison of mean values of Vital Parameters between Survivors and Non-survivors

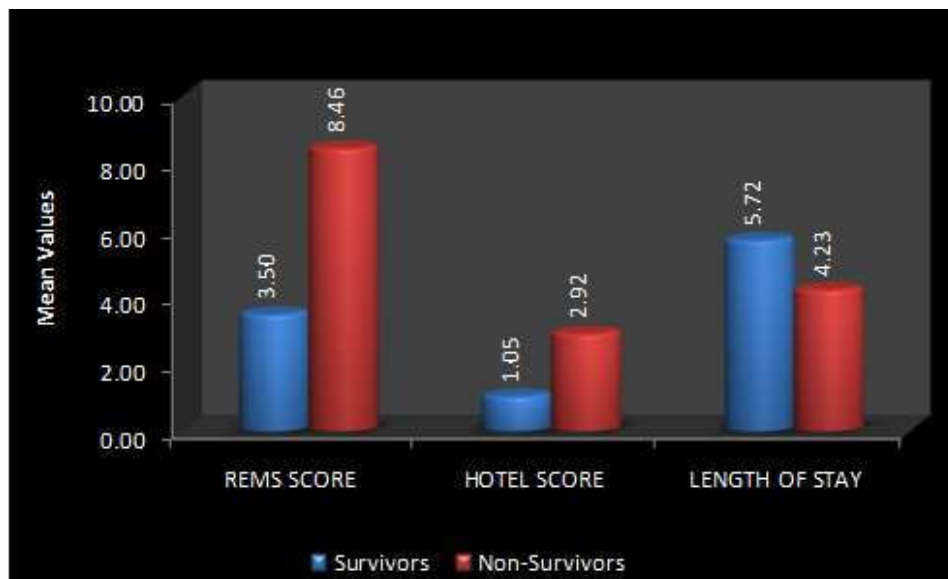| Vital Parameters	Survivors		Non-Survivors		Z	P-Value
	Mean	SD	Mean	SD		
HR / Min	98.16	18.66	94.69	33.36	0.653	0.52
SHOCK INDEX	0.80	0.24	0.92	0.38	-1.830	0.07
RR (cpm)	15.68	5.51	22.65	10.74	-3.439	<0.001*
TEMP F	98.55	0.58	98.46	0.93	-0.777	0.44
MAP [mmhg]	91.74	21.65	77.04	36.24	-1.628	0.10
SPo2 AT RA	94.84	9.07	84.96	13.90	-3.828	<0.001*
GCS	13.66	2.86	10.85	4.54	-3.666	<0.001*
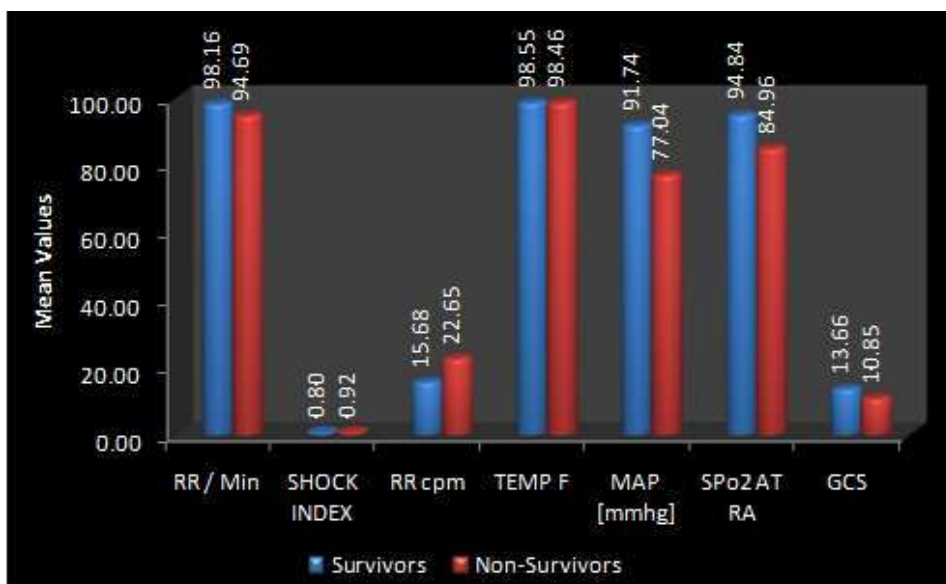
Graph 4: Comparison of mean values of Vital Parameters between Survivors and Non-survivors

Table 6: Comparison of Loss of Independence & ECG findings between Survivors and Non-survivors

Variables	Categories	Survivors		Non-Survivors		c² Value	P-Value
		n	%	n	%		
Loss of Independence	No	46	62.2%	3	11.5%	19.731	<0.001*
	Yes	28	37.8%	23	88.5%		
ECG	WNL	39	52.7%	3	11.5%	13.383	<0.001*
	ABNL	35	47.3%	23	88.5%		

Table 7: Comparison of mean values of REMS and HOTEL score between Survivors and Non-survivors

Prognostic Indicators	Survivors		Non-Survivors		Z	P-Value
	Mean	SD	Mean	SD		
REMS Score	3.50	3.83	8.46	4.30	-4.688	<0.001*
Hotel Score	1.05	1.01	2.92	1.16	-5.858	<0.001*
Length of Stay	5.72	4.14	4.23	4.38	-2.781	0.005*

Shabbir Shekhli, Saikiran G, Rajanikanth S Malapur / A Study of Initial
Assessment of Emergency Patients Using REMS Score and HOTEL Score

265

Graph 5: Comparison of mean values of REMS and HOTEL score between Survivors and Non-survivors

The Table 8 and Graph 6 shows, The ROC curve obtained by plotting a different cut-offs of value of REMS and HOTEL score are shown in graphs x and y. The area under the curve in graph REMS score is 0.808 with SE of 0.0436 at CI ranging from 0.719 to 0.879 with p<.0001 and for HOTEL score is 0.874 with SE of 0.0413 at CI ranging from 0.794 to 0.931 with p<0.0001 respectively. The largest AUC values, better a predictive capacity of mortality.

HOTEL score with sensitivity of 89.61% and specificity of 73.08% compared to REMS score with sensitivity 63.64% and specificity 84.62%.
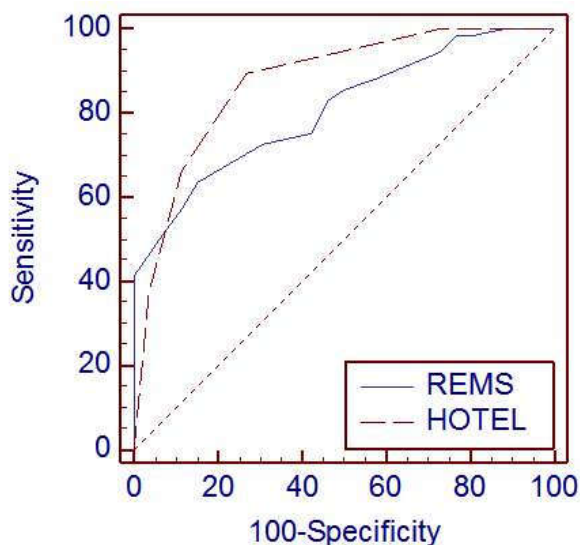
Graph 6: Comparision of Area Under ROC Curve for REMS and HOTEL Score

Graph 8: Comparision of Area Under ROC Curve for REMS and HOTEL Score

Variable 1		REMS
Variable 2		HOTEL
Classification variable		Group

Sample size		100
Positive group:	Group = 1	74
Negative group:	Group = 0	26

	AUC	SE [a]	95% CI [b]
REMS	0.808	0.0436	0.719 to 0.879
HOTEL	0.874	0.0413	0.794 to 0.931

[a] DeLong et al., 1988
[b] Binomial exact

Table 9: Pair wise comparison of ROC curves

REMS ~ HOTEL	
Difference between areas	0.0657
Standard Error[c]	0.0427
95% Confidence Interval	-0.0181 to 0.149
z statistic	1.537
Significance level	P = 0.1243

The Table 9 shows, The HOTEL score demonstrated the largest AUC curve of the studied scoring systems for the outcome of mortality, although the CIs on point estimates of the AUC of the REMS score overlap. Which was not statically significant (p=0.1243)

Discussion

Medical patients admitted to Emergency Department (ED) are highly heterogeneous in terms of disease spectrum and severity. Mortality

is the most important outcome of ED care, and the rate of mortality can be used as a means for better prioritization of care and resource allocation [5,6]. The rate of mortality among ED patients is high. In ED, the death of a patient is commonly preceded by a cumulative deterioration of vital signs and clinical abnormalities. Therefore, several prognostic models, including the Rapid Emergency Medicine Score, Rapid Acute Physiology Score and Worthing Physiological scoring system have been developed to make use of the clinical signs and abnormalities for predicting the risk of death in ED patients [7,8,9].

Comparing present study with other similar studies by Sasi Sekhar et al. [10], Duc T. Ha et al. [1] showed that there was no statistically significant difference between age, sex and prediction of mortality.

In the present prospective study the variables includes Breathlessness, Respiratory Rate, Peripheral oxygen saturation at room air, GCS and Loss of Independence, ECG abnormality are found to be statistically significant in prediction of in hospital mortality which were seen in similar studies [11,12,13].

Conclusions

1. Majority of the study population were in the age group of 21- 60 years.

2. There is slight male sex predominance in the study population.

3. Mortality rate was 26% in our study population.

4. Age of patient and sex of patient were found to be insignificant in predicting outcomes in this present study.

5. Most common chief complaint was fever (37), followed by toxic substance ingestion (31), breathlessness (27), vomiting (15), altered sensorium (12), loose stool (11). Breathlessness at admission was found to be important predictor of mortality.

6. Measurement of vital parameters such as Respiratory Rate, Peripheral oxygen saturation at room air found to be significant predictor of prognosis and mortality.

7. GCS and Loss of Independence on the day of admission was found to be significant predictor of mortality.

8. ECG done on the day of admission was found to be significant predictor of mortality.

9. The area under the curve for REMS score at admission and HOTEL score at admission in predicting mortality of the study population was 0.808, (95% CI=0.719-0.879) were (p < 0.001) and 0.874, (95% CI=0.794-0.931) were (p < 0.001) respectively. Hence the predictive in-hospital mortality of HOTEL score at admission is better than the REMS score.

Key Messages

HOTEL scoring is better in ED.

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