Prediction Of Outcome Of Poly Traumatized Patients Using Different Trauma Scoring Systems

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Abstract: Trauma remains the third largest cause of death in all regions of the world. If young people only are considered, trauma becomes the leading cause of death and is thus the greatest source of potential years of life lost. Scoring systems have been developed in response to an increasing emphasis on the evaluation and monitoring of health services. These systems enable comparative audit and evaluative research of intensive care. For the trauma outcomes researcher the scores are risk stratifiers, used to divide patients into subsets of risk so that other predictors of outcome may be evaluated. To administrators, score-based measures are a first step toward quality control "report cards" and improvements in health care delivery or injury prevention. The aim of this study was to compare the validity of six current trauma scoring systems [Glasgow coma scale (GCS), Acute Physiology and Chronic Health Evaluation II (APACHE II), Revised Trauma Score (RTS), Injury Severity Score (ISS), Trauma Revised Injury Severity Score (TRISS) and Therapeutic Intervention Score (TISS)] in predicting the outcome in critically ill polytraumatized patients . The study was carried out on 175 polytraumatized patients who were admitted to Critical Care and Emergency Medicine Departments at Alexandria University Main Hospital from 1st of July 2010 to the end of December 2010. All patients are subjected to the routine care and management of trauma patients and The previously mentioned six scoring systems were applied to all patients. The patient outcome was assessed by Glasgow Outcome Score, in hospital &one month mortality. Correlation of the outcome with the different individual score results and comparison between different individual scores were done. It was found that all the six scores correlate significantly with the outcome parameters with different degree of significance and It was also found that the most significant sensitive and specific score was the combined score (anatomical& physiological) TRISS (sensitivity 95.0%, specificity 96.0% and accuracy 95.0%), while the grading of the other scores was in the following sequence: APACHEII, RTS, GCS, TISS (All are physiological) and finally ISS score (Anatomical score). The different scores were compared as regards sensitivity, specificity & accuracy & the comparison revealed that TRISS had the highest sensitivity ,specificity & accuracy of all the scores in this study(95, 96 ,95%)respectively, while , ISS had the lowest values (68 ,70 ,68%).Comparison also revealed that APACHEII score had higher sensitivity (92%) than RTS but the latter had better specificity (94%) &accuracy (92%)than the former (88% and 90%) respectively . In general, the physiological scores in this study tend to have a better performance than the anatomical one &the combined scores had the best performance.

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1. Introduction

Trauma can be defined as an injury (as a wound) to living tissue caused by an extrinsic agent. The word "Trauma" derives from the Greek meaning bodily injury. Trauma was estimated to have caused 10% of all deaths occurring in 1990 world-wide [1-2].

Trauma is one of today's most important health problems worldwide. It is the disease of the young and the leading cause of death up to the age of 45years. The reported mortality rates of severely injured patients range from 7 to 45%. This variance could either reflect real differences in therapeutic results or rely on differences concerning injury severity, age, or mixture of the study populations. A prerequisite for comparisons of therapeutic results are comparable study populations. [3,4]

Trauma score systems try to translate the severity of injury into a number. The scores enable physicians to translate different severities of injury into a common language. This common language could be the basis for quality control and quality assurance programs. More than 50 score systems are published for classification of trauma patients in the field of emergency or intensive care. [5]

One of the important scoring systems commonly used in critical care units is APACHE II ("Acute Physiology and Chronic Health Evaluation II") which is a severity of disease classification system. An integral score from 0 to 71 is computed based on several measurements; higher scores imply a more severe disease and a higher risk of death. [6]

Revised Trauma Score (RTS) is one of more common physiologic scores, with high inter-rater reliability and demonstrated accuracy in predicting death . It is scored from the first set of data obtained on the patient and consists of 3 specific physiologic parameters, Glasgow Coma Scale (GCS), systolic blood pressure (SBP), and respiratory rate (RR). [7]

Trauma Revised Injury Severity Score (TRISS) methodology combines the Revised Trauma Score (a measure of the physiologic response to injury), the Injury Severity Score (describing the site and severity of injury), a classification of the type of injury (blunt or penetrating), and patient age. It has been widely used in the assessment of trauma and in the prediction of group outcome. It assesses three physiologic variables (Glasgow Coma Scale, systolic blood pressure, and respiratory rate), and does not include an evaluation of chronic health status. [8,9]

The Injury Severity Score (ISS) is an anatomical scoring system that provides an overall score for patients with multiple injuries. Each injury is assigned an Abbreviated Injury Scale (AIS) score and is allocated to one of six body regions [Head, Face, Chest, Abdomen, Extremities (including pelvis), and External structures].only the highest AIS score in each body region is used. The 3 most severely injured body regions have their score squared and added together to produce the ISS score. [10]

The Therapeutic Intervention Scoring System (TISS) quantifies type and number of intensive care treatments. This system, therefore, indicates the work load of intensive care and may be used for calculating costs in the ICU.[11]

2. Material and Methods

The present study was carried out on 175 polytraumatized patients of both sex who were admitted to Critical Care and Emergency Medicine Departments at Alexandria University Main Hospital from 1st of July 2010 to the end of December 2010.

A written informed consent was obtained from every patient included in the study or from his relatives. The study was approved from the ethical committee of the Alexandria Faculty of Medicine.

Exclusion criteria:

1. Children less than 12 years old.
2. Major burns.
3. Concomitant cardiac injuries e.g. stab heart.
4. RTS (coded) =12.

The aim of this prospective study was to compare the validity of six current trauma scoring systems [Glasgow coma scale (GCS), Acute Physiology and Chronic Health Evaluation II (APACHE II), Revised Trauma Score (RTS), Injury Severity Score (ISS), Trauma Revised Injury Severity Score (TRISS) and Therapeutic Intervention Score (TISS)] in predicting the outcome in critically ill polytraumatized patients .

All patients included in the study were subjected on admission to the following:

1. Complete history including: Biosocial data, Circumstances of the injury and Associated chronic diseases.
2. Clinical assessment:
3. Radiological assessment: This was done according to the clinical condition and included the following: Computerized Tomography of the Brain, Ultrasound Abdomen, X-Ray long bones and joints, X-Ray pelvis, X-Ray chest and X-Ray cervical spine.
4. Laboratory investigations:
5. The following scoring systems were applied to all patients.

1) Glasgow Coma Scale: It was measured only once within the 1st 24 hours after admission.

2) APACHE II Scoring: It was calculated only once within the 1st 24 h after admission.

3) Revised Trauma Score (RTS): This score was measured only once within the 1st24h after admission .this score includes Measurement of respiratory rate (RR), systolic blood pressure (SBP) and Glasgow Coma Score (GCS). These Parameters are coded from 0-4 based on magnitude of the physiologic derangement.

4) Injury Severity Score (ISS): It was measured only once within the 1st 24 hours after admission .The ISS is calculated by summing the squares of the three highest AIS scores in the different body regions: head and neck, face, thorax, abdominal or pelvic contents; extremities or pelvic girdle; and external.

5) Trauma Revised Injury Severity Score (TRISS): It was measured only once within the 1st 24 hours after admission, it incorporates ISS (anatomic component), RTS (physiologic component), and an age indicator (≤55, >55, co morbidity component) to estimate survival. Two separate equations, one each for blunt and penetrating patients, represent weighted sums of each of the three components and were calculated from data gathered in the Major Trauma Outcomes Study (MTOS) [12]. From these equations, a probability of survival can be calculated for an individual patient. This probability (usually called the TRISS Score) can be used as a risk adjustor.

6) Therapeutic Interventions Score System (TISS)[13]: It was measured within the 1st 24 hours after admission and then measured daily.(table 1)

6. The patient outcome was assessed by: Glasgow Outcome Score[14], in hospital &one month mortality. Patients were classified according to Glasgow Outcome Score (GOS) into 2 groups, the first group with good prognosis that includes patients who were fully recovered or had moderate disability. the second group with poor prognosis that include patients who were died , vegetative, or had severe disability .
7. Correlation of the outcome with the different individual score results and comparison between different individual scores were done.

3. Results

Table (2) & Fig (1) show the relation between the different scores and one month mortality. It is shown that the mortality at one month included (33/175) patients (18.8%), hence the survival group after one month in our patients sample were (142/175) patients i.e. (81.14 %). The mean value for APACHEII score in the one month mortality group was (22.52 +/- 6.91), which was significantly higher than the mean APACHEII value for survival group after one month (15.42 +/- 5.24).(p=0.0001). .The mean value for RTS in the one month mortality group was (3.94+/-1.81) which was significantly lower than the mean RTS value for the survived group after one month (5.37+/- 1.15) . (p=0.0001) .The mean GCS for the one month mortality group was (4.76+/- 2.82). which was significantly lower than the mean GCS value for the survived group after one month (7.11+/- 3.83)(p=0.0001) .The mean ISS value for the one month mortality group was (44.58,SD 13.06)was significantly higher than the mean ISS value for the survival group after one month (37.79+/- 10.81) (p=0.002) . The mean TRISS value for the one month mortality group was (predicted mortality) (69.21 % +/-32.43) was significantly higher than the mean TRISS for the survival group after one month (40.01 %+/- 26.86) (p=0.0001). .finally the mean TISS value for the one month mortality group (71.06+/- 8.33) was significantly higher than the mean TISS value for the survival group after one month (62.37+/- 10.75) (p=0.0001).

Table (3) shows the relation between the different scores and the in hospital mortality. It is shown that, the mortality group was (48/175) patients (27.42 %).and so, the survival group of patients was (127/175) patients (72.57%).The mean APACHEII score value for the in hospital mortality group was (22.27+/-6.28).which was significantly higher than the mean APACHEII score value for the survived group which was (14.68+/-4.81). (p=0.0001).The mean RTS value for the in hospital mortality group was (3.96+/-1.67).which was significantly lower than the mean RTS value for the survival group which was (5.53+/- 1.02.).(p=0.0001). The mean GCS for the in hospital mortality group was (4.63+/- 2.58) which was significantly lower than the mean GCS value for the survival group was (7.44+/- 3.38). (p=0.0001).The mean ISS for the in hospital mortality group was (45.9 +/- 12.94) .which was significantly higher than the mean ISS value for the survival group was (36.50 +/- 9.89). (p=0.0001).The mean TRISS for the in hospital mortality group was (71.6+/-30.49).which was significantly higher than the mean TRISS value for the survival group was (35.79+/- 23.54) (p=0.0001). The mean TISS for the in hospital mortality group was (70.98+/- 7.57) .which was significantly higher than the mean TSS value for the survival group which was (61.33 +/- 10.81) (p=0.0001).

Table (4) shows the relation between the outcome and APACHEII score, it was found that, the mean value of APACHEII score in poor prognosis was 19.92±6.17, while in good prognosis was 13.33±4.14, there was a significant increase in APACHEII score in poor prognosis than the good prognosis (p=0.0001).

Table (5) shows the Relation between the outcome and GCS, the mean GCS in poor prognosis was 5.07±2.50, while in good prognosis was 8.39±3.42, there was a significant increasing in GCS in good prognosis patients than the poor prognosis (p = 0.0001).

Table (6) shows Relation between the outcome and RTS, in poor prognosis the mean RTS score was 4.51±1.46, while in good prognosis the mean RTS was 5.74±1.05, there was a significant increase in RTS in good prognosis than poor prognosis (p = 0.0001).

Table (7) shows the relation between the outcome and ISS, the mean value of ISS in poor prognosis group was 43.36±10.85, while in good prognosis was 34.42±10.46, there was a highly significant increase in ISS score in poor prognosis than the good prognosis. (P =0.0001)

Table (8) shows the relation between the outcome and TRISS (%), in poor prognosis patients the mean TRISS was 60.16±28.56, while in good prognosis was 29.65±23.05, there was a highly significant increase in TRISS score in poor prognosis patients than the good prognosis patients (p = 0.0001).

Table (9) shows the relation between the outcome and TISS, the poor prognosis patients had mean TISS score 68.1±8.26, while the mean TISS in good prognosis was 59.48±11.56, there was a significant increase in TISS in poor prognosis patients than the good prognosis (p = 0.0001).

Table (10) and Figure (2) show the sensitivity, specificity and accuracy of the different studied scores in the detection of the outcome of the patients,

it was found that the most significant sensitive and specific score was the combined score (anatomical& physiological) TRISS (sensitivity 95.0%, specificity 96.0% and accuracy 95.0%), while the grading of the other scores was in the following sequence: APACHEII, RTS, GCS, TISS (All are physiological) and finally ISS score (Anatomical score). The different scores were compared as regards sensitivity, specificity & accuracy & the comparison revealed that TRISS had the highest sensitivity ,specificity & accuracy of all the scores in this study(95, 96 ,95%)respectively, while , ISS had the lowest values (68 ,70 ,68%).Comparison also revealed that APACHEII score had higher sensitivity (92%) than RTS but the latter had better specificity (94%) &accuracy (92%)than the former (88% and 90%) respectively . In general, the physiological scores in this study tend to have a better performance than the anatomical one &the combined scores had the best performance.

TISS (Table1) (Therapeutic Intervention Scoring System - Update 1983) [13]

4 points			3 points		
a. Cardiac arrest and/or countershock within past 48 h	yes	no	a. Central iv hyperalimentation (includes renal, cardiac, hepatic failure fluid)	yes	no
b. Controlled ventilation with or without PEEP	yes	no	b. Pacemaker on standby	yes	no
c. Controlled ventilation with intermittent or continuous muscle relaxants	yes	no	c. Chest tubes	yes	no
d. Balloon tamponade of varices	yes	no	d. IMV or assisted ventilation	yes	no
e. Continuous arterial infusion	yes	no	e. CPAP	yes	no
f. Pulmonary artery catheter	yes	no	f. Concentrated K^+ infusion via central catheter	yes	no
g. Atrial and/or ventricular pacing	yes	no	g. Nasotracheal or orotracheal intubation	yes	no
h. Hemodialysis in unstable patient	yes	no	h. Blind intratracheal suctioning	yes	no
i. Peritoneal dialysis	yes	no	i. Complex metabolic balance (frequent intake and output)	yes	no
j. Induced hypothermia	yes	no	j. Multiple ABG, bleeding, and/or STAT studies (> 4 shift)	yes	no
k. Pressure-activated blood infusion	yes	no	k. Frequent infusion of blood products (>5 units /24 h)	yes	no
l. G-suit.	yes	no	l. Bolus iv medication (nonscheduled)	yes	no
m. Intracranial pressure monitoring	yes	no	m. Vasoactive drug infusion (1 drug)	yes	no
n. Platelet transfusion	yes	no	n. Continuous antiarrythmia infusions	yes	no
o. IABP (Intra Aortic Balloon Pressure)	yes	no	o. Cardioversion for arrythmia (not defibrillation).	yes	no
p. Emergency operative procedures (within past 24 h)	yes	no	p. Hypothermia blanket	yes	no
q. Lavage of acute GI bleeding	yes	no	q. Arterial line	yes	no
r. Emergency endoscopy or bronchoscopy	yes	no	r. Acute digitalization - within 48 h	yes	no
s. Vasoactive drug infusion (> 1 drug)	yes	no	s. Measurement of cardiac output by any method	yes	no
			t. Active diuresis for fluid overload or cerebral edema	yes	no
			u. Active Rx for metabolic alkalosis	yes	no

				v. Active Rx for metabolic acidosis.	yes	no	
				w. Emergency thora-para and peri-cardiocenteses.	yes	no	
				x. Active anticoagulation (initial 48 h)	yes	no	
				y. Phlebotomy for volume overload	yes	no	
				z. Coverage with more than 2 iv antibiotics	yes	no	
				aa. Rx of seizures or metabolic encephalopathy (within 48 h of onset)	yes	no	
				bb. Complicated orthopedic traction	yes	no	
2 points				1 point			
a. CVP (central venous pressure)	yes	no		a. ECG monitoring	yes	no	
b. 2 peripheral iv catheter	yes	no		b. Hourly vitals signs	yes	no	
c. Hemodialysis stable patient	yes	no		c. 1 peripheral iv catheter	yes	no	
d. fresh tracheostomy (less than 48 h)	yes	no		d. Chronic anticoagulation	yes	no	
e. Spontaneous respiration via endotracheal tube or tracheostomy (T-piece or trach mask)	yes	no		e. Standard intake and output (q 24 h)	yes	no	
f. GI feedings	yes	no		f. STAT blood tests	yes	no	
g. Replacement of excess fluid loss	yes	no		g. Intermittent scheduled iv medications	yes	no	
h. Parenteral chemotherapy	yes	no		h. Routine dressing changes	yes	no	
i. Hourly neuro vitals signs	yes	no		i. Standard orthopedic traction	yes	no	
j. Multiple dressing changes	yes	no		j. Tracheostomy care	yes	no	
k. Pitressin infusion iv	yes	no		k. Decubitus ulcer	yes	no	
				l. Urinary catheter	yes	no	
				m. Supplemental oxygen	yes	no	
				n. Antibiotics iv (2 or less)	yes	no	
TISS 76 = SUM (points for activities performed)= 0 Class = 0				o. Chest physiotherapy	yes	no	
				p. Extensive irrigations, packings or debridement of wound, fistula or colostomy	yes	no	
				q. GI decompression	yes	no	
				r. Peripheral hyperalimentation / Intralipid therapy	yes	no	

Table (2): Relation between different scores and the (one month mortality).

Scores	Outcome(Mortality at 1 month)	N	Mean	S.D	Min.	Max	T	Sig
APACHEII SCORE	Survived	142	15.42	5.24	8.00	33.00	43.148	.0001*
	Died	33	22.52	6.91	9.00	34.00		
RTS	Survived	142	5.37	1.15	3.803	7.55	32.729	.0001*
	Died	33	3.94	1.81	0.87	6.904		
GCS	Survived	142	7.11	3.38	3.00	15.00	13.662	.0001*
	Died	33	4.76	2.82	3.00	12.00		
ISS	Survived	142	37.79	10.81	15.00	63.00	9.727	.002*
	Died	33	44.58	13.06	22.00	63.00		
TRISS (%)	Survived	142	40.01	26.86	3.2	99.00	29.178	.0001*
	Died	33	69.21	32.43	2.80	97.5		
TISS	Survived	142	62.37	10.75	26.00	82.00	18.913	.0001*
	Died	33	71.06	8.33	57.00	85.00		

*P < 0.05=SIGNIFICANT

Table (3): Relation between different scores& the (in hospital mortality):

Scores	outcome	N	Mean	S.D	Min.	Max	T	Sig
APACHEII SCORE	Survived	127	14.68	4.81	8.00	33.00	72.646	.0001*
	Died	48	22.27	6.28	9.00	34.00		
RTS	Survived	127	5.53	1.02	3.803	7.55	56.950	.0001*
	Died	48	3.96	1.67	.87	7.55		
GCS	Survived	127	7.44	3.38	3.00	15.00	27.124	.0001*
	Died	48	4.63	2.58	3.00	12.00		
ISS	Survived	127	36.50	9.89	15.00	59.00	26.277	.0001*
	Died	48	45.90	12.94	22.00	63.00		
TRISS (%)	Survived	127	35.79	23.54	2.80	97.50	67.879	.0001*
	Died	48	71.60	30.49	2.80	99.00		
TISS	Survived	127	61.33	10.81	26.00	81.00	32.224	.0001*
	Died	48	70.98	7.57	57.00	85.00		

*P <0.05=SIGNIFICANT

Table (4): Relation between the outcome and APACHEII score.

APACHEII SCORE	Mean	S.D.	Min.	Max	T	p
Poor prognosis	19.92	6.17	9.00	34.00		
Good prognosis	13.33	4.14	8.00	33.00	67.643	0.0001*

*P< 0.05=SIGNIFICANT T-test

Table (5): Relation between the outcome and GCS.

GCS	Mean	S.D.	Min.	Max	t	p
Poor prognosis	5.07	2.50	3.00	12.00		
Good prognosis	8.39	3.42	3.00	15.00	54.537	0.0001*

*P <0.05=SIGNIFICANT

Table (6): Relation between the outcome and RTS

RTS	Mean	S.D.	Min.	Max	t	p
Poor prognosis	4.51	1.46	0.87	6.904		
Good prognosis	5.74	1.05	3.803	7.55	40.283	0.0001*

*P <0.05=SIGNIFICANT

Table (7): Relation between the outcome and ISS.

ISS	Mean	S.D.	Min.	Max	t	p
Poor prognosis	43.36	10.85	22.00	63.00		
Good prognosis	34.42	10.46	15.00	59.00	30.737	0.0001*

*P< 0.05=SIGNIFICANT

Table (8): Relation between the outcome and TRISS (%)

TRISS (%)	Mean	S.D.	Min.	Max	t	p
Poor prognosis	60.16	28.56	2.80	99.00		
Good prognosis	29.65	23.05	2.80	97.50	59.856	0.0001*

*P <0.05=SIGNIFICANT

Table (9): Relation between the outcome and TISS

TISS	Mean	S.D.	Min.	Max	t	p
Poor prognosis	68.1	8.26	47.00	85.00		.
Good prognosis	59.48	11.56	26.00	77.00	33.08	.0.0001*

*P< 0.05=SIGNIFICANT

Table (10): Sensitivity, specificity and accuracy of different studied scores in the detection of the outcome of patients.

Scores	Sensitivity	Specificity	Accuracy
TRISS (Combined)	95.0	96.0	95.0
APACHE II (physiological)	92.0	88.0	90.0
RTS (physiological)	89.0	94.0	92.0
GCS (physiological)	74.5	80.0	78.0
TISS (physiological)	75.0	78.6	77.0
ISS (anatomical)	68.0	70.0	68.0

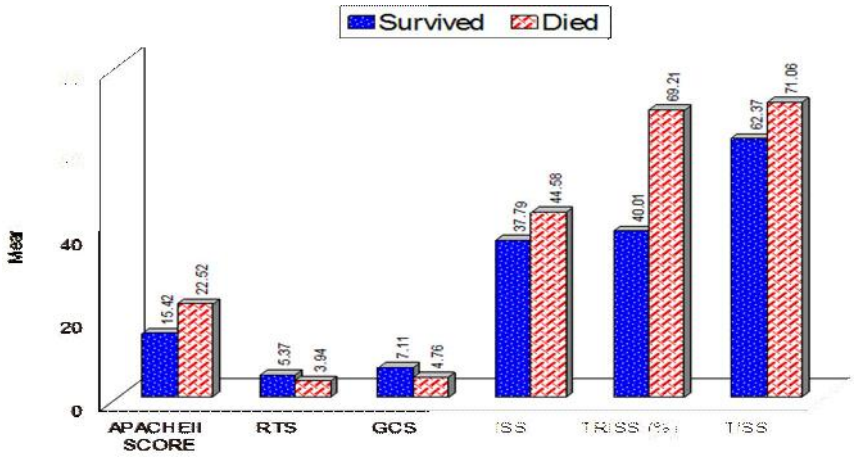

Figure (1): Relation between different scores and the (one month mortality).

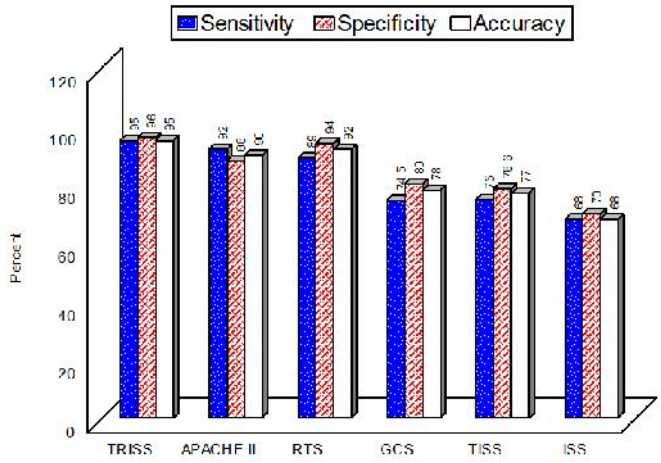

Fig. (2): Sensitivity, specificity and accuracy of different studied scores in the detection of the outcome of the studied patients.

4. Discussion

In the present study, Injury Severity Score (ISS) as the anatomic score was compared to the physiologic scores (RTS, APACHE II, GCS &TISS) and to combined score (TRISS) .Aspects of comparison were sensitivity, specificity & accuracy.

The study showed significantly positive correlation between higher mortality in relation to increased ISS, APACHE II score, TISS &TRISS (probability of death) and to decreased RTS &GCS.

While the anatomic description of the injury gives a picture of the injury severity and reflects the force that caused the injury, the physiologic parameters reflects the body derangement and compensatory responses to this injury. Our study revealed that physiologic scores tend to perform better than anatomic scores in both calibration and discrimination. Against our results are the results of Eryilmaz et al[15] ,who evaluated the anatomic (ISS) combined (TRISS) and physiologic (RTS) trauma scores in assessing mortality. Study data were obtained from a retrospective chart screening of 373 patients , There was no statistical difference between ISS, TRISS and RTS with respect to mortality prediction. So they concluded that there is no difference between physiologic and anatomic scoring systems to predict mortality .We attribute the difference between the results of the present study and the previous results to the high percentage of cases of penetrating trauma (firearm and stab wounds) taken by Eryilmaz et al in comparison to the present study, also to the higher number of cases than the present study.

As regards RTS, the present study showed that the mean RTS score was 4.51±1.46 in the poor prognosis group, while in good prognosis group the mean RTS was 5.74±1.05, there was a significant increase in RTS in good prognosis group than poor prognosis group ($p < 0.01$). Our findings are similar to Hafiz[16] study in 2004 conducted at Nishtar Hospital Multan From August 1999 to January

2001.He studied 30 adult patients of road traffic accidents sustaining multisystem injuries due to high energy blunt trauma and were managed according to the protocols of advanced trauma life support (ATLS) and from their first set of data RTS was calculated. Score of each patient was compared with his final outcome at the time of discharge from the hospital. He found that RTS is a reliable predictor of prognosis of polytraumatized patients. Therefore, it can be used for field and emergency room triage. Also, Ohaegbulam et al[17],conducted a prospective study on relationship between the weighted revised trauma score and patient outcome (mortality), The records of 38 critically injured trauma patients admitted to the general ICU of National Hospital, Abuja, Nigeria over a nine-month period (April - December 2005) were analyzed. The results confirmed that RTS is a good predictor of both severity of head injury (and thus the need for ICU admission) and mortality.

As regards APACHEII score the present study showed that the mean value of APACHEII score in poor prognosis group was 19.92±6.17, while in good prognosis group was 13.33±4.14, there was a significant increase in APACHEII score in poor prognosis group than the good prognosis group. Similar to our results Markgraf et al [18,19] , validated The APACHE II for predicting mortality of trauma patients as well as their length of stay in 2002. The study demonstrated a higher degree of overall goodness-of-fit of APACHE II than APACHE III and SAPSII . Also Similar to our results Liang et al[20] found in 1998 that APACHE II is a better predictor for ICU trauma patients than ISS .

In order to improve these scores performance, we examined the hypothesis that combining the anatomic and physiologic parameters gives better prediction of outcome in critically ill trauma victims. In our study, only one commonly used combined trauma score (TRISS) was used and compared to the anatomic and physiologic scoring models. As regards TRISS in the present study, the mean TRISS score was (60.16) for poor prognosis group versus (29.65) for good prognosis group. TRISS had the highest sensitivity, specificity and accuracy than all other scores included in our study as previously detailed. The results of our study are similar to that of Siritongtaworn et al[21] , In this study 1487 trauma patients were admitted to the Division of Trauma Surgery, Department of Surgery, Faculty of Medicine, Siriraj Hospital between October 2004 and September 2005. The probability of survival (Ps) was calculated for each patient according to the TRISS method. The cut-off value for Ps > 95.0% was the most accurate level of TRISS of which the sensitivity and specificity of the TRISS methodology were 90.9% and 97.2% respectively .They confirmed the accuracy of TRISS methodology in trauma mortality prediction .

Osterwalder et al .[22], in 2000 used ISS, TRISS and ASCOT predicted mortality as a tool for quality management. They agreed with the superiority of TRISS and ASCOT over ISS. Similar to our work, they recommended the use of TRISS for easier application.

As regards GCS score the present study showed that that GCS in poor prognosis group was 5.07±2.50, while in good prognosis group was 8.39±3.42, there was a significant increase in GCS in good prognosis patients than the poor prognosis patients ($p < 0.01$). These results are similar to that found by Balestreri et al [23] , which was carried out on 2003 in Addenbrooke's Hospital, Cambridge on Data from 358 subjects with head injury, collected between 1992 and 2001. Glasgow Outcome Scores (GOS) were determined at six months, they found a significant correlation between the GCS and GOS for the first five years . Also Stefan Grote et al [24] in the Department of Trauma Surgery, Ludwig-Maximilians-University Munich, Germany, in 2011, they studied Diagnostic Value of the Glasgow Coma Scale for Traumatic Brain Injury in 18,002 Patients with Severe Multiple Injuries. Although patients with severe multiple injuries may have other reasons for unconsciousness, traumatic brain injury (TBI) in these patients is frequently defined by the Glasgow Coma Scale (GCS). The diagnostic value of GCS ≤8 for severe TBI in patients with multiple injuries has low sensitivity (56.1%) but higher specificity (82.2%) versus sensitivity of (74.5%) and specificity of (80%) in the present study.

As regards TISS the present study showed that the poor prognosis patients had mean TISS score 68.1±8.26, while the mean TISS in good prognosis patients was 59.48±11.56, there was a significant increase in TISS in poor prognosis patients than the good prognosis patients ($p < 0.01$). similar to our results Chepkoech,et al [25] in their study in 2009 which was carried out in the intensive care units of a public sector hospital in Johannesburg to validate the use of TISS, Their findings support validity and reliability of TISS hence its feasibility for use in South African ICUs. Against our results Hariharan et al [26], in their study in 2007, prospectively applied to patients consecutively admitted to the intensive care units (ICU) of three public teaching hospitals and two private hospitals in Trinidad on a daily basis for a period of eight weeks. TISS scores of 595 patients were analyzed. They concluded that TISS is useful for evaluating the resource utilization and costs and may not be useful as a prognostic scoring system. The difference between Hariharan et al study and the present study may be attributed to the larger sample

of population and the diversity of clinical cases as the study was not designed specifically for trauma patients.

As regards ISS the present study showed that, the mean value of ISS in poor prognosis group was 43.36±10.85, while in good prognosis group was 34.42±10.46. Our results are similar to Beverland et al[27] , in their study Injury Severity Scores were calculated for the injuries of 875 patients in 1983, suffering from gunshot wounds. These scores were plotted against mortality. Increasing ISS is associated with increasing mortality.

Ozdemir et al [28] in the Department of Emergency Medicine, Uludağ University, Faculty of Medicine, Bursa, Turkey, conducted a study directed towards the Comparison of trauma scoring systems for predicting mortality in firearm injuries. Records of 135 firearm-injured patients who applied to Uludag University Emergency Department between January 2001 and December 2005 were analyzed retrospectively. Mortality rate was 12.6%. The patients' mean GCS, RTS, ISS, and TRISS scores were 13.41 +/- 0.31, 10.65 +/- 0.26, 21.94 +/- 1.45, and 9.52 +/- 2.37, respectively. They concluded that ISS performed well in mortality prediction of firearm injuries. By comparing the mean values of the present study to Ozdemir et al study, We can find that the mean GCS (13.41) in Ozdemir et al study was higher than that of the present study GCS (5) , also the mean RTS in Ozdemir et al study was (10.65) which is higher than that of the the present study RTS (4.38), ISS value in the previous study (17.04) which was much lower than that of the present study (44.33), Also the mean TRISS value in the previous study (9.52) was much lower than that of the present study (63.59). the significant differences in the scores values between the two studies can be easily explained by the selectivity of cases in Ozdemir et al as all patients were suffering from firearm injuries which carried better clinical status and outcome compared to the polytraumatized patients in our study.

Deburah et al [29], in the department of surgery, university of Nevada, school of medicine, lass Vegas, Nevada, USA , studied Predictors of mortality in adult trauma patients to prove that the Physiologic Trauma Score is equivalent to the Trauma and Injury Severity Score. Prospective data were analyzed in 9,539 trauma patients evaluated at a Level I Trauma Center over a 30-month period (January 1997 to July 1999). Injury Severity Score (ISS), Revised Trauma Score (RTS), TRISS, Glasgow Coma Score, age, gender, and race were used to predict trauma patients' risk of death. They found that TRISS and ISS were the most predictive of mortality, these results are in agreement of our study.

The conclusions from this study are that the higher APACHEII, ISS, TRISS or TISS, the higher the mortality while the higher RTS & GCS the lower the mortality rate , Physiologic scores RTS, APACHEII, GCS & TISS showed better sensitivity, specificity & accuracy than the anatomical score ISS. The combined score TRISS performed better than the isolated anatomical and physiological scores. TRISS is the most sensitive trauma score available till now. It should be learned by all the physicians working in the field of trauma as in ER and critical care. There is a need for a new score model that is easy to apply in polytraumatized patients and intensely reflects the patient status to improve the discrimination ability. In addition this score model should be well calibrated to be applied in developing countries.

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