

Assessment of Abdominal Trauma Penetrating Index for Detecting of Patients' Morbidity and Mortality

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Original Article

Summary

Background: The Penetrating Abdominal Trauma Index used to identify trauma patients at risk of postoperative complications. Methods of trauma quantification have been extensively developed but their outcome evaluations have been naïve, subject only to basic statistical analyses.

Objective: To evaluate PATI for predicting the morbidity and mortality in penetrating abdominal trauma.

Patient and Methods: This was a prospective study over an 11-month period; patients with penetrating abdominal trauma who underwent laparotomy were enrolled. Initial assessment of the patients was done following the ATLS guidelines. Patients were stratified on the basis of those who developed complications, no complications and postoperative Mortality. PATI was calculated based on operative findings and the outcomes were measured on the basis of complications or mortality in the postoperative period.

Results: Eighty-nine consecutive patients underwent laparotomy for abdominal trauma, 39 for built wounds and 50 for shells wounds. Patients with complications scored a mean PATI of 21.47; those who died scored a mean PATI of 25.29. ROC curve analysis of PATI scores in patients who developed complications showed results of 42.1%.

Conclusion: The statistical evaluation of trauma scores should be performed using an adequate methodology to avoid naïve evaluations. ROC curve evaluation of this trauma score index allows a comprehensive study of the instrument's performance avoids data simplification and permits cross analysis of different trauma score indexes

Keywords: Penetrating Abdominal Trauma Index, Morbidity, Mortality, Instrument Performance

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1. INTRODUCTION

Trauma continues to be the most frequent cause of death in the first four decades of life and is a major public health problem in some countries(1) In war conditions, abdominal injuries are very common, aggravated by a significant number of complications, prolonged treatment, and a mortality rate that cannot be neglected. The time factor is of essential importance for the outcome of treatment.(2) The frequency of abdominal injuries in war conditions has increased with the development of military technology: 2% in World War I, 4% in World War II,(3). In the Vietnam War, the percentage of abdominal injuries was 13.84% (4) more recent studies, based on smaller series of wounded in Afghanistan and the Arabian Gulf found abdominal injury frequencies of 12% and 11%, respectively. Rignaut thinks the frequency of abdominal injuries is close to 20% on the battlefield, but half of the wounded die from loss of blood immediately upon wounding (3-2).

The peak age incidence was 15-29 years (3) In 1981 Moore and colleagues developed the Penetrating Abdominal Trauma Index (PATI) (1). Which was used to identify trauma patients at risk of postoperative complications? Methods of trauma quantification have been extensively developed but their outcome evaluations have been naïve, subject only to basic statistical analyses. The accuracy of PATI was assessed by means of Receiver Operating Characteristics (ROC) curve analysis (4-5).

To evaluate PATI by means of ROC curve analysis and establish its sensitivity and specificity for predicting the morbidity and mortality in penetrating abdominal trauma Moore and colleagues facilitated identification of the patient at high risk of post-operative complications when they developed the Penetrating Abdominal Trauma Index (PATI) scoring system for patients whose only source of injury was penetrating abdominal trauma. (6)A complication risk factor was assigned to each organ system involved, and then multiplied by a severity of injury estimate. Each factor was given a value ranging from 1 to 5. The complication risk designation for each organ was based on the reported incidence of post-operative morbidity associated with the respective injury. Early death secondary to exsanguinations hemorrhage has been replaced by delayed death due to infection (6)The risk factors influencing mortality and morbidity in these civilian settings have been studied (7) Elsewhere, prolonged prehospital time,

inadequate supply of blood for transfusions and the high rate of colon injury contribute to a relatively high incidence of postoperative infectious complications and death (8-9). It was determined that PATI Score, number of postoperative complications per patient and presence of shock on admission were independently significant factor in predicting mortality in patients with abdominal trauma. The severity of injury was estimated by a simple modification to the Abbreviated Injury Scale, where 1 = minimal injury to 5 = maximal injury. The sum of the individual organ score times risk factor comprised the final Penetrating Abdominal Trauma Index (PATI) (10).

Abbreviated injury scale

The Abbreviated Injury Scale (AIS) was developed in 1971. The AIS grades each injury by severity from 1 (least severe) to 5 (survival uncertain), within six body regions (head/neck, face, chest, abdominal/pelvic contents, extremities, and skin/general. The AIS has been periodically upgraded and AIS-90 is currently being revised. (11)

In 1974, Baker et al created the Injury Severity Score (ISS) to relate AIS scores to patient outcomes. ISS body regions are listed in Figure below The ISS is calculated by summing the square of the highest AIS scores in the three most severely injured regions. ISS scores range from 1-75 (since the highest AIS score for any region is 5). By convention, an AIS score of 6 (defined as a non-survivable injury) for any region becomes an ISS of 75.

ISS body regions. (12-13)

The ISS only considers the single, most serious injury in each region, ignoring the contribution of injury to other organs within the same region. Diverse injuries may have identical ISS but markedly different survival probabilities (ISS of 25 may be obtained with isolated severe head injury or by a combination of lesser injuries across different regions). (12-15) Also, ISS does not have the power to discriminate between the impact of similarly scored injuries to different organs and therefore cannot identify, for example, the different impact of cerebral injury over injury to other organ systems. In response to these limitations, in 1997, the ISS was modified to become the New Injury Severity Score (NISS) as the simple sum of the squares of the three highest AIS scores regardless of body region NISS is able to predict survival outcomes better than ISS.

Calculation of the PATI from MOORE et al:

Based on assigning a complication risk factor (x) to each organ system involved and grading each organ injury (12)

1 = minimal

2 = minor,

3 = moderate

4 = major

5 = maximum

Patient evaluation

- 14 organs are examined
- The risk associated with injury to each organ is graded from 1 to 5.
- The estimated severity of each type of injury is graded from 1 to 5.
- The percent injury to an organ wall probably indicates the portion of the entire circumference involved. (13)

Organ score = (risk factor) * (injury estimate)

Penetrating abdominal trauma index (PATI) = SUM (all injured organs)

Interpretation:

- minimum PATI: 0
- Maximum PATI: 200(9-16)

Complications: (17)

1. Intra-abdominal abscesses
2. Evisceration.
3. Wound infection.
4. Urinary tract infection.
5. Urinary retention.
6. ARDS.
7. Sepsis
8. MOFS.
9. Pulmonary embolism.

2. PATIENTS and METHODS

This is a prospective study which carried on 89 patients who were admitted in the third surgical unite in two teaching hospital during a period of 11 months. (86 male and 3female) who arrived in the emergency room with penetrating abdominal Trauma by shell wound or gunshot wound, and underwent exploratory laparotomy after evaluation by the general surgeon.

All those patients were subjected to different kinds of surgery.

Excluded all patients who had no lesion at laparotomy or died during the first 24 hour postoperative.

Each patient with penetrating abdominal trauma considered for laparotomy is assigned a PATI score after laparotomy abdominal evaluation in our unite. Patients received standard post-surgical care at the intensive care unit when needed and/or general surgical hospitalization care if not amenable to the ICU.

Complications and/or the cause of death were recorded and tabulated against the PATI scores. After laparotomy, PATI was assigned to each patient calculating the risk factor per organ injured and multiplying by the severity of injury estimate. Complications were recorded during the hospitalization period and this outcome was managed as a dichotomous variable, that is, patients who had postoperative complications and patients who had no complication until the time of discharge. The severity of trauma outcome was also analyzed as dichotomous variable, thus, patients were stratified as survivors or deaths.

Statistical analysis

Mean score results for the two subsets of populations were obtained by analysis of variance (ANOVA) of the difference of points obtained by each subset of patients i.e. complicated vs. non-complicated and survival vs. non-survival. Logistic regression analysis was performed to determine the association of the relative predictive power of the independent variable with respect to the categorical dichotomous complication/no complication and survival/death dependent variables. And statistical analysis according to the Model Chi-Square statistic and dominant epitasis (12:3:1) to shows the relation of increasing PATI to complication and non-survival according to P value.

3. RESULTS

Eighty-nine consecutive patients admitted for penetrating abdominal trauma who underwent laparotomy were included in the analysis. The mean age was 27.10 ± 9.98 yrs. with a range of 14 to 69. Eighty-six patients were male, 3 patients female. 55.1% lesions were caused by shell wounds whereas 44.6% by gunshot wounds to the abdomen.

PATI results in the Complications/No complication:

subset of patients When stratified as subsets of populations, mean PATI score in patients who developed complications was 21.47 ± 12.97 , in contrast with those who did not complicate for whom the score was 11.24 ± 8.33 (Table 2).

Figure 1 Depicts this, PATI separated complicated from non-complicated patients but overlapping is present. As obtained from the logistic regression model we can assume that patients with PATI scores of 22 are 1.09 (95% CI 1.04 to 1.16) times more likely to present with Complications than those with lesser score points.

PATI results in the Death / Survivors subset of patients:

Mean PATI score in patients who died was 25.29 ± 15.98 , compared to the patients who survived (which account for all those who complicated and did not complicate) that was 12.41 ± 9.15 (Table 4+5). Figure 2 shows how survivors are separated from non-survivors according to increasing PATI scores, although, overlapping exists as in almost all injury scores. The logistic regression model depicts that patient with this score of 25 or more are 1.08 (95% CI 1.02 to 1.16) times more likely to die when compared to patients scoring less points. According to the result of our study which shows in table 6 and when did statistical analysis according to the Model Chi-Square statistic and dominant epistasis (12:3:1) we found that calculated P value (1.8464418) which located between tabulated of (1.39-2.41) and that mean the P value of 0.50-0.30 which is acceptable (not significant). This means that when increase PATI score there is increase the chance of complication and not survival

Table 1. The table shows the gender and cause of trauma

	Number of patients	Percentage
Male	86	96.60%
Female	3	3.37%
Shell injury	50	55.10%
Gun shot	39	44.60%

Table: 2. mean PATI scores in patient who had complicated and not complicated.

PATI scores	Non-complicated cases	Complicated cases
Number of cases	70	19
Mean	11.24	21.47
SD	8.33	12.97
95% CI	9.50-12.97	18.77-24.16

Table 3. The distribution of patient according to PATI scores as complicated and not complicated

PATI scores	Non-complicated cases N=70	Complicated cases N = 19
	n (%)	n(%)
5	63(70.78)	0 (0.0)
10 - 15	7 (7.68)	0 (0.0)
16-25	0 (0.0)	12 (13.84)
26-35	0 (0.0)	2(2.24)
36-45	0 (0.0)	3(3.36)
46	0 (0.0)	2(2.24)
Total	70 (78.7)	19 (21.3)

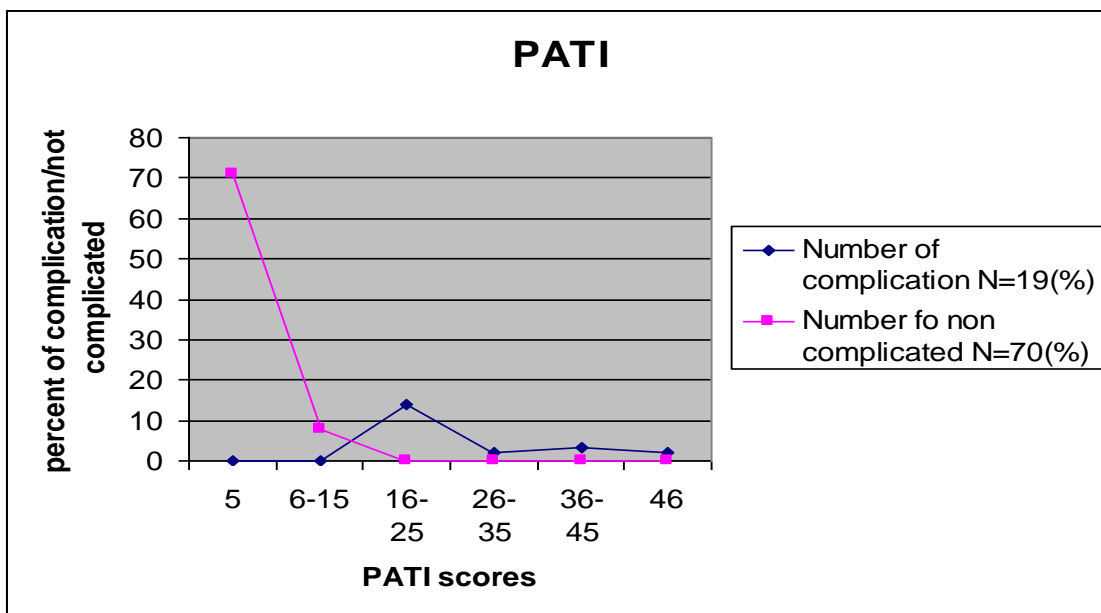


Figure 1 Depicts this, PATI separated complicated from non-complicated patients but overlapping is present.

Table 4. Mean PATI scores in patients who survived and not survive

PATI scores	Survived	Death
Number of cases	82	7
Mean	12.41	25.29
SD	9.15	15.98
95% CI	10.05-14.31	21.97-28.6

Table 5. The distribution of patient according to PATI scores as survival and not survival

PATI scores	Non-complicated cases N=89	Complicated cases N = 7
	n (%)	n(%)
5	63(70.78)	0 (0.0)
10 - 15	7 (7.86)	0 (0.0)
16-25	12 (13.48)	2(2.24)
26-35	2(2.24)	2(2.24)
36-45	3(3.36)	2(2.24)
46	2(2.24)	1.12))1
Total	89	7

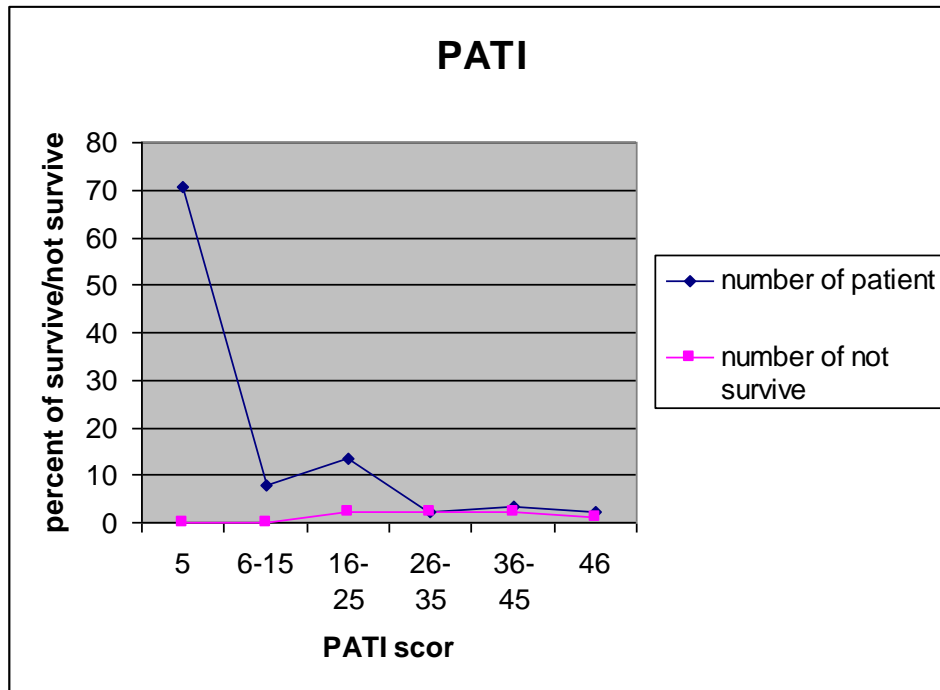


Figure 2: frequency distribution of patients who lived or died stratified by the PATI.

Table 6. The percent of Postoperative complication and death according to PATI score

PATI scores	Number of patient N=89(%)	Number of non-complicated N=70(%)	Number of complication N=19(%)	Number of not survive N=7(%)
5	63(70.78)	63(70.78)	0	0
6-15	7 (7.86)	7 (7.68)	0	0
16-25	12 (13.48)	0	12 (13.84)	2 (2.24)
26-35	2 (2.25)	0	2 (2.24)	2 (2.24)
36-45	3 (3.36)	0	3 (3.36)	2 (2.24)
46	2 (2.24)	0	2 (2.24)	1 (1.12)
total	89	70	19	7

4. DISCUSSION

During the study period, of 11 month Eighty-nine consecutive patients admitted to the emergency department by their penetrating abdominal trauma, whom underwent laparotomy were included in the analysis.

The mean age was 27.10 ± 9.98 yrs. with a range of 14 to 69.

Eighty-six patients were male, three patient's females. 55.1% lesions were caused by shell wounds whereas 44.6% by gunshot wounds to the abdomen this result when compare with the result of study done in Sinai Trauma and Surgery Research Center, University of Tehran, (18) which showed that the a male to female ratio of 22:1. The range age of patients was 8 to 63 years with mean age 27.12 years The peak age incidence was 15-29 years, Thus patients aged 15-44 years accounted for 87% of the Admissions the most common mechanism of injury in their patients was stab wound with 62 (89.9%) cases. PATI in Baghdad affects mainly young men 96.6% Overall, males were affected 28.6 times as female and patients aged 15-44 years This is the most productive age group and this has grave implication for the national economy and for families who depend on these young men and women for survival. Young males are the most common victims because they have more outdoor activities.

In our study, we could observe how increasing PATI score values correlate with complications in the postoperative period and even mortality secondary to complications; this is congruent with the published literature (18). Our aim was then to evaluate how this instrument's performance fits with the standard statistical techniques currently used to assess the models. In our study we found that mean PATI. of patient 11.24 ± 8.3 which is not complicated compared with other study (University Hospital 'Sister milosrdnice', Zagreb, Croatia) (19) when they found that PATI score less than 10 will not develop complication and this is due to that low PATI score mean there is minimal injury to organs and there is no associated injury that may increase the morbidity or mortality and also low score patient need no more logistic service and we expects that patients need no postoperative RCU or farther management in more specialize trauma center and that patients will discharge early from hospital and this will affect the logistic and economic support.(20) .

When PATI score of our patient of 21.47 which developed complication compared with other study (Jose Francisco Gomez-Leon) (21-22) which show that a PATI score of >25 developed serious postoperative complications and this variation is due to well-developed medical services (Improvements of conditions such as, rapid transport of major trauma victims, blood bank services, education of paramedical personnel, and other trauma care systems would result in a significant reduction in patient mortality within the first hours after injury.) And when mean PATI scores of patients who died was 25.29 ± 15.98 which compared to the patients who survived (which account for all those who complicated and did not complicate) that was 12.41 ± 9.15 . the increase morbidity and mortality in patients with high scores is due many factor such as involvement of many organs with severe injury , also associated injury to another area in body such head, chest and compound fracture and also increase the morbidity and mortality (22) is due to lack the proper ways for transport the injured patient to specialized trauma centers and longtime of transport which exposed the patients to long period of bleeding , shock and hypothermia and that effect the decision of surgeon in treatment of patients and the choice of type of repairing the organs such as in case of colonic injury when there is long period between the injury and laparotomy make the surgeon prefer colostomy to primary repairs and make the patients more prone to develop infection and this will increase the morbidity and mortality (23).

Previous studies have shown that in military and civilian abdominal gunshot wounds,

mortality rate rises with the number of intra-abdominal organs injured (24-26). The number of injured organs and the degree of injury depend upon the severity of trauma. When the severity of trauma increases, the number of injured organs, morbidity and mortality also increase. Like others, we determined that there was a positive correlation between the number of organs injured and mortality in univariate analysis. However, the number of organs injured does not accurately quantify the overall severity of injury. The PATI score is a more accurate method of quantifying the extent of damage to different organs and therefore is a more valid index of overall severity of injury. PATI is the most frequently used scoring system to estimate the risk of morbidity and mortality by determination of the severity of trauma in the penetrating injuries. Though this index, defined by MOORE et al., is more important in determining the risk of morbidity, it is also used for mortality (27) the number of injured organs in cases with shell injury is generally more elevated than that in cases with gun injury. Therefore; PATI scores higher in patients exposed to shell injury (28). Our study showed that PATI score correlated with mortality in both univariate and multivariate analysis. PATI has been used to measure injury severity in abdominal trauma in order to assist the surgeon in categorizing the patients at risk of developing complications, and even in decision-making techniques for repairing intra-abdominal organs or shift to damage control surgery which more expansive and time consuming according to its severity score (29-30). This study supports the use of PATI as a useful method of quantifying penetrating abdominal trauma and as a predictor of complications and mortality, Limitations are those of the observational study type, as no experimental groups can be established, confidence evidence level is not the highest, but further robust statistical evaluations of the different trauma indices could produce enough evidence to set statements to encourage their use in the management of the trauma patients in our countries. Several methods to assess abdominal trauma have been evaluated with adequate statistical techniques that quantify sensitivity and specificity, but they include invasive approaches as laparoscopy or image studies. (31, 32) Among the trauma indices that have used this methodology of evaluation are the injury severity score and the new injury severity score. (25) A Trauma index instrument's behavior in categorizing a specific characteristic in trauma patients should be evaluated by methodology that avoids data simplification and therefore base on the conclusions. Obtained by its application. Logistic regression analyses allow evaluations on

how an instrument's performance can be graded with respect to the relative predictive power of a study variable on the effect of a specific characteristic outcome. finally, we found that PATI score of our patients and PATI score of other patients in developed country different in predicted the morbidity and mortality and this due to different in stander level of medical care which affected the outcome so we need another score beside the PATI to evaluate the medical surfaces of country such low, moderate and good surfaces which has direct effect on predicted morbidity and mortality

5. CONCLUSIONS

We conclude that the age of person who prone to trauma is 27.19 years. The increasing PATI score led to increasing the number of complication and increasing the percent of not survival. Patient with high scores needs special care at ICU. And trauma center. Patients with high PATI scores mean that there is massive organs injury and there is associated injury to other area in body and this will increase the morbidity and mortality. Improvement of the conditions such as, rapid transport of major trauma victims, blood bank services, education of paramedical personnel, and other trauma care systems would result in a significant reduction in patient mortality within the first hours after injury.

PATI score is not an enough index to predicate the outcome without studies to evaluate the medical services of the country.

Ethical Clearance : Ethical clearance and approval of the study are ascertained by the authors. All ethical issues and data collection were in accordance with the World Medical Association Declaration of Helsinki 2013 of ethical principles for medical research involving human subjects. Data and privacy of patients were kept confidentially.

Conflict of interest: Authors declared none

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