

## The Utility of the Predictive Scores in Polytrauma with Abdomino-pelvic Injuries: A Series of 38 Patients

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### Rezumat

#### *Utilitatea scorurilor predictive în politraumatismele cu leziuni abdomino-pelvine: o serie de 38 pacienți*

Trauma reprezintă cauza principală de deces în cadrul populației cu vârsta sub 40 ani. Scopul studiului a fost compararea scorurilor traumatice predictive și demonstrarea utilității acestora în evaluarea calității tratamentului pacienților politraumatizați.

**Material și metodă:** Am realizat un studiu retrospectiv pe perioada 2000-2011 în care am urmărit pacienții politraumatizați cu leziuni abdominale și fractură de bazin la care s-au efectuat laparotomii de urgență. Am calculat scorurile traumatice ISS, GCS, RTS, TRISS, ASCOT și scorul W pentru evaluarea calității tratamentului.

**Rezultate:** La 38 de pacienți am obținut informații necesare calculării scorurilor predictive. Comparând valorile obținute la pacienți care au supraviețuit și la cei care au decedat, factorii cu rol predictiv în privința mortalității au fost următorii: GCS 13,74 vs. 6,13 ( $p < 0,0001$ ), ISS 28,52 vs. 35 ( $p = 0,0169$ ), RTS 6,96 vs. 3,07 ( $p < 0,0001$ ), TRISS 84,67% vs. 28,7% ( $p < 0,0001$ ), ASCOT 10,34% vs. 64,32% ( $p < 0,0001$ ). Scorul W pentru metodologia TRISS a fost -2,05 ( $p = 0,7997$ ) iar pentru metodologia ASCOT -7,81 ( $p = 0,336$ ). Mortalitatea reală a fost 39,47%, fără semnificație statistică față de predicția scorurilor traumatice mixte.

**Concluzii:** Nu am constatat diferențe în privința predicției mortalității între metodologia TRISS și ASCOT ( $p = 0,5401$ ).

Oricare poate fi folosit pentru predicția evoluției pacientului politraumatizat iar scorul W este util în evaluarea calității tratamentului.

**Cuvinte cheie:** leziuni abdominale, fractură de bazin, scoruri predictive

### Abstract

Trauma is the principal cause of mortality among the population under 40 years. The aim of our study was to compare predictive trauma scores and demonstrate their utility in the evaluation of the quality of care in polytrauma. **Material and methods:** A retrospective study was performed between 2000-2011 including polytrauma patients with abdominal lesions and pelvic fracture who underwent emergency laparotomy. We calculated ISS, GCS, RTS, TRISS, ASCOT trauma scores and W score for evaluation of treatment quality.

**Results:** We obtained the necessary data to calculate the predictive scores in 38 cases. Comparing the scores of the survivals and non-survivals we noted the following regarding mortality predictive scores: GCS 13.74 vs. 6.13 ( $p < 0.0001$ ), ISS 28.52 vs. 35 ( $p = 0.0169$ ), RTS 6.96 vs. 3.07 ( $p < 0.0001$ ), TRISS 84.67% vs. 28.7% ( $p < 0.0001$ ), ASCOT 10.34% vs. 64.32% ( $p < 0.0001$ ). The W score in TRISS and ASCOT methodology was -2.05 ( $p = 0.7997$ ) and -7.81 ( $p = 0.336$ ), respectively. There was no statistically significant difference between actual and predicted mortality, the former being 39.47%.

**Conclusion:** We did not observe differences between the two methodologies TRISS and ASCOT in mortality prediction

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( $p=0.5401$ ). Both of them can be used to predict polytrauma patient evolution. The W score is useful in treatment quality assessment.

**Key words:** abdominal injuries, pelvic fracture, predictive scores

## Introduction

Trauma is one of the major health problems worldwide, causing about 10% of all deaths occurred (1). In the case of trauma patients, mortality may be influenced by the severity of the injury, the patient's age, comorbidities and the efficiency of diagnostic methods and treatment. Trauma score systems convert the severity of traumatic injury in numbers (2). The common language given by predictive scores may represent the base of quality control in trauma patient care.

The aims of this study are the following:

- comparing the 5 predictive trauma scores: Glasgow Coma Scale (GCS), Revised Trauma Score (RTS), Injury Severity Score (ISS), Revised Trauma Injury Severity Score (TRISS) and A New Severity Characterisation of Trauma (ASCOT);
- assessment of treatment effectiveness in trauma patients by comparing the real and predicted mortality;
- identifying factors influencing trauma patient mortality.

## Material and Methods

This retrospective study was performed on 38 trauma patients who were admitted to Tg-Mures County Emergency Hospital during 2000-2011 and operated on Surgical Department No. 1 and 2.

Criteria for inclusion in the study:

- trauma patients with pelvic fracture, with hemodynamic instability or signs of acute abdomen;
- $ISS \geq 16$ ;
- emergency laparotomy;
- blunt trauma;

Criteria for exclusion from the study:

- polytraumatized patients without pelvic fracture
- $ISS < 16$
- patients with nonoperative management
- penetrating trauma

We noted the age and gender of patients, the mechanism of injury, the systolic blood pressure and hematocrit values on the arrival to the emergency room, and the severity of abdominal injuries associated with pelvic fractures. We followed the difference between the results of trauma scores and real results achieved and we calculated the W score, resulting from the number of patients who survived minus expected survival rate, divided by the total number of patients and multiplied by 100, for the projection of predictive scores on 100 patients ( $W = (\text{real survival} - \text{expected survival}) / (\text{total number of patients}) \times 100$ ). The data obtained were processed with the help of statistic functions by using Microsoft Excel and Graphpad software. For statistical calculations we used the Student *t* test. P values lower than 0.05 were considered as statistically significant.

## Results

During the period 2000-2011 a total of 522 patients underwent surgery for abdominal trauma, of which 48 cases with abdominal trauma (9.19%) were associated with pelvic fracture. We obtained the information needed to calculate predictive scores in 38 of these cases. In this group of patients there were 28 men and 10 women. The average age of patients was 47.21 years. Abdomino-pelvic polytrauma lesions occurred after road accidents in 25 cases (20 motor vehicle crashes, 3 motorcycles, 2 rail accident,) by falling from height in 8 cases and crush injury in 5 cases. The average survival probability based on TRISS methodology was 62.58%. Thereby the expected survival is 23.78 patients. Mean probability of death based on the ASCOT methodology was 31.64%. So the expected survival is 25.97 patients. Emergency surgery was based on achieving hemostasis and peritoneal decontamination. In *Table 1* the abdominal lesions associated with pelvic fracture among our group of patients are listed. *Table 2* shows the performed surgical procedures. Therapeutic angiography was not performed for the treatment of parenchymal organ lesions or pelvic injuries. The study did not include nontherapeutic laparotomies. Mortality in the studied group was

**Table 1.** Abdominal injuries associated with pelvic fractures

Abdominal organ lesions	Nr. of cases
Retro- and subperitoneal vessels	38
Spleen	11
Liver	10
Urinary bladder or ureter	9
Intestine or mesentery	5
Colon or mesocolon	4
Kidney	2
Pancreas	2
Total	81

**Table 2.** The performed surgeries

Surgical procedures	Nr. of cases
Pelvipitoneal packing	11
Splenectomy	9
Hepatoraphy	9
Cystoraphy, cystostomy	9
Intestinal resection	4
Splenopancreatectomy	2
Colostomy	2
Gastroraphy	1
Atypical liver resection	1
Hypogastric artery ligature	1

**Table 3.** *W score calculation*

All patients	Expected mortality TRISS/ASCOT	Actual mortality	Actual survival	Expected survival TRISS/ASCOT	W score TRISS/ASCOT
38	14.22/12.03	15	23	23.78/25.97	-2.05/-7.81 p=0.7997/p=0.336

39.47% (15/38). There were two intraoperative deaths, and in 10 cases the patient's death occurred within 24 hours from the accident. In case the death occurred on the first day the determining factor was hemorrhagic shock. There were 3 cases in which patients died on postoperative days 8, 16 and 17, due to pulmonary embolism, pneumonia and sepsis, respectively.

By calculating the W score a difference of 2.05 was noted between real and expected mortality based on TRISS methodology. The difference calculated at 100 patients by ASCOT methodology was 7.81. (Table 3) Differences are not statistically significant ( $p = 0.7997$  and  $p = 0.336$ ).

In Table 4 the factors having a predictive role in terms of the mortality of patients with severe trauma associated with pelvic fracture are displayed.

## Discussion

From 522 patients operated in Surgical Department No. 1 and 2 from Tg.-Mures County Emergency Hospital between 2000-2011 for injuries caused by abdominal trauma, in 48 cases (9.2%) abdominal trauma was associated with pelvic fracture. The prevalence of pelvic fracture in case of blunt trauma ranges from 5-11.9%, representing 2-8% of skeletal lesions (3). Among polytrauma patients with blunt trauma, almost 20% had pelvic lesions, with an incidence of 37/100.000 persons per year (4). Based on the current study and the literature data, the frequency of pelvic fracture among polytrauma patients with blunt trauma is 10%. Pelvic fracture incidence seems to be increasing as a consequence of the increased number of road accidents due to high-energy trauma in adults. Due to airbags and safest car models the increasing number of patients who survive such accidents is ascertained (4).

The mean age of patients in the survival and the non-

survival group was  $43.96 \pm 2.87$  and  $52.20 \pm 4.20$  years, respectively. Although we found a difference of 8 years in the average age of the survivals and non-survivals, it was not statistically significant ( $p = 0.10$ ).

Mean GCS in patients who survived was  $13.74 \pm 0.36$ , and  $6.13 \pm 0.96$  in patients who died, resulting a statistically significant difference between the two groups of patients. ( $p < 0.0001$ ). There was a significant difference ( $p = 0.0169$ ) between the dead and living patients and the mean ISS values in the two groups. Ali and colleagues found that ISS's final value is higher in polytrauma patients who underwent laparotomy, than in the case of those who were treated conservatively. This is due to the fact that laparotomy gives detailed information on intra-abdominal injuries. Since the ISS in the laparotomized group of patients is higher, Ali concluded that the ISS is a strong predictor of the need to perform laparotomy (5). In our group the indication for laparotomy was based on lesion severity and haemodynamic instability or the presence of signs of peritoneal irritation.

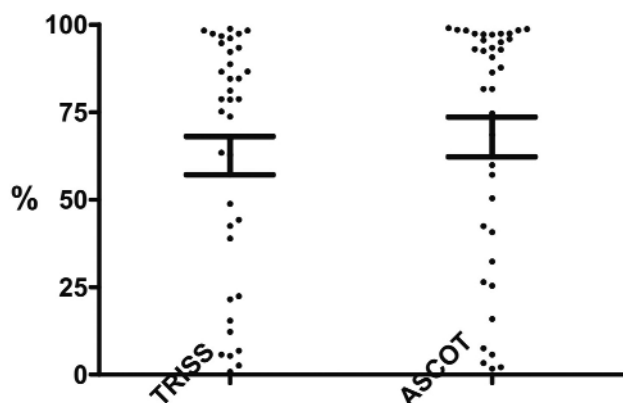
Systolic blood pressure in the survivals group was  $85.04 \pm 3.82$  mmHg and  $57.60 \pm 3.19$  mmHg in the non-survivals group ( $p < 0.0001$ ). Hematocrit level in the two groups, respectively was  $23.32\% \pm 0.84$  and  $19.00\% \pm 1.30$ . Statistically significant difference was found ( $p=0.0061$ ). Ali and colleagues noted that the severity of pelvic fracture is not a predicting factor regarding mortality and performing laparotomy. Related lesions are more important in the context of mortality than the type of the pelvic fracture. Hypotension and anemia are predictive factors of laparotomy and mortality regardless of the presence or absence of a pelvic fracture (5).

GCS, especially verbal and motor components, and RTS are the most effective predictors of survival, with small difference between them (6). In our study the difference of RTS between the two groups is statistically significant ( $p < 0.0001$ ).

Mean survival probability based on TRISS methodology was 62.58%. Mean TRISS score in patients who survived was  $84.67\% \pm 3.00$ , and  $28.7\% \pm 6.65$  in patients who died ( $p < 0.0001$ ). There was unexpected survival in one case against 42.5% probability, predicted by TRISS (Z score = - 0.22). Although TRISS methodology is widely used to predict the result of trauma, it has some limitations. An insufficiency of TRISS methodology is its inability to quantify multiple injuries occurring in the same body region. Similar to RTS, intubated patients should be excluded because respiratory rates and verbal responses can not be obtained. Siritongtaworn studying TRISS methodology on a number of 1487 patients reported a sensitivity of 97% and a specificity of 91% (7).

**Table 4.** *Predictive factors on mortality*

Factor	All patients (mean)	Survival (mean)	Non survival (mean)	p value
GCS	10.73	13.74	6.13	< 0.0001
ISS	31.07	28.52	35.00	0.0169
RTS	5.42	6.96	3.07	< 0.0001
TRISS (%)	62.58	84.67	28.70	< 0.0001
ASCOT (%)	31.64	10.34	64.32	< 0.0001
SBP (mmHg)	74.21	85.04	57.60	< 0.0001
Htc (%)	21.61	23.32	19.00	0.0061



**Figure 1.** Comparison of survival probability based on TRISS and ASCOT methodology

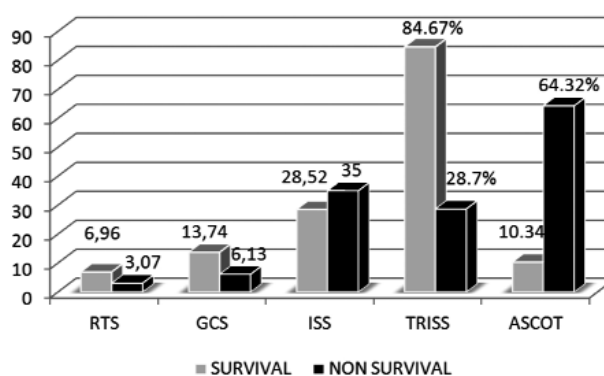
Mean probability of death based on the ASCOT methodology was 31.64%. Mean ASCOT score in patients who survived was  $10.34\% \pm 3.18$ , and  $64.32\% \pm 8.05$  in patients who did not survive ( $p < 0.0001$ ). In one case, despite 57.6% probability of ASCOT predicted death, the patient survived ( $Z$  score = 0.21).

Further on the two predictive score systems TRISS and ASCOT were compared. For the two methodologies to be comparable, probability of death obtained by ASCOT score was converted into a probability of survival by subtracting from 100 in each case separately. Paired comparison is made for the probability of survival (Fig. 1). There is no statistically significant difference between the values obtained with the two methodologies ( $p = 0.5401$ ).

Okasha and colleagues (1) found a statistically significant positive correlation between increased mortality and high values of ISS and TRISS, respectively low value of RTS and GCS. While anatomical description of the lesion provides an image on the severity of injuries and reflects the force that caused the damage, physiological parameters reflect the disturbance of body and the compensatory responses to these injuries. Okasha's study revealed that physiological scores tend to work better than anatomic scores (1).

Eryilmaz and colleagues found that anatomic score (ISS), combined score (TRISS) and physiological score (RTS) are trauma scores that give the best results in predicting trauma patients' evolution (8). We found no statistically significant difference between ISS, RTS, TRISS and ASCOT in predicting mortality, concluding that there was no difference in mortality prediction between physiological and anatomical score systems (Fig. 2).

Based on the calculation of the  $W$  score it is possible to quantify treatment effectiveness in the case of trauma patients. Differences between  $W$  score values are not statistically significant ( $p = 0.7997$  and  $p = 0.336$ ). It validates that the efficacy of treatment for laparotomized patients with abdomino-pelvic injuries was appropriate.



**Figure 2.** Ratio of different predictive scores (anatomical, physiological and mixed)

## Conclusions

By performing this study we found that there is no difference between predictive anatomical, physiological and mixed scores in predicting mortality of trauma patients with associated abdomino-pelvic lesions. Hypotension and anemia are predictors of mortality. Based on objective criteria ( $W$  score), the evaluation of treatment quality for trauma patients allows comparative studies between trauma centers. This would help improve diagnostic methods and treatment.

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