International Surgery Journal
Essa AA et al. Int Surg J. 2017 Mar;4(3):1014-1018
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20170853

Original Research Article

Prognostic predictors in polytraumatized children and their impact on outcome

Ahmed Abdelhady Essa*, Islam M. El-Shaboury, Mohammed A. Ibrahim, Emadeldien A. Abdelgwad, Mohammed A. Gadelrab

Department of Medicine, Suez Canal University, Ismailia, Egypt

Received: 12 December 2016
Accepted: 08 January 2017

***Correspondence:**
Dr. Ahmed Abdelhady Essa,
E-mail: abdelhady200@yahoo.com

ABSTRACT

Background: Trauma is the leading cause of death and disability in children ≥ 1 year of age. More than 80% of injuries are caused by blunt trauma. Most seriously injured children have multiple injuries. Injury scoring systems are designed to accurately assess injury severity, appropriately triage the injured, and develop and refine trauma patient care. The pediatric trauma scoring (PTS) was devised specifically for the triage of pediatric trauma patients. The pediatric trauma scoring (PTS) was devised specifically for the triage of pediatric trauma patients. The PTS is calculated as the sum of individual scores from six clinical variables. The variables include weight, airway, systolic blood pressure (SBP), central nervous system (CNS) status (level of consciousness), presence of an open wound, and skeletal injuries. Other predicting factors for morbidity and mortality in polytraumatised children include age and gender of the patients, trauma type, arrival interval time, Glasgow Coma Scale (GCS), respiratory rate, heart rate, hematocrit value at admission. These factors can further help to prevent mortality. The objectives of this study were to assess the prognosis of polytraumatised pediatric patients by evaluation of pediatric trauma scoring system and clinical predictors of morbidity and mortality as prognostic predictors of trauma in pediatric patients.
Methods: This was adescriptive study, included 60 polytraumatised pediatric patients who were attended emergency department in Suez Canal University Hospital, Ismailia, Egypt.
Results: This study showed that the mean of the pediatric trauma scoring system was 10±2. According to the nature of the most severe injury, this study showed that 43 % of injuries among patients were of extremities and pelvis nature. According to length of resuscitation time among patients, this study showed that the mean time of resuscitation was 35.5±8.23 minutes. According to the type of treatment done for the patients, this study showed that 72% of the patients didn't need surgical intervention. This study showed that regarding the final outcome of the patients, 68% of the patients were admitted to inpatient.
Conclusions: This study showed that both heart rate and respiratory rate had good sensitivity while both of them had lower specificity. This study showed that GCS good specificity and fair sensitivity. Regarding the PTS, this study showed that PTS had the highest specificity and the highest sensitivity among all the predictors.

Keywords: GCS, PTS, Mortality

INTRODUCTION

Trauma is the leading cause of death and disability in children ≥ 1 year of age. More than 80% of injuries are caused by blunt trauma. Most seriously injured children have multiple injuries.[1] Injury scoring systems are designed to accurately assess injury severity, appropriately triage the injured, and develop and refine

trauma patient care.[2] The pediatric trauma scoring (PTS) was devised specifically for the triage of pediatric trauma patients. The PTS is calculated as the sum of individual scores from six clinical variables. The variables include weight, airway, systolic blood pressure (SBP), central nervous system (CNS) status (level of consciousness), presence of an open wound, and skeletal injuries.[2,3]

Other predicting factors for morbidity and mortality in polytraumatised children include age and gender of the patients, trauma type, arrival interval time, Glasgow Coma Scale (GCS), respiratory rate, heart rate, hematocrit value at admission. These factors can further help to prevent mortality.[4]

The objectives of this study was to assess the prognosis of polytraumatised pediatric patients by evaluation of pediatric trauma scoring system and clinical predictors of morbidity and mortality as prognostic predictors of trauma in pediatric patients.

METHODS

This was descriptive study, the pediatric trauma scoring (PTS) was devised specifically for the triage of pediatric trauma patients. The PTS is calculated as the sum of individual scores from six clinical variables. The variables include weight, airway, systolic blood pressure (SBP), central nervous system (CNS) status (level of consciousness), presence of an open wound, and skeletal injuries.[2,3]

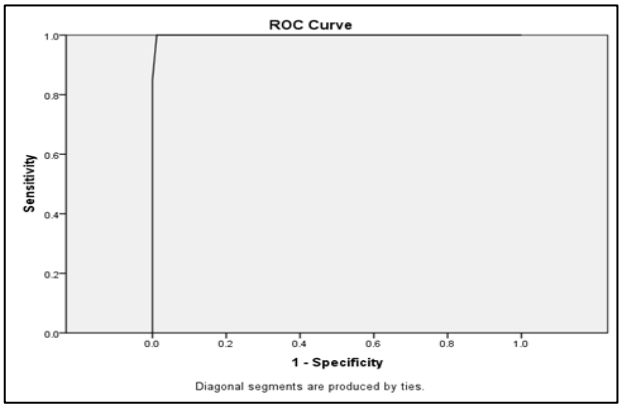
The study included 60 polytraumatised pediatric patients attending emergency department in Suez Canal University Hospital. The inclusion criteria were: 18 Years and younger as ages Eligible for Study, both male and female genders are eligible for Study and polytraumatised pediatric patients. The exclusion criteria include: burn patients, associated systemic diseases, as these co-morbid diseases may affect final outcome. Data was collected in pre-organized data sheet by the researcher. All patients were subjected to the following baseline assessment by history, clinical examination and investigations. Then, the patients were followed up and recorded till they reached one of these final outcome; left before treatment completion, referred to another center, treated and discharged home without disability, treated and discharged home with disability, admitted to ward, admitted to ICU, admitted for emergency surgery and died in emergency room. Later on, the actual outcome of the patient was compared to the expected outcome of the pediatric trauma scoring system and prognostic predictors and the discrepancy in outcome was analyzed and evaluated for justification.

RESULTS

This study revealed that the mean age of the studied patients was 7.45±5.15 with a wide range of (5 - 17), 67% of the studied patients were males. the majority of the patients were in the preschool age (40%), while the minority of the patients was infants group (13%). With around 7% of studied populations were smokers. 58% of the pediatric patients were from rural areas and most of them from Ismailia (78%). Regarding the mean arrival interval time, it was at 35 minutes.

Table 1: Socio-demographic data of the study population.

Socio-demographic variables	Number	Percentage	Mean ±SD	Range
Age (years) and age groups				
Infant (< 2)	8	13%	7.45± 5.15	5-17
Preschool age (2-6)	24	40%		
1 year school age (6-12)	13	22%		
Adolescents (12-18)	15	25%		
Gender				
Male	40	67%		
Female	20	33%		
Smoking State				
Smoker	4	7%		
Non - smoker	56	93%		
Geographic distribution				
Urban	25	42%		
Rural	35	58%		
Governorate				
Ismailia	47	78%		
Portsaid	5	8%		
Suez	3	6%		
Others	5	8%		



Area under the curve: .940; P-value: .03; Cutoff value: 8; Sensitivity: 95.8%; Specificity: 98.6%.

Figure 1: ROC curve of PTS for prediction of mortality among studied patients.

Table 1 shows that among the patients, the range of ages was 5 - 17 years, 40% of the patients' groups was preschool status, 67% were males and 33% were females, among the patients' group, 7% were smokers, 93% were non-smokers, 58 % of the trauma among pediatrics

occurred in rural areas while 42% in Urban areas, 78% were from Ismailia. According to the distance of injury site from the hospital, it was with a narrow range of 3-70 kilometers. According to type of transportation vehicle, 73% of the patients are transported to the hospital by ambulance.

Regarding to the mechanism of injury, 81.7% of injuries among patients are caused by motor vehicle accident. Regarding the interpretation of the pediatric trauma scoring system, the mean of the pediatric trauma scoring system was 10+2. According to the nature of the most severe injury, 43% of injuries among patients were of extremities and pelvis nature. Regarding the vital signs, 44% of the studied patients were tachycardic regarding to the age. The study showed that the range of respiratory rate was (12-32). According to GCS, this study showed that 67% of the patients have GCS of (13-15). According to investigations, the mean of Hb among patients is 11.6±2.77. the mean of Hct on arrival is 33%. Regarding the blood transfused to the polytraumatised pediatric patients, 90% of the injured children did not need any blood transfusion and all the patient who needed blood transfusion have an initial hematocrit <30%. According to length of resuscitation time among patients, the mean time of resuscitation was 35.5±8.23 minutes. According to the type of treatment done for the patients, that 72% of the patients didn't need surgical intervention. This study showed that regarding the final outcome of the patients, 68% of the patients were admitted to inpatient. Both heart rate and respiratory rate had good sensitivity while both of them had lower specificity. GCS has a good specificity and fair sensitivity PTS had the highest specificity and the highest sensitivity among all the predictors.

Table 2: Comparison between heart rate, respiratory rate, Glasgow coma scale and pediatric trauma score (PTS) regarding specificity and sensitivity.

	AUC	p-value	Cut-off value	Sensitivity	Specificity
Heart rate	0.720	0.001*	125	78%	11.8%
Respiratory rate	0.693	0.001*	24	62%	38.1%
Glasgow coma scale	0.253	0.001*	9	71%	73.1%
Pediatric trauma score (PTS)	0.940	0.03*	8	95.8	98.6%

AUC = Area under curve.

Table 2 shows the best cutoff values of all suggested predictors with predictive characteristics. The most sensitive predictor was PTS 95.8% while the most specific predictor was also PTS 98.6%.

DISCUSSION

This was descriptive study conducted in emergency department in Suez Canal university hospital to assess the prognosis of polytraumatised pediatric patients by evaluation of pediatric trauma scoring system and clinical predictors of morbidity and mortality as prognostic predictors of trauma in pediatric patients. This study revealed that the mean age of the studied patients was 7.45±5.15 with a wide range of (5-17), 67% of the studied patients were males. study performed by Soyer T. et al, 146 polytraumatised children as retrospective study, the mean age was 6 (range: 3-9.25), 63% of the studied patients were males.[5] another study performed by Derakhshanfar H et al, the mean age of the patients was 8.62±4.8 years. 117 children (78%) were males.[6] This might be due to the more active behavior of male children than females. As well as in eastern societies; males predominate in practicing of many activities which are restricted to females such as sports and motor cycling which increase the risk of trauma. The majority of the patients was in the preschool age (40%) while the minority of the patients was infants group (13%), another study conducted by Adegoke SA et al, the majority of the patients was 39.6% in preschool group and the minority of the patients was the infants group (4%).[7]

58% of the pediatric patients were from rural areas while 42% of the patients were from urban areas which matches the results of a study by Mihalicz D et al, which 63.3% of the patients were from rural areas while 36.7% from urban ones.[8]

Regarding the mean arrival interval time, this study showed that it was at 35 minutes, another study performed by Lichtveld RA et al, found that the mean arrival interval time was 31 minutes.[9] Derakhshanfar H et al, in a descriptive cross-sectional study, conducted on 151 consecutive children, found that the mean accident-hospital arrival interval time was 134 minutes.[6] Van DM et al found that the time interval between incident and arrival at the Trauma Unit varied from 20 - 360 minutes, with a mean of 82 minutes.[10]

This prolonged time in Netherlands is justified because many polytraumatised children were referred from other hospitals to the trauma center where this study was conducted in 2013. The good arrival interval time in our study could be due to the distance between governorates at which trauma occurred is relatively not far and the main objective for paramedics in EMS system in Egypt is

to transport pediatric trauma patients to the nearest medical facility (scoop and run) rather than treatment on scene (stay and play).

The distance of injury site from the hospital, it was with a narrow range of 3-70 kilometers. which matches the results of another study performed by Falcone RA et al, who found narrow range of distance of injury site from the hospital (1-30 miles) (1.6 - 48.2 km).[11]

According to type of transportation vehicle, this study revealed that 73% of the patients were transported to the hospital by ambulance, another study performed by Falcone RA et al, which showed that 48% of the studied patients were transferred by ambulance, while the other patients were transferred by another types of transportation such as helicopters which are not available here in our country.[11]

Regarding to the cause of injury, this study showed that 81.7% of injuries among patients were caused by motor vehicle accident with the predominant type is motor cycle, another study performed by Adegoke SA, which revealed that 37.7% of the injuries were due to falls followed by road traffic accidents (32.8%).[7] The predominance of the motor cycle accident as a mechanism of injury in Egypt might be due to the low socioeconomic status combined with the absence of awareness about the safety precautions on roads such as wearing protective helmet, following traffic regulations and bad maintenance of the vehicles.

Regarding the interpretation of the pediatric trauma scoring system, this study showed that the mean of the pediatric trauma scoring system was 10±2, another study performed by Derakhshanfar H et al, which revealed that the mean of the pediatric trauma scoring system was 11±1.7.[9]

According to the nature of the most severe injury, 28% of injuries among patients were of extremities and pelvis nature, results of another study performed by Adegoke SA, which showed that 57.3% of injuries among patients were of extremities too.[7]

44% of the studied patients were tachycardic regarding to the age which matches the results of another study performed by Falcone RA et al, which showed that 40% of the studied patients were tachycardic regarding to the age.[11]

The study showed that the range of respiratory rate was (12-32) which matches the results of another study performed by Borgman MA et al, who found that the range of respiratory rate of the injured children (24-30).[12]

According to GCS, this study showed that 85% of the patients had GCS ≥ 9, another study performed by Adegoke SA et al, which showed that 93% of the studied population with GCS > 9.[7] This study showed that the mean of Hb among patients is 11.6±2.77, another study performed by Schoeneberg C et al, which showed that the mean of HB among patients was 10.6±1.8.[13] This study showed that the mean of Hct on arrival is 33.0 , another study performed by Ciarallo L et al, in a retrospective review conducted on 257 patient, that the mean hematocrit (Hct) was 35.2% on arrival.[14]

Regarding the blood transfused to the polytraumatised pediatric patients, 90% of the injured children did not need any blood transfusion, 10% (6 patients) of the polytraumatised children needed blood transfusion when Hct < 30% and this matches the data of Ciarallo L et al, Patients who present with a Hct <30%, or who have poly-traumatic injuries had a relatively greater risk of needing a transfusion.[14]

According to length of resuscitation time among patients, this study showed that the mean time of resuscitation was 35.5±8.23 min., another study performed by Schoeneberg C et al, in a prospective study published, who found that the mean time of resuscitation 51.7±19.2.[13] This might be due to the calculation of the resuscitation time in our emergency department from the start of patient presentation, deleting all the period consumed in transportation of the patient. This is because, not all the paramedics in EMS in Egypt are well trained to start resuscitation of the polytraumatised patient, unlike Germany, resuscitation starts on scene (stay and play) so the transportation time is calculated within the time of resuscitation.

According to the type of treatment done for the patients, this study showed that 72% of the patients didn't need surgical intervention. But these results did not match the results of another study performed by Gürses D et al, Turkey, who found that 48% of the studied patients needed surgical intervention and conservative management equally.[15]

This study showed that regarding the final outcome of the patients, 68% of the patients were admitted to inpatient, of another study performed by Acosta CD et al, in a retrospective observational study, USA, which revealed that 74.4% of the studied patients were admitted to the hospital.[16] This study showed that both heart rate and respiratory rate had good sensitivity 78% and 62% respectively while both of them had lower specificity 11% and 38.3% respectively. This study showed that GCS has good sensitivity and good specificity 71% and 73.1% respectively when the cutoff point was 9 which matches a study performed by Grinkeviciute DE et al, in a prospective study conducted on 59 injured children over a period of 2 years (2004-2006), who found that GCS had sensitivity of 79% and specificity of 67% when the cutoff point was 5.[17]

Ducrocg et al, in a retrospective study in France, found that threshold value of GCS score for death was 5, but did

not define PTS as an independent predictor of death and poor outcome.[18]

In Table 2 and Figure 1, regarding the PTS, this study showed that PTS had the highest specificity and the highest sensitivity among all the predictors 98.6% and 95.8% respectively when the cutoff point was 8 which matches with the results performed by Adegoke SA et al, in which PTS > 8 had 0% mortality, since all those who died had a PTS of <8.[7]

Grinkeviciute et al, in a study focused on probing the predictive value of scoring systems in severe pediatric head injury in Lithuania, used the PTS and GCS as the initial assessment tools. They showed that PTS ≤ 3 and Glasgow Coma Scale (GCS) ≤ 5 were significant risk factors of death in children with severe head injury.[17] Narci et al, studied the prognostic value of PTS in pediatric trauma patients and found it to be an independent predictor of morbidity.[19] Cantais et al did a study in pediatric ICU on children with severe multiple trauma. They found that, PTS < 5 and GCS < 7 had significant association with death in ICU setting.[20]

CONCLUSION

PTS had the highest specificity and the highest sensitivity among all the predictors. Both heart rate and respiratory rate had good sensitivity, while both of them had lower specificity. GCS has good sensitivity and good specificity.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Guice K, Cassidy L, Oldham K. Traumatic injury and children: a national assessment. J Trauma, 2007;63:S68-80.
2. Furnival R, Schunk J. ABCs of scoring systems for pediatric trauma. Pediatr Emerg Care. 1999;15:215-23.
3. Gilbert J, Arbesman M. Pediatric injury scoring and triage methodology. In Ziegler MM, Azizkhan RG, Weber TR, Operative Pediatric Surgery. McGraw-Hill Professional; 2003:1089-1095.
4. Clark D, Ryan L. Concurrent prediction of hospital mortality and length of stay from risk factors on admission. Health Serv Res. 2002;37(3):631-45.
5. Soyer T, Deniz T, Akman T. The impact of pediatric trauma score on burden of trauma in emergency room care. The Turkish J Pediatr. 2009;51:367-70.
6. Derakhshanfar H, Hatamabadi H, Karimian K. The prognosis of trauma among children and the factors contributing to it. Health. 2012;4(4):212-5.
7. Adegoke S, Oginni L. Predictors of paediatric injury mortality. SAJCH. 2011;5(1).
8. Mihalicz D, Phillips L, Bratu I. Urban versus rural pediatric trauma in Alberta: where can we focus on prevention? J Pediatr Surg. 2010;45(5):908-11.
9. Rob L, Ivo F, Ronald B. Predictors of death in trauma patients who are alive on arrival at hospital. Eur J Trauma Emerg Surg. 2007;33:46-51.
10. Zuidgeest J, Jonkheijm A, van Dijk A. Is the golden hour optimally used in South Africa for children presenting with polytrauma? South African Med J. 2013;103:35-42.
11. Falcone R, Beaudin M, Daugherty M. Assessment of factors associated with the delayed transfer of pediatric trauma patients. An EMS Emerg Physician Surv. 2010;1-48.
12. Borgman M, Maegele M, Wade C. Pediatric trauma BIG score: predicting mortality in children after military. Pediatr. 2011;127:e892.
13. Schoeneberg C, Schilling M, Keitel J. Mortality in severely injured children: experiences of a German level 1 trauma center. BMC Pediatr. 2014;14:194.
14. Ciarallo L, Fleisher G. Femoral fractures: are children at risk for significant blood loss? Pediatr Emerg Care. 1996;12(5):343-6.
15. Gürses D, Sarioglu-Buke A, Baskan M. Cost factors in pediatric trauma. Can J Surg Dec. 2003;46(6):441-5.
16. Acosta C, Delgado M, Gisondi M. Characteristics of pediatric trauma transfers to a level I trauma center: implications for developing a regionalized pediatric trauma system in California. Aca Emerg Med. 2010;17:1364-73.
17. Grinkeviciute DE, kevalas R, Saferis V. Predictive value of scoring system in severe pediatric head injury. Med Kaunas. 2007;43(11):861-9.
18. Ducrocq S, Meyer P, Orliaquet G. Epidemiology and early predictive factors of mortality and outcome in children with traumatic severe brain injury: experience of a French pediatric trauma center. Pediatr Crit Care Med. 2006;7(5):461-7.
19. Narci A, Solak O, Turhan N. The prognostic importance of trauma scoring systems in pediatric patients. Pediatr Surg Internat. 2009;25:25-30.
20. Cantais E, Paut O, Giorgi R. Evaluating the prognosis of multiple, severely traumatized children in the intensive care unit. Int Care Med. 2001;27:1511-7.

Cite this article as: Essa AA, El-Shaboury IM, Ibrahim MA, Abdelgwad EA, Gadelrab MA. Prognostic predictors in polytraumatized children and their impact on outcome. Int Surg J 2017;4:1014-8.