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Accuracy of mechanism, glasgow coma scale, age and arterial pressure (MGAP) score in predicting mortality in Polytrauma patients

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ABSTRACT

The purpose of this investigation was to evaluate the accuracy of the MGAP score and its components in prediction of in-hospital mortality versus the accuracy of the Revised trauma score RTS in Emergency department. This study included 220 patients; all were polytrauma patients subjected to Blunt and Penetrating trauma including head injuries. Mortality rate in low risk group according to MGAP and RTS scores was (8.5% and 1% respectively) it was significant (p=0.01), in moderate risk group (47.7% and 66.3% respectively) it was significant (p=0.04). Meanwhile, in High risk group (96.6% and 100% respectively) it wasn't significant (p=1.000). RTS is better than MGAP in predicting mortality in low risk group, MGAP is better than RTS in intermediate risk group and no difference between both scores in high risk group.

Keywords: Traumatic brain injury, RTS score, MGAP score

INTRODUCTION

Traumatic brain injury is a major cause of death and disability worldwide, especially in children and young adults and presents a major social, economic, and health problem. TBI is defined as damage to brain resulting from external mechanical force, such as rapid acceleration or deceleration, impact, blast waves and penetration by projectile (Maas et al., 2008).

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Prognosis worsens with the severity of injury (Rao and Lyketsos., 2000).Most TBIs are mild and do not cause permanent or long-term disability; however, all severity levels of TBI have the potential to cause significant, long-lasting disability (Brown et al., 2008) .Permanent disability is thought to occur in 10% of mild injuries, 66% of moderate injuries, and 100% of severe injuries (Frey., 2003).

Revised trauma score (RTS) (Champion et al., 1989) is most widely cited and used. It Score is made up of a three categories: Glasgow Coma Scale, Systolic blood pressure, and respiratory rate.

A coded form of the RTS is used for quality assurance and outcome prediction.

Glasgow coma scale (GCS)	Systolic blood pressure(SBP)	Respiratory rate(RR)	Coded value
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0

RTS = 0.9368 GCS + 0.7326 SBP + 0.2908 RR
Value for the coded RTS range 0 to 7.8408. (0= dead, 7.8408=normal).
High mortality <3.4
Moderate mortality 3.4-7.2
Low mortality >7.2

The Mechanism of injury, Glasgow coma scale, Age, Arterial blood pressure (MGAP) score is the one of the best and more recent scoring systems for predicting in-hospital mortality for trauma patients (Sartorius et al., 2010).

(MGAP) score- (Total 3 to 29 points)

Mechanism of injury (Blunt trauma vs. Penetrating trauma)	+4
Glasgow coma scale	3-15
Age <60 years	+5
SBP>120mmHg	+5
SBP60-120mmHg	+3
SBP<60mmHg	0

Risk Categories

Low <5%	23-29
Medium, 5-50%	18-22
High, >50%	3-17

MATERIALS AND METHODS

Patients:

All individuals were polytrauma patients subjected to Blunt and Penetrating trauma including head injuries and admitted to the Emergency Department (ED) of Alexandria Main University Hospital in 2013.

Study design:

Retrospective study was conducted to collect data that include all polytrauma patients including head injury who attended emergency department (ED) of Alexandria Main university hospital in 2013.

Tools of data collection:

We reviewed the files of 220 patients admitted to emergency department (ED) of Alexandria Main University in the year 2013.

All individuals in this study were subjected to the following:

1. History taking:
   - Age.
   - Sex.
   - Mechanism of trauma.

2. Clinical examination:

A. Primary survey including:
   - Airway.
   - Breathing.
   - Circulation.
   - Disability: Glasgow coma scale (GCS)
   - Exposure of the patient to detect other injuries.

B. Secondary survey:
   - Full clinical examination of all body.
   - MGAP score on admission after primary respiratory and hemodynamic stabilization
   - GCS on admission after primary respiratory and hemodynamic stabilization
   - Revised trauma score on admission after primary respiratory and hemodynamic stabilization

3. Radiological investigations:
   - FAST (focused assessment with sonography for trauma).
   - Multislice CT brain.

Statistical Analysis:

The basic data of patients was calculated based on each scoring system as seen on tables 1, 2, 3 and 4.

This classification was based on previous studies, mortality rate of each risk group on MGAP and RTS scoring systems were subjected to statistical analysis by suing Chi-Square test since the data involved 3 groups and categorical type.

Computation was done using SPSS statistics software; p value <0.05 were considered statistically significant.

RESULTS

Throughout 2013, 220 patients were included in the study (Table-1).

Table-1. Distribution of the studied cases according to demographic characteristics and mechanism of trauma.

Variable	Number (%)
Sex	
Male	173 (78.6%)
Female	47 (21.4%)
Age	
< 60	202 (91.8%)
≥60	18 (8.2%)
Mechanism of trauma	
Penetrating trauma	15 (6.9%)
Blunt trauma	205 (93.1%)
Systolic arterial blood pressure	
>120 mm Hg	46 (21%)
60-120 mm Hg	154 (70%)
<60 mm Hg	20 (9%)
Total	220

Among patients 60 years or more, the percentage of dead patients (77.8%) was significantly higher than those who were dead in younger age category (36.6%) (Figure-1).

The frequency of men and women in alive and dead patients was compared (Figure-2), and the analysis demonstrated that the percentage of alive females was higher than that of males (66% and 58.4% respectively). In addition, males who died had a higher percentage than dead females (41.6% versus 34%), however, these differences were statistically insignificant (P=0.347) (Table-2).

Figure-1. Age-wise Analysis of alive and dead patients

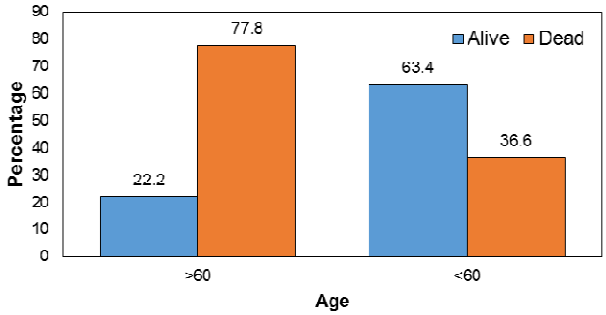


Figure-3 shows that death rate of penetrating trauma was higher than the death rate of blunt trauma (46.7% as compared to 39.5%). These differences were statistically insignificant (P=0.585).

Figure-4 shows that death rate in patients with arterial blood pressure below 60 mm Hg was significantly higher than that of patients with arterial blood pressure between 60 and 120 mm Hg and patients with blood pressure above 120 mm Hg (90%, 34.5% and 37% respectively). Table-3 reveals the distribution of studied cases according to RTS and MGAP scores in Alive and dead patients.

Table-2. Age, Sex, Mechanism of trauma, Systolic arterial blood pressure and frequency comparison between alive and died patients

Variable	Alive		Died		Total	X^2 Test	P value
	N	%	N	%			
Frequency, No (%)	**132**	**60**	**88**	**40**	**220**		
Age							
<60	128	63.4	74	36.6	202	11.6575	0.0006*
≥ 60	4	22.2	14	77.8	18		
Sex							
Male	101	58.4	72	41.6	173	0.8839	0.347
Female	31	66	16	34	47		
Mechanism of trauma							
Penetrating trauma	8	53.3	7	46.7	15	0.2981	0.585
Blunt trauma	124	60.5	81	39.5	205		
Systolic arterial blood pressure							
>120 mm Hg	29	63	17	37	46		
60-120 mm Hg	101	65.5	53	34.5	154	23.012	0.0000*
< 60 mm Hg	2	10	18	90	20		

Figure-2. Sex-wise Analysis of alive and dead patients

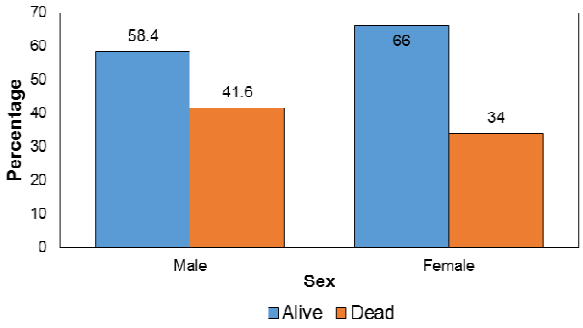
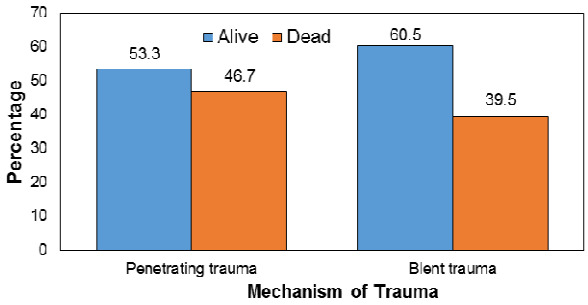


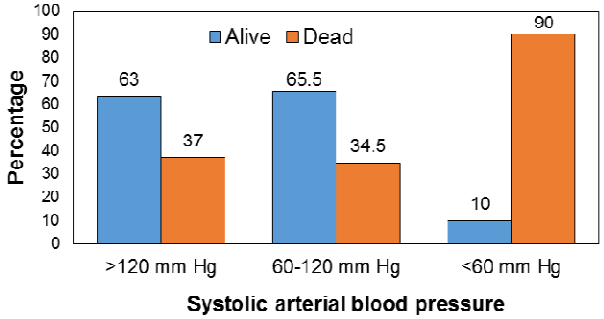
Figure-3. Analysis of trauma among alive and dead patients



As regards RTS score, 46.8% of patients had a low score with only a mortality of 1%. About 40% of patients had an intermediate score with a mortality of 66.3% while 12.7% of patients had a high score and they all died (Figure 4).

On the other hand for MGAP score, 53.2%, 20% and 26.8% of patients had low, intermediate and high scores categories respectively. Death rates among 3 category groups were 8.5% for low score patients, 47.7% for intermediate score patients and 96.6% for high score patients (Figure-5).

Figure-4. Systolic arterial blood pressure of alive and dead patients



Both MGAP and RTS scores performed well in the low level scores where percentages of alive patients were significantly higher than their percentages in intermediate and high risk categories (91.5% versus 52.3% and 3.4% in MGAP score respectively, Figure-6) and (99% versus 33.7% and 0% respectively in RTS).

Figure-5. Distribution of Revised Trauma Score in alive and dead patients

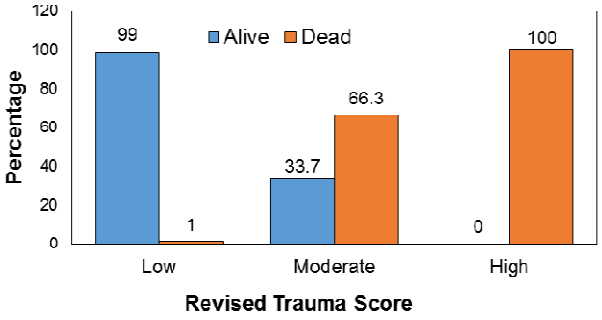
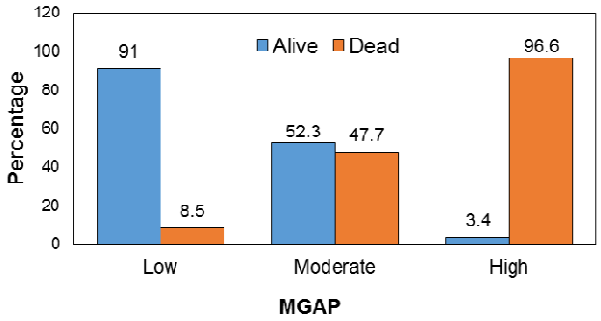


Table-4 shows that the mortality rates on low risk on MGAP and RTS were 8.5% and 1% respectively. On intermediate risk the mortality rates were 47.7% for MGAP and 66.3% for RTS, the mortality rates on high risk in MGAP and RTS were 96.6% and 100% (Figure-5 & 6).

Table-3. Distribution of the studied cases according to RTS and MGAP (n = 220)

	Alive		Dead		Total (n=220) (%)	Test significance P value
	n.	%	n.	%		
RTS						
Low	102	99.0	1	1.0	103 (46.8%)	
Intermediate	30	33.7	59	66.3	89 (40.5%)	0.000*
High	0	0.0	28	100.0	28 (12.7%)	
MGAP						
Low	107	91.5	10	8.5	117 (53.2%)	
Intermediate	23	52.3	21	47.7	44 (20.0%)	0.000*
High	2	3.4	57	96.6	59 (26.8%)	

Figure-6. Distribution of MGAP in alive and dead patients



A statistical significant difference was shown between the two scoring systems (MGAP and RTS) where P value were 0.01 in low risk category, 0.04 in intermediate category however, there was no statistical significance found on MGAP and RTS scoring system in the high risk category (Table-4).

Table-4. Comparison of mortality rate on each trauma scoring system

Mortality Rate	MGAP	RTS	P
Low	10/117 (8.5%)	1/103 (1.0%)	0.01*
Intermediate	21/44 (47.7%)	59/89 (66.3 %)	0.04*
High	57/59 (96.6 %)	28/28 (100.0%)	1.000**

DISCUSSION

In our study we observed that, the percentage of male patients is higher than the percentage of female patients (78.6% versus 21.4% respectively). This reflects that males are more prone than females to poly-trauma and their impact on life and productivity (Sauaia et al., 1995; Mackenzie et al., 2006) similar findings were reported by Kondo et al and Sartorius et al(Sartorius et al.,2010; Kondo et al., 2011), where percentage of male patients were (68.9% and 75% respectively).

In the present study of traumatic brain injury victims, it was observed that the majority of cases were in the age group below 60 years old (202 patients) (91.8%) followed by age group above 60 years old (18 patients) (8.1%). Similar findings were reported by Erhan Ahun, Özlem Köksal, Deniz Sığırlı, Gökhan Torun et al, who studied the mortality predictive power of MGAP score on 100 major trauma patients and they found that the commonest age group below 60 years old (Ahun et al., 2014) .

The large number of cases in this age group can be explained by the fact that this age group is the most active period in life, and young persons in this age group are at the peak of their creativity and have the tendency to take unwarranted risk, thereby subjecting themselves to the danger of accidents and injuries (kondo et al., 2011).

In our study, we found that 18 poly-trauma patients above 60 years old admitted to Emergency department and the outcome was 4 patients alive (22.2%) and 14 patients died (77.8%). On the other hand we found that 202 poly-trauma patients below 60 years old and the outcome was 128 patients alive (63.4%) and 74 patients died (36.6%). These results reflect the importance of Age on the poly-trauma patients subjected to traumatic brain injuries. In MGAP score, the patient below 60 years old take 5 points score and the patient above 60 years old take 0 points Similar results are reported by Sartorius D, Le Manach Y, David JS, Rancurel E, Smail N, Thicoïpí M, et al. who reported the increased mortality and morbidity in elderly trauma patients.

According to mechanism of trauma (Blunt Vs Penetrating), 205 (93 %) poly-trauma patients subjected to Blunt trauma such as Road Traffic Accident (RTA), falling from height, falling down and alleged assault by blunt object, the outcome was 124 patients alive (60.5%) and 81 patients died (39.5%). fifteen poly-trauma patients (6.9%) subjected to Penetrating trauma by Gunshot (pellets), as these pellets have a large area of distribution including more than one organ, the outcome was 8 patients alive (53.3%) and 7 patients died (36.6%). From these results we found that the mortality rate among patients subjected to penetrating injury higher than mortality rate among patients subjected to Blunt trauma. Some studies have shown that penetrating trauma is more severe than blunt trauma (Raux et al., 2011).These results reflect the importance of mechanism of injury on the outcome so the patient with penetrating injury takes 0 score and the patient with Blunt trauma takes 4 points score and Blunt trauma has a better prognosis than penetrating trauma.

Moreover, penetrating trauma patients have been found to comprise fewer than 10% of trauma patient population (Sartorius et al., 2010; Raux et al., 2011) as shown in our study only 7% of poly-trauma patients subjected to penetrating injury.

Systolic arterial blood pressure plays an important role in RTS and MGAP score. In MGAP score systolic arterial pressure is classified into 3 main groups; above 120 mmHg (5 points), between 60-120 mmHg (3points) and below 60 mmHg (0 points).In our study we realized that the majority of patients 70% (154 patients) admitted with arterial blood pressure between 60 and 120 mmHg and the mortality rate was 34.5%, then 21% of patients (46 patients) admitted with arterial blood pressure above 120 mmHg with mortality rate 37%.

In patients with arterial blood pressure below 60 mmHg 9% (20 patients), the mortality rate obviously significantly increased 90%. We realized that the strong relation between mortality rate and severe hypotension (blood pressure below 60 mmHg) that represents a big problem in dealing with poly-trauma patients with head injuries as we must apply a rapid resuscitation of circulation (Mohammed Helal Ibrahim et al, 2015; Pauloujadoff et al., 2007 and Dalia Esam Nasser et al, 2015) after stabilization of Airway and Breathing to maintain the perfusion of the Brain. Similar results and conclusions were shown by Sartorius et al and Ahun et al, they reported that the continuous increase in mortality as systolic arterial blood pressure decreased has been recognized previously

We used the Chi-square test to detect the significance of our statistics to detect the accuracy of MGAP score in comparison to RTS score in prediction of in-hospital mortality rate; p value < 0.05 was considered statistically significant.

In Low risk group RTS score is more accurate than MGAP score in predicting mortality rate, P value is (0.01) that is statistically significant. In Moderate risk group MGAP score is more accurate than RTS score in predicting mortality rate, P value is (0.04) that is statistically significant. In High risk group, MGAP score accuracy is the same as RTS score, P value is 1.000 that is statistically not significant.

CONCLUSION

MGAP score is easier than RTS score to calculate and has few parameters, it is advantageous for providing fast results, allowing quick decision making in major poly-trauma patients including head injuries.

MGAP score is an easily calculable system both in the field and at the time of admission to the ED that can suggest future decision-making schemes to ED physicians by predicting patient mortality

MGAP score is a simple scoring system that can guide healthcare staff at the scene and enable the transfer of trauma patients to trauma centers, which may reduce the loss of time

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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