

Characteristics and Outcome of Pediatric in a Referral Trauma Center in Iran; a Cross-Sectional Study

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Abstract

Background

Pediatric trauma is the leading cause of death from early childhood through adolescence. In this study, characteristics and associated factors of pediatric trauma cases are evaluated.

Methods

In this cross-sectional study, demographic and clinical characteristics of 622 patients admitted to a referral hospital in Tehran, Iran are evaluated. Reported clinical characteristics include mechanism of trauma, type of trauma, ultrasonographic (US) findings, chest and abdomino-pelvic and brain computed tomography (CT) scan findings, blood hemoglobin (Hb) level, urinalysis, type of surgery, and mortality rate.

Results

The average age was 7.46 ± 3.64 years and the majority (63.7%) were male and endured direct trauma (36.3%). Most of our patients (n=305; 49%) were admitted in the orthopedic ward, followed by the neurosurgery ward (n=235; 37.8%). The mortality rate was 23 cases (3.7%). The lowest mortality was in the patients 11 to 15 years old (n=3; 13%), and the highest in five years and younger group (n=14; 60.9%).

Conclusions

Motor vehicle accidents are the leading fatal trauma injuries in children, therefore implementation of preventive measures specific to children is quite important but long overdue.

Introduction

Pediatric trauma is the leading cause of death from early childhood through adolescence (1, 2). It was estimated that each day approximately 2,000 children aged less than 14 die due to traumatic injuries world-wide (3). Trauma related mortality rates in pediatric population is increasing in developing countries, (4) however in developed countries a reduction in this trend is reported.(5) The most common mechanism of injury is reported to be falls from heights.(6) Living environments which are potentially riskier with regards to trauma, for example lack of playgrounds that would encourage children to play in the streets, low quality vehicles leading to more severe motor vehicle accidents and paucity of training in term of child safeguarding are a number of causes which lead to increased incidence of pediatric trauma.(7, 8)

Unintentional injury accounts for 25% of deaths in under-5-year children (9). More efficient improvements in driving rules, increased vehicle quality, raised public knowledge and awareness, enhanced individual education, as well as advancements in medicine, have reduced pediatric trauma-related mortality rates over the recent years (10). There are reports indicating a decline in the mortality rate of children under the age of 5 in Iran (11). However, our knowledge about the trauma related mortality and morbidity in Iran is limited. Understanding the patterns of pediatric trauma in large populations is the first strategy implementation required in order to achieve an effective preventive program. There are a few studies from developing countries discussing the epidemiology and trends of pediatric trauma. Therefore, we aimed to provide all concerned parties with common patterns of this and related mortalities. Also, any significant correlation between evaluated factors in a referral trauma center in Tehran, Iran is reported.

Materials And Method

This cross-sectional study was carried out from 2007 to 2010 in emergency department (ED) of Rasool Akram Hospital which is a tertiary trauma center in Tehran, Iran. This study have been performed in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee of Tehran University of Medical Sciences. After obtaining written informed consent from patients' parents or guardians, those who were brought to the ED due to trauma (outpatients and inpatients treatment both included) and aged less than 15 years old, were included in the study and those patients whom their age was missing were excluded. Demographic and clinical characteristics of 622 patients were extracted from the hospital data registry. Reported clinical characteristics include mechanism of trauma, type of trauma, ultrasonographic (US) findings, chest and abdomino-pelvic and brain computed tomography (CT) scan findings, blood hemoglobin (Hb) level, urinalysis, type of surgery, and mortality rate.

Data Analysis:

Statistical analyses were carried out by the statistical package for social sciences (SPSS Inc., Chicago, Illinois, USA) version 17.0, and data were presented as mean \pm SD and proportions as appropriate. The student t test and chi-square were used to compare the baseline continuous and non-continuous variables between two groups, respectively. A P-value of less than 0.05 was considered significant.

Results

During the period of our study, a total of 622 pediatric patients were included. The average age was 7.46 ± 3.64 years, in which three (0.5%) were under one year of age. Regarding age groups, the majority were six to ten years old (43.3%), followed by 11-15 years old (22.5%), and one to five years old (33.7%). Also, the majority (63.7%) were male and endured direct trauma (36.3%). Most of our patients (n=305; 49%) were admitted in the orthopedic ward, followed by the neurosurgery ward (n=235; 37.8%). Table 1 demonstrates the overall features of the patients in our study and its distribution among age group.

Table 1
Demographical and clinical features of pediatric patients in our study

Variable; n (%)	Total; N= 622	Age groups (years)			P-value*	Mortality		P-value*	
		≤ 5; n=212	6 – 10; n=269	11 – 15; n=140		Survived; n=587	Deceased; n=23		
Gender	<i>Male</i>	396 (63.7)	123 (31.1)	176 (44.4)	97 (24.5)	0.074	378 (97.9)	8 (2.1)	0.007
	<i>Female</i>	226 (36.3)	89 (39.6)	93 (41.3)	43 (19.1)		209 (93.3)	15 (6.7)	
Mechanism	<i>Direct trauma</i>	226 (36.3)	39 (17.3)	111 (49.1)	76 (33.6)	<0.001	215 (98.2)	4 (1.8)	0.121
	<i>Motor Vehicle Accident</i>	131 (21.1)	51 (38.9)	59 (45.0)	21 (16.0)		118 (92.2)	10 (7.8)	
	<i>Falling down</i>	127 (20.4)	66 (52.0)	41 (32.3)	20 (15.7)		120 (96.0)	5 (4.0)	
	<i>Pedestrian to car accident</i>	117 (18.8)	45 (38.8)	50 (43.1)	21 (18.1)		113 (96.6)	4 (3.4)	
	<i>Stab wound</i>	20 (3.2)	10 (50.0)	8 (40.0)	2 (10.0)		20 (100)	0 (0)	
	<i>Gun shot</i>	1 (0.2)	1 (100)	0 (0)	0 (0)		1 (100)	0 (0)	
Sonography	<i>Positive finding</i>	23 (6.1)	9 (39.1)	9 (39.1)	5 (21.7)	0.851	20 (87.0)	3 (13.0)	0.121
	<i>Normal</i>	351 (93.9)	142 (40.6)	148 (42.3)	60 (17.1)		327 (95.1)	17 (4.9)	
Chest CT	<i>Pneumothorax</i>	5 (16.7)	1 (20.0)	3 (60.0)	1 (20.0)	0.581	5 (100)	0 (0)	1.000
	<i>Hemothorax</i>	2 (6.7)	0 (0)	2 (100)	0 (0)		2 (100)	0 (0)	
	<i>Contusion</i>	2 (6.7)	0 (0)	2 (100)	0 (0)		2 (100)	0 (0)	
	<i>Pneumothorax and contusion</i>	2 (6.7)	2 (100)	0 (0)	0 (0)		2 (100)	0 (0)	
	<i>Hemopneumothorax</i>	1 (3.3)	1 (100)	0 (0)	0 (0)		1 (100)	0 (0)	
	<i>Normal</i>	18 (60)	7 (38.9)	8 (44.4)	3 (16.7)		17 (94.4)	1 (5.6)	
Abdominal CT	<i>Solid organ injury</i>	17 (10.8)	6 (35.3)	10 (58.8)	1 (5.9)	0.222	14 (82.4)	3 (17.6)	0.400
	<i>Normal</i>	141 (89.2)	64 (45.4)	54 (38.3)	23 (16.3)		126 (90.0)	14 (10.0)	
Brain CT	<i>Intracranial Hemorrhage</i>	223 (81.1)	108 (48.4)	85 (38.1)	30 (13.5)	0.046	205 (92.3)	17 (7.7)	0.213
	<i>Normal</i>	52 (18.9)	16 (30.8)	24 (46.2)	12 (23.1)		47 (97.9)	1 (2.1)	
Hemoglobin drop	<i>Positive</i>	148 (23.9)	63 (42.6)	53 (35.8)	32 (21.6)	0.068	134 (91.2)	13 (8.8)	<0.001
	<i>Negative</i>	443 (71.5)	143 (32.4)	196 (44.3)	103 (23.3)		424 (97.7)	10 (2.3)	
Surgical Intervention	<i>Positive</i>	367 (59.2)	102 (27.9)	164 (44.8)	100 (27.3)	<0.001	358 (97.5)	9 (2.5)	0.034
	<i>Negative</i>	253 (40.8)	109 (43.1)	104 (41.1)	40 (15.8)		227 (94.2)	14 (5.8)	

CT: Computed tomography

* Chi-square or Fisher's Exact test

Regarding radiological findings, in the evaluation of the 30 patients who underwent chest CT scans, eight (26.6%) of the patients had pneumothorax, which was accompanied with contusion in two, and hemothorax in another patient. Incidence of intracranial hemorrhage was

significantly higher in the younger populations (P-value = 0.046). Also, surgical interventions were mostly carried out in older populations (P-value < 0.001)

The mortality rate in our study was 23 cases (3.7%). The association between mortality and factors in our study is demonstrated in Table 1. The mortality among females, and patients with hemoglobin drop were significantly higher (P-value =0.007 and 0.034, respectively).

The median hospitalization duration in our study was 4 days [IQ1 – IQ3 = 2 – 6]. There was no significant correlation between hospitalization duration and age (Correlation coefficient = -0.008; P-value = 0.843) or mortality (P-value = 0.299). Based on independent sample t-test analysis, the average age of the deceased patients was significantly lower than the survived patients (5.74 ± 3.79 vs. 7.47 ± 3.62 ; P-value = 0.025). Also, among the age groups, the lowest mortality was in the patients 11 to 15 years old (n=3; 13%), and the highest in five years and younger group (n=14; 60.9%). The differences among the mortality age groups were also significant (P-value=0.028).

Discussion

Trauma is the leading cause of death and disability in children (2). More than 950,000 children under the age of 18 died due to intentional or unintentional accidents in 2004. In 2008, the main cause of death in children older than one year were reported to be accidents (12). We found that overall, mortality rate was higher in females (6.7%) and motor vehicles accidents were associated with the highest rate of mortality amongst all evaluated causes.

In all age groups, majority of our cases were male, this finding is consistent with the 2/1 ratio reported in other studies (6, 13)but, many cases of female trauma are probably under reported due to cultural and social backgrounds of various communities. In contrast with other studies which reported as the age group increases among boys, the percentage of trauma increases as well,(14, 15) we did not find such trend in our data. It is suggested that this could be due to the fact that boys tend to express more dangerous behaviors as they age(16).

Regarding causes of injuries, falls were the most common mechanism of injury in patients under 5 years of age (52%) which is in consistent with other studies.(17–19) Previous studies, also reported that other than young age, male sex and low socioeconomic status are the other risk factors for fall injuries among those with less than 6 years of age.(20, 21)

In this study, the leading cause of mortality was motor vehicle accidents. The results of various studies on motor vehicle injuries differ due to differences in the cultural and economic status of communities, the quality of vehicles, and road construction (22). However, road traffic accidents, if not considered the most important cause, has been recognized as one of the major factors associated with mortality in pediatric trauma(13, 23).

Children are more likely to be injured following road traffic accidents, mainly due to physical and cognitive-social characteristics of different stages of development.(19). Therefore, the proper education at different ages in the field of transportation and road traffic plays a vital role in improving their behavior, awareness, and knowledge. (24)

The leading type of injury with higher mortality was the head trauma. Fetal head injuries reported to happen mostly in boys during spring and summer.(25)The mean length of hospital stay was generally higher in these injuries. It is suggested that traumatic brain injury (TBI) is associated with higher mortality and morbidity rates in children which seems to be due to the distinctive physical characteristics of children (26). The skull of children is relatively smaller but the proportion of skull to the whole body is higher than of adults, and thus the risk of head trauma in children may be higher (27). Also, due to the vulnerable sutures of the skull in children, a physical shock after head trauma is almost imminent. In addition, the child's skull bones are less intense, and if a severe injury is endured, the damage to the brain and vascular tissue would be more critical.

In this study a positive correlation between a hemoglobin(Hb) drop and the mortality rate could be recognized. However; *Yee et al.*, unlike our results, did not find Hb status significantly correlated with mortality in pediatric trauma (28).

In 70.6% of patients, urinalysis was performed, but only 0.4% of our patients needed further evaluations because of microscopic hematuria. It was indicated that in a large number of patients, urinalysis was not necessary. Other reports also suggested that the diagnostic value of urinalysis is minimum in terms of differentiating the injuries following abdominal trauma and this test should be used only as an adjacent to other diagnostic procedures (29, 30).

The results of our study showed that there was a positive correlation between mortality and male gender, head trauma, positive brain, abdominopelvic CT scan findings, positive Focused assessment with sonography in trauma (FAST), Hb drops and need for surgery. Although the patients in the mortality group were 2 years younger than the study population, we could not find a correlation between age and mortality.

Conclusion

Motor vehicle accidents are the leading fatal trauma injuries in children, therefore, educating people on safety measures in this matter is rather important. Moreover, improving the quality of roads along with implementation of preventive strategies in transportation is required. According to

high incidence of orthopedic and head injuries in children, presence of a neurosurgery and an orthopedic team in children medical centers and in trauma centers seems necessary.

Abbreviations

US

ultrasonographic

CT

computed tomography

Hb

blood hemoglobin

ED

emergency department

SPSS

statistical package for social sciences

TBI

traumatic brain injury

FAST

Focused assessment with sonography in trauma

Declarations

Ethics approval and Consent to participate

The study was approved by the *Research Ethics Committee of Tehran University of Medical Sciences*. Permission to carry out the study and access patient records was sought from the respective university administrators (*Research department of Tehran University of Medical Sciences*). All methods were performed in accordance with the relevant guidelines and regulations. Written informed consent was obtained from the patients' parents or legal guardians during data collection and confidentiality of the information was secured by omitting any identifiers from data.

Consent for publication

Not applicable.

Availability of data and material

The data that support the findings of this study are available from *Research department of Tehran University of Medical Sciences* but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of *Research department of Tehran University of Medical Sciences*.

Competing interests

The authors have no conflict of interest to declare.

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Authors' contributions

MV and MK conceived and designed the study, MK and MM collected the clinical data and FJ carried out the data gathering. MV, SS carried out the statistical analysis. MY and MK drafted the manuscript and provided logistic support while MV, MM and SS edited and prepared the final version of the article.

All author proofread and approved the final version of the manuscript.

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