



Analysis of Pediatric Traumas: Characteristics and the Role of Scoring Systems

Pediyatrik Travma Vakalarının Analizi: Karakteristikleri ve Skor Sistemlerinin Rolü

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ABSTRACT

Objectives: Trauma is a major health problem in the pediatric age group. Various etiological factors can be accounted for the traumas, and they cause significant mortality and morbidity in children. Multiple scoring systems have been developed for evaluating trauma patients. The present study aims to investigate to find out which trauma scoring system used in pediatric trauma is superior to others.

Methods: This retrospective study was conducted in the Emergency Department of a private university hospital that accepts over 200.000 patients annually. Records of all 20314 trauma cases between 0 and 18 years of age, who were referred to ED of a private university hospital in two years, were searched, and 251 of them who were hospitalized evaluated retrospectively. Demographical, etiological, and clinical characteristics, including scores of five trauma scoring systems, were analyzed.

Results: The mean age of the cases was 6.8 ± 5.4 years, 86.9% of the cases had blunt trauma, and 46.9% had isolated head trauma. The most frequent trauma type was falling from a height (57.3%), followed by traffic accidents (25.8%). Mean pediatric trauma score of the patients was 9.41 ± 1.32 , mean Glasgow Coma Score was 14.79 ± 0.88 , mean Injury Severity Score was 7.74 ± 8.44 , mean Revised Trauma Score was 7.84 ± 0 , mean Trauma Revised Injury Severity Score blunt was 98.45 ± 7.71 and mean Trauma Revised Injury Severity Score penetrating was 98.61 ± 6.90 . The mean duration of the Intensive Care Unit and ward stay was 2.6 ± 3.1 and 1.9 ± 2 days, respectively, and the total duration of hospitalization was 2.2 ± 2.7 days.

Conclusion: The trauma scores provide predictive value for clinical severity and treatment in the initial evaluation of cases at admission to the Emergency Department. In this study, we found that Injury Severity Score and Trauma Revised Injury Severity Score are more valuable than the other scoring systems for determining the patient's length of stay in the hospital.

Keywords: Emergency department; pediatric trauma; trauma score.

ÖZET

Amaç: Travma, başlıca çocukluk çağı sağlık problemlerindedir ve çoğunluğu önlenemez özelliktedir. Travma olgularında, mortalite ve morbiditeye belirgin bir şekilde etki eden çeşitli etiyolojik faktör sayılabilir. Travma hastalarını değerlendirmek için birçok skor sistemi geliştirilmiştir. Bu çalışmanın amacı, pediyatrik travma hastalarında kullanılan skor sistemlerinin birbirlerine üstünlüğünü incelemektir.

Yöntem: Bu retrospektif çalışma, Acil Servis başvuru sayısı yıllık 200.000 hastanın üzerinde olan bir özel hastanede yapılmıştır. Bu çalışmada, iki yıl boyunca, 0-18 yaş arası travma ile acil servise başvuran 20314 hasta tarandı ve hastaneye yatırılan 251 tanesi retrospektif olarak incelendi. Demografik, etiyolojik ve klinik özellikler ile birlikte beş travma skor sistemi (Yaralanma Ciddiyeti Skoru, Revize Travma Skoru, Travma Revize Yaralanma Ciddiyeti Skoru, Pediyatrik Glasgow Koma Skoru, Pediyatrik Travma Skoru) analiz edildi.

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Bulgular: Olguların yaş ortalaması 6.8 ± 5.4 yaş idi. Olguların 86.9%'u künt travma, 46.9%'u izole kafa travması idi. En sık görülen travma tipi, yüksekten düşme (57.3%) idi. Bunu 25.8% ile trafik kazaları takip ediyordu. Hastaların ortalama Pediatrik Travma Skoru 9.41 ± 1.32 , ortalama Glasgow Koma Skoru 14.79 ± 0.88 , ortalama Yaralanma Ciddiyeti Skoru 7.74 ± 8.44 , ortalama Revize Travma Skoru 7.84 ± 0 , ortalama Travma Revize Yaralanma Skoru (Künt) 98.45 ± 7.71 ve ortalama Travma Revize Yaralanma Skoru (Penetran) 98.61 ± 6.90 olarak bulundu. Yoğun Bakım ve Acil Servis Gözlem yatış süreleri sırası ile ortalama 2.6 ± 3.1 ve 1.9 ± 2 gün, toplam hospitalizasyon süre ortalaması ise 2.2 ± 2.7 gün idi. Hastaneye yatış süreleri, travma skorları ve pozitif görüntüleme bulguları ile korelasyon göstermekteydi.

Sonuç: Acil serviste yatan hastaların ilk değerlendirmesi sırasında klinik ciddiyeti ve gerekli tedaviyi öngörmede travma skorlarının olumlu rolü tespit edildi. Yaralanma Ciddiyeti Skoru ve Travma Revize Yaralanma Ciddiyeti Skoru'nun hastaların hastanede kalma süresini saptamakta diğer skor sistemlerine göre üstün olduğu tespit edildi.

Anahtar sözcükler: Acil tıp departmanı; pediatrik travma; travma skoru.

Trauma, which is the most frequent cause of death and disability during childhood, is a preventable condition. [1-4] There are several types of trauma, such as chemical trauma, thermal trauma, and psychological trauma. Physical trauma can be classified according to blunt or penetrating nature. Traffic accidents are the first cause of mortality in Turkey. [3, 5] The physiological responses to trauma are different in children when compared with adults. The blood vessels are narrow in children, and they have strong vasoconstriction compensatory responses. Also, multisystem injuries are more frequent in children. Due to these reasons, diagnosis and triage are harder to perform in children. [6]

Multiple scoring systems have been developed for evaluating pediatric trauma patients. However, there are not enough superiority studies between these systems in the literature.

In this study, we have evaluated the hospital records of trauma cases between 0-18 years of age, who were referred to the Emergency Department (ED) of a private university hospital and hospitalized for treatment and follow-up monitoring. This study aims to determine which trauma scoring system used in pediatric trauma is superior to others.

Methods

This retrospective study was conducted in the Emergency Department of Baskent University Adana Hospital which has an annual census of over 200.000 patients. Ethical Committee approval was also obtained from the same university. The inclusion criteria for this study were patients below 18 years of age, patients hospitalized and patients without missing information. The hospital records of 20314 pediatric trauma cases that admitted to the Emergency Department between 1st Jan 2009 to 31st Dec 2010 was searched and 251 of them were hospitalized and they were either monitored,

had surgery, transfusion or treated medically. The information collected from the records were age, sex, date, time of admission, type of trauma, consultation notes, imaging studies, Injury Severity Score (ISS), [7] Revised Trauma Score (RTS), [7] Injury Severity Score (TRISS), [7] Pediatric Glasgow Coma Score (GCS), [8] Pediatric Trauma Score (PTS), [7] result of ED admission, hospitalization status, and admission to intensive care unit (ICU).

Descriptive statistics of categorical data were presented as frequency and percent, and numerical data were presented as median, range, mean and standard deviation, where appropriate. Comparisons of non-normally distributed numerical data between independent groups were made using Kruskal-Wallis in more than two groups, and Mann-Whitney U in two groups. Categorical data were compared by Chi-square test. The SPSS® 21 (IBM Inc, USA) software was used for the analyses.

Results

This study included 251 patients (174 boys, 69.3%; 77 girls, 30.7%) with a mean age of 6.8 ± 5.4 years. 86.9% of the cases had blunt, and 13.1% had penetrating trauma. Majority of the cases had only head trauma (46.9%), and most frequent period for trauma occurrence was between 5 pm to 12 pm (Table 1).

When the types of traumas were assessed, it was seen that falling from a height was seen with a ratio of 57.3%, and it was the most frequent type of trauma in the study population. Traffic accidents were the second most common cause (25.8%), and 83.6% of traffic accidents were out-vehicle accidents. The findings in imaging studies are shown in Table 2.

A total of 322 consultations were made to the patients. Neurosurgery was the most frequent department for consultations

Table 1. Characteristics of traumas

	n	%
Type of trauma		
Blunt	218	86.9
Penetrating	33	13.1
Localization of trauma		
Head only	107	46.9
Limb only	66	28.9
Head+trunk+limb	17	7.5
Trunk only	17	7.5
Head+limb	10	4.4
Head+trunk	6	2.6
Trunk+limb	5	2.2
Time of trauma		
8 a.m.-12 p.m.	25	10
12 p.m.-5 p.m.	78	31.1
5 p.m.-12 a.m.	107	42.6
12 a.m.-8 a.m.	41	16.3

Table 2. Types of injuries

	n	%
Falls		
Falls from a height	94	66.2
Falls from ground level	48	33.8
Traffic accident		
Out-vehicle	54	83.6
In-vehicle	10	16.4
Assault	5	2.0
Firearm injury	5	2.0
Other	32	12.9

(39.4%), followed by orthopedics (24.5%) and pediatric surgery (23.9%). Patients were hospitalized most frequently to neurosurgery department (44.6%), followed by pediatric surgery (20.3%) and orthopedic surgery (4%) departments (Table 3).

The mean durations of stays in ICU was 2.6 ± 3.1 days, in-patient departments 1.9 ± 2 days, and total duration of hospitalization was 2.2 ± 2.7 days. Mean pediatric trauma score of the patients was 9.41 ± 1.32 (4.0-12.0), mean GCS was 14.79 ± 0.88 (7.0-15.0), mean ISS was 7.74 ± 8.44 (0-75.0), mean RTS was 7.84 ± 0 (7.84-7.84), mean TRISS blunt was 98.45 ± 7.71 (0-99.7) and mean TRISS penetrating was 98.61 ± 6.90 (1-99.7). The correlation analyses between trauma scores and hospitalization periods revealed that all scores were statistically significantly correlated with the durations of stays in hospital. The results of the correlation analyses are shown in Table 4.

Table 3. Distribution of departments of consultation and hospitalization

	n	%
Department of consultation		
Neurosurgery	127	39.4
Orthopedics	79	24.5
Pediatric surgery	77	23.9
Ear-nose-throat	12	3.7
General surgery	9	2.8
Plastic surgery	7	2.2
Anesthesia	7	2.2
Cardiovascular surgery	2	0.6
Ophthalmology	2	0.6
Department of the hospitalization		
Neurosurgery	112	44.6
Pediatric surgery	57	22.7
Orthopedics	51	20.3
Ear-nose-throat	10	4.0
Plastic surgery	7	2.8
Anesthesia	4	1.6
General surgery	4	1.6
Cardiovascular surgery	3	1.2
Emergency department	1	0.4
Ophthalmology	1	0.4

Table 4. Association of the trauma scores with hospitalization periods

	r	p
TRISS penetrating		
ICU+In-Patient	-0.537	<0.001
ICU	-0.461	0.004
In-patient	-0.502	<0.001
TRISS blunt		
ICU+In-Patient	-0.547	<0.001
ICU	-0.489	0.002
In-patient	-0.520	<0.001
ISS		
ICU+In-Patient	0.559	<0.001
ICU	0.552	<0.001
In-patient	0.531	<0.001
GCS		
ICU+In-Patient	-0.313	<0.001
ICU	-0.313	<0.001
In-patient	-0.314	<0.001
PTS		
ICU+In-Patient	-0.379	<0.001
ICU	-0.372	<0.001
In-patient	-0.369	<0.001

TRISS: Trauma Revised Injury Severity Score; ISS: Injury Severity Score; GCS: Glasgow Coma Score; PTS: Pediatric Trauma Score; ICU: Intensive Care Unit.

Discussion

In a previous study that was conducted in 13 trauma centers in United States (US) between 1997-1998, hospitalization due to isolated head trauma was reported to be 18% of all hospitalizations.^[9] In our study, we found that the hospitalization due to isolated head trauma had a proportion of 46.9%, and the mean hospitalization duration was one day for these patients. In another study, the mean duration of hospitalization due to head trauma was found to be 2.9 days.^[10] This is similar with the hospitalization of children patients due to head trauma in our university. This relatively high number of days of hospitalization affects the cost and workload, and the indications for hospitalization should be reviewed.

The proportion of the patients with isolated extremity injury was 33% in the same study,^[9] and this was similar to our results of 28.9%. The mean ISS of all patients in the US study was 6.3 ± 5.9 , and this value was 7.74 in our study. The mean hospitalization duration was 3.3 days in this study,^[9] and 2.2 days in our study. Most of the subjects with isolated head trauma had shorter hospitalization periods, and this has lowered our overall hospitalization rates.

In another study, hospitalization due to falling was 23.3% in pediatric trauma patients.^[11] This rate was 57.3% for our patients. The hospitalization due to traffic accidents was 51.1% in this study,^[11] and 25.8% in our study. These significant differences may have some causes. The sociocultural level of the environment around our hospital and the diversity of trauma in our ED are determinative of these differences. Moreover, relatively lower hospitalization periods in traffic accidents in our hospital are linked to close follow-up and utilization of evidence-based imaging methods.

Another study from our country, Turkey, reported the distribution of blunt and penetrating trauma as 89.2%, and 10.8%, respectively, and these rates were 86.9% and 13.1% in our study. The proportion of traffic accidents in hospitalizations due to trauma was 50% in that study, which was higher our rate of 25.8%. The in-vehicle and out-vehicle accidents were reported to be 29.7% and 20.3%, respectively, which was partly different from our results of 4.1% and 21.7%. The falls from a height constituted 33.8% of the traumas in that study, which was similar with our 37.9%. The rate of assaults was reported to be 8.1%, whereas it was 2% in our study population. Firearm injuries were nearly doubled in that study, 4.1% vs. 2% in our study. Mean, minimum and maximum days for hospitalization were 4.5 days, 1 day, and 35

days in that study, respectively, and these periods were 2.2, 1 and 21 days in our study. According to their findings, the authors reported that ISS was an independent predictor of hospitalization period ($p < 0.05$), and it was more valuable in prognostic evaluations of trauma patients when compared to other scoring systems.^[12] In our study, we found a correlation between TRISS and ISS and hospitalization periods of the patients ($p < 0.001$). Also, GCS and PTS had correlations with hospitalization durations, but it was weaker than the previous ones ($p < 0.001$). Our results showed that TRISS and ISS were the most appropriate scores in the evaluation of the prognosis of trauma patients

Limitations

This was a retrospective observational study, and thus, it is possible that some of the important factors that may affect the results were overlooked. For example, physicians who evaluated the study patients could not be standardized about "how to approach trauma patients". The information of the patients before they are admitted to the ED and the reasons for admitting to ED are not known, unfortunately. Also, there is no clear data for the lesions that occurred at the time of trauma.

Conclusion

Our results revealed the risk factors for pediatric trauma cases as male gender, preschool and primary school age group, 5 pm - 12 pm period, out-of-school environment, and summer months. The most frequent causes of trauma were fallings and traffic accidents, which both can be avoided by legal regulations, centralized monitoring, and social responsibility awareness. The most frequent type of trauma was head trauma. The most frequent department of hospitalization was neurosurgery, and most of these cases were smaller age group patients. The relatively shorter duration of hospitalization in our study population is related to the utilization of advanced imaging methods, and follow-up of the patients by the trauma team, despite we are not a trauma center.

Emergency Physicians do not have a consensus for pediatric trauma patients about hospitalization because there is no standardized protocol has been introduced.^[13-15] The trauma scores provide a prediction for clinical severity and treatment in the initial evaluation of cases at admission to ED. In this study, results showed that TRISS and ISS were the most appropriate scores in the evaluation of the prognosis of trauma patients. Determination of the predictive values of

trauma scoring systems on the survival of the patients will provide better clinical profits for the utilization of these systems. Further studies with larger sample sizes will be useful for elucidating these issues.

Disclosures

Ethics Committee Approval: The Ethics Committee of Baskent University Medical and Health Sciences Research Board provided the ethics committee approval for this study (B.30.2.B ŞK.0.05.05.05/050.01.08.01-409 - 03.05.2011).

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