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Full Length Research Paper

Triage of the Pediatric Polytrauma Patient

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As trauma is the leading cause of mortality in patients under the age of 35 years optimizing both pre-hospital and initial in-hospital care is of utmost importance. Many different scores have been proposed. The aim of the present retrospective study was to compare the predictive value of two pediatric trauma scores: the pediatric trauma score (PTS) and the modified injury severity scale (MISS). The study population consisted of 84 patients (64 boys and 20 girls) admitted to the intensive care unit of the Garrahan Hospital between November 11, 1987 and August 1, 1991 with a diagnosis of polytrauma. For each score the level of severity of injury of the children in the study population was determined. The predictive abilities of the scores were analyzed as to final outcome (survival-death), sensitivity, specificity, and positive and negative predictive value of the PTS with a cut-off point of 3 or less and of the MISS with a cut-off point of 25 or more. PTS with a cut-off point of 3 or less had both a high specificity and a high predictive value accurately discriminating the cases with a low risk of mortality (94%). The positive predictive value was somewhat less, but still satisfactory for the detection of the patients with a high risk of mortality (66%). With a cut-off point of 25 or more, the predictive accuracy of the MISS was similar to that of the PTS with a slightly higher sensitivity (83%) and specificity (78%) However, the positive predictive value was low (38.5%) and the negative predictive value was 96.7%. In conclusion, in the pre-hospital stage on the site of the accident and during the initial care at the hospital the PTS demonstrates to be a very useful tool to assess injury severity of the patient, to decide on the first treatment measures, and to evaluate the degree of complexity of care the patient needs.

Keywords: Triage, score, politrauma, children.

INTRODUCTION

As trauma is the leading cause of mortality in patients under the age of 35 years optimizing both pre-hospital and initial in-hospital care is of utmost importance (Najarian, 1992). A tool of vital importance in this process is the adequate triage of the clinical severity of the patient. This triage does not only allow us to correctly indicate the first therapeutic measures, but also to effect appropriate triage decisions (Asensio, 1991) according to the severity score of the patient.

Many different scores have been proposed (Peter et al., 1993). Some scores are taken at the trauma scene while others are done on admission to the intensive care unit. There are scores that are mainly physiological and others that use anatomic and topographic criteria to assess the magnitude of trauma.

A trauma score should easy to use, define the most important aspects for the evaluation of the patient, and require readily available data to facilitate medical decision-making processes. The score should also have high sensitivity and specificity in its predictive value of morbidity and mortality. Finally, the score should provide the possibility to retrospectively analyze the quality of medical care and to compare results to those obtained at other centers.

MATERIAL AND METHODS

The study population consisted of 84 patients (64 boys and 20 girls) admitted to the intensive care unit of the Garrahan Hospital between November 11, 1987 and August 1, 1991 with a diagnosis of polytrauma. Ages ranged between 2 months and 17 years with a mean of 7.15 years (SD: 3.61).

All patients that had received medications that could have modified their vital signs were excluded from the

Table 1. Pediatric Trauma Score

Component	Category		
	+2	+1	-1
Weight	>20 Kg	10-20 Kg	<20 Kg
Airway	Normal	Maintainable	Not maintainable
Systolic blood pressure	>90mm Hg or palpable radial pulse	90-50mm Hg or palpable femoral pulse	<50mm Hg or non-palpable pulse
Central nervous system	Awake	Obtunded or loss of consciousness	Comatose or decerebrate
Open wounds	None	Minor	Major or penetrating
Skeletal	None	Closed fracture	Open or multiple fractures

study.

All patients were evaluated by two scores to assess the severity of the trauma

a- PTS: assesses weight, airway stability, systolic blood pressure, the degree of neurologic involvement, presence of and severity of wounds, and bone fractures (Table 1). The total score ranges from 12 points (best outcome) to -6 (incompatible with survival). It is considered that a child with a PTS score below 9 points should be admitted to a pediatric intensive care unit.

b- MISS: this is an adapted version for pediatric patients of the adult injury severity score. The difference between the two scores is that the MISS includes the Glasgow Coma Score for neurologic evaluation and does not exclude burn injuries. The MISS is an anatomic score assessing the following body regions: 1) central nervous system; head and neck; 2) chest; 3) abdomen; and 4) extremities and pelvic girdle. The degree of injury is calculated by the Abbreviated Injury Scale (AIS) that assesses increasing severity ranging from grade 1 to 6 (1: minor; 2: moderate; 3: serious but not life threatening; 4: severe, life threatening; 5:critical, survival uncertain; 6: unsurvivable) in each of the body regions considered.

The MISS is calculated by summing the squares of the AIS scores of the three most compromised body regions. The MISS values range from 3 (greatest probability for survival) to 75 (least probability for survival) (Table 2).

For each score the level of severity of injury of the children in the study population was determined.

A PTS between 12 and 9 was considered as moderate trauma, between 8 and 4 as severe trauma, between 3 and 1 as a high risk of death, and between 0 and -6 as improbable survival.

A MISS[9] score between 3 and 25 was considered as mild trauma, between 26 and 45 as moderate trauma, and a MISS score of 46 or higher was considered as severe trauma.

Finally, the predictive abilities of the scores were analyzed as to final outcome (survival-death), sensitivity, specificity, and positive and negative predictive value of the PTS with a cut-off point of 3 or less and of the MISS with a cut-off point of 25 or more.

RESULTS

Table 3 shows that the PTS with a cut-off point of 3 or less had both a high specificity and a high predictive value accurately discriminating the cases with a low risk of mortality (94%). The positive predictive value was somewhat less, but still satisfactory for the detection of the patients with a high risk of mortality (66%).

With a cut-off point of 25 or more, the predictive accuracy of the MISS was similar to that of the PTS with a slightly higher sensitivity (83%) and specificity (78%) (Table 4). However, the positive predictive value was low (38.5%) and the negative predictive value was 96.7%.

DISCUSSION

The PTS is a useful tool for the triage of the patient at the trauma scene. The score is easy to memorize, fast to apply, and has a physiological profile that allows immediate decision making. The PTS also meets the objective parameters to be used in the records of the different operators in the process. In the present study, the PTS proved to be more accurate in the prediction of final outcome of the patients than the MISS which characterizes injury severity within the different anatomic regions with equal values without assessing overall severity (Mark et al., 1996).

The MISS also suffers from other important limitations. Any mistake in the calculation of the AIS translates into an error in the MISS; a wide range of lesions of varying severity is evaluated by the same score and thus, patients with a similar MISS value resulting from multiple combinations of injury patterns may have very different prognoses.

The inclusion of the Glasgow Coma Score in the MISS is important as it prioritizes brain injury, which accounts

Table 2. Modified Injury Severity Scale (MISS)

Body Area	1: Minor	2: Moderate	3: Severe	4: Severe, life-threatening	5: Critical, survival uncertain
Neural, face, and neck	GCS score 13-14 Contusion of eye Conjunctival hemorrhage Fractured teeth	GCS score 9-12 Undisplaced facial bone fracture Laceration of eye	GCS score 9-12 Avulsion of optic nerve Displaced facial fracture	GCS score 5-8 Bone or soft-tissue injury with minor destruction	GCS score 4 Injuries with major airway obstruction
Chest	Muscle ache	Simple rib or sterna fracture	Multiple rib fractures Pulmonary contusion Hemothorax or pneumothorax Diaphragnatic fracture	Open wounds Pneumomediastinum Myocardial contusion	Tracheal laceration Aortic laceration Hemomediastinum
Abdomen	Wall hematoma	Major abdominal-wall contusion	Contusion of intra-abdominal, retroperitoneal or extraperitoneal organs Thoracic or lumbar spine fractures	Minor laceration of abdominal organs Bladder rupture Spine fractures with paraplegia	Rupture or severe laceration of abdominal vessels or organs
Extremities and pelvic girdle	Minor sprains and simple fractures	Open fractures of digits Nondisplaced long bone or pelvic fractures	Displaced long bone or multiple hand or foot fractures Simple open fractures Pelvic fractures with displacement Laceration of major nerves or vessels	Multiple closed long bone fractures Amputation of limbs	Multiple open long bone fractures

Table 3. Outcome of Polytrauma Patients According to PTS with a Cut-off Point of 3

Cut-off Point	Outcome		Total
	Dead	Alive	
<3	8	4	12
3 or more	4	110	72
Total	**12**	**72**	**84**

PTS with a cut-off point of 3 or more: Sensitivity 66%; Specificity 94%; Positive predictive value 66%; Negative predictive value 94%.

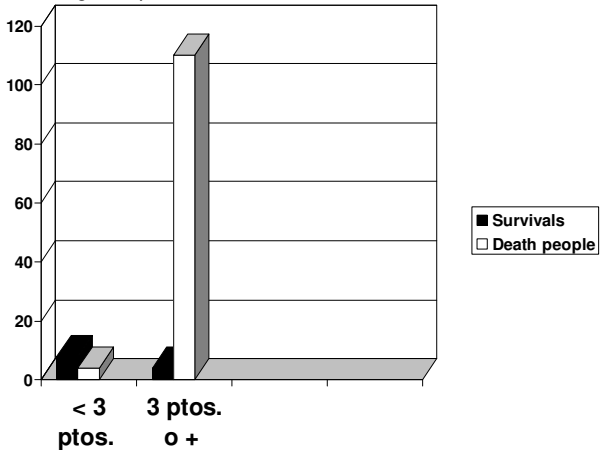
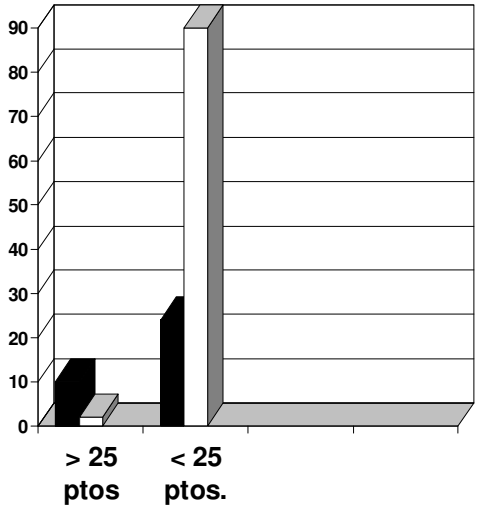


Table 4. Outcome of Polytrauma Patients according to MISS with a Cut-off Point of 25

Cut-off Point	Outcome		Total
	Dead	Alive	
25 or more	10	24	26
< 25	2	90	72
Total	**12**	**72**	**84**

MISS with a cut-off point of 25 or more: Sensitivity 10/12 83%; Specificity 56/72 78%; Positive predictive value 38.5%; Negative predictive value 96.7%.



for 50% of mortality in pediatric polytrauma patients. It allows, unlike the ISS for adults, to simplify the neurological evaluation and achieve a more homogeneous diagnosis among different disciplines.

In spite of these advantages, the score still fails to distinguish severity among different types of trauma. An example may be a patient with brain injury and a Glasgow coma score of 4 who would have a value of 25 on the MISS and has a higher risk of mortality than a patient with a value of 27 due to pulmonary contusion (9 points) that may be mild, splenic contusion (9 points), and multiple fractures of the hands and feet (9 points).

The exclusion of an injury in the same region, based on selection according to severity, may lead to errors in the prediction of mortality. An example would be a patient with a single lesion in the abdomen (AIS: 5 points) and another with various lesions (AIS: 5 points) who have the same final MISS value of 25 points.

The usefulness of Severity Scales in pediatric polytrauma patients is undisputable. They are probably most important in the pre-hospital stage in the decision-making process to get the patient to the adequate facility with the appropriate infrastructure in a timely fashion (Daniel et al., 1994).

A score that combines both physiological and anatomical aspects is likely to be the most complete. An example of such score is the Trauma Score with Injury Severity Score (TRISS).

Nevertheless, the PTS has proven to be extremely valuable mainly in the pre-hospital stage. The MISS with incorporation of the Glasgow Coma Score and a cut-off point of 25 or more showed to be useful for injury assessment during the in-hospital stage. Both scores provide appropriate predictive values of injury severity for pediatric patients and are easy to use (Dello et al., 1993).

CONCLUSION

In the pre-hospital stage on the site of the accident and during the initial care at the hospital the PTS demonstrates to be a very useful tool to assess injury severity of the patient, to decide on the first treatment measures, and to evaluate the degree of complexity of care the patient needs.

The MISS is a useful predictive tool once the patient is admitted to the intensive care unit of choice.

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