



## An evaluation of pediatric forensic trauma cases: a retrospective study

### Çocuk adli travma vakalarımızın değerlendirilmesi: retrospektif çalışma

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#### Abstract

**Aim:** Forensic trauma has become frequently seen in Emergency Departments and these injuries can leave significant sequelae reaching a life-threatening degree and may even result in death. Through retrospective examination, the aim of this study was to define the frequency of forensic trauma cases presenting at our clinic in one year, to reveal the outlook of our region with references to relevant epidemiological data, and to provide guidance on the approach to be taken by physicians encountering these cases.

**Materials and Methods:** A retrospective examination was made among cases aged below 18 years who presented for forensic reasons at the Emergency Medicine Clinic of Kayseri Training and Research Hospital between August 2013 and August 2014.

**Results:** The study included 951 patients aged under 18 years who presented at the Emergency Department. The patients were 703 (73.9%) males and 248 (26.1%) females. The reasons for presentation were determined as physical assault in 521 cases, fall from heights in 220 (23.0%), assault in 79 (8.3%), burn injury in 19 (2.0%), stabbing and penetrating injuries in 7 (0.7%), family violence in 4 (0.4%), sexual abuse in 2 (0.2%), assault and drug use in 2 (0.2%), attempted suicide in 3 (0.3%), intoxication in 2 (0.2%), and other causes in 92 (9.7%).

**Conclusion:** Physical assault and fall heights were seen to be the most common causes of pediatric forensic traumas. The results of the current study showed significant differences in forensic trauma according to gender. In males, there was a significantly higher rate of stab wounds.

**Keywords:** Forensic Trauma; Child; Non-Traffic Accident Trauma; Emergency Department.

#### Öz

**Amaç:** Çocuklarda görülen adli travmalar, acil servislerde sık karşılaşılan bir duruma haline gelmiş olup önemli sekeller bırakabilmekte, hayatı tehdit edici boyutlara ulaşabilmekte, hatta ölüme sonuçlanabilmektedir. Bu çalışmada kliniğimize bir yılda başvuran pediatrik adli travma vakaları retrospektif olarak araştırılarak sıklığının belirlenmesi, konuyla ilgili epidemiyolojik verilerin ve bölgemizin durumunun ortaya konması, vakayla karşılaşacak hekimlere hastaya yaklaşım konusunda fikir verilebilmesi amaçlanmıştır.

**Gereç ve Yöntem:** Kayseri Eğitim ve Araştırma Hastanesi Acil Tıp Kliniği'ne Ağustos 2013 ile Ağustos 2014 tarihleri arasında adli nedenlerden dolayı başvuran 18 yaş altı travma olguları retrospektif olarak araştırıldı.

**Bulgular:** 18 yaş altında acil servisimize başvuran 951 olgu çalışmaya dahil edildi. Olguların 703'ü erkek (%73,9), 248'i (% 26,1) kız idi. Olayın niteliği incelendiğinde; 521'inin darp, 219'unun (%23,0) yüksekten düşme, 79' unun saldırı (% 8.3), 19'unun yanık (%2.0), 7'sinin kesici delici alet yaralanması (% 0.7), 4'ünün Aile İçi Şiddet (%0.4), 2'sinin cinsel suçlar ve istismar (%0.2), 2'si Uyuşturucu Kullanımı ile birlikte darp (%0.2), 2'si zehirlenme (%0.2), 3'ünün intihar (%0.3) olgusu olduğu tespit edildi.

**Sonuç:** Çocukluk dönemi adli travmaların ek sık nedenlerinin darp ve düşmeler olduğu görülmektedir. Çocuklarımızı adli travmalardan korumak için alınması gereken önlemlere ve eğitime önem verilmelidir.

**Anahtar Kelimeler:** Adli Travma; Çocuk; Trafik Kazası Olmayan Travma; Acil Servis.

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## INTRODUCTION

Injuries from all kinds of firearms, explosive materials, cutting, penetrating and chopping tools, falls, physical assaults, workplace accidents, burns, electric shocks, lightning strikes and sudden or unexpected or suspicious deaths are evaluated as forensic cases (1). There are differences in the understanding and evaluation of pediatric forensic trauma from trauma seen in adults (2). The child may experience difficulty in expressing himself. The family may not disclose findings or have knowledge (3). As the Emergency Clinics of state hospitals are the healthcare institutions which are the most frequent place of first presentation for forensic cases, they assume a key role in pediatric forensic cases (4). Without any delay, forensic cases must be evaluated by a physician. Physical examination must be conducted and signs of assault must be investigated. If a pediatric psychiatrist is available, consultation should be requested and the treatment must be co-ordinated with the pediatric clinics. Finally, filling in forensic reports is mandatory for such cases.

## MATERIALS and METHODS

To be able to conduct the study, approval was granted by the Education Planning Co-ordination Committee of the hospital. A retrospective investigation was made for children aged 0-18 years who presented for forensic reasons at the Emergency Clinic Trauma Unit of Kayseri Training and Research Hospital between 01.08.2013 and 31.07.2014. The study included 953 patients who presented at the trauma unit. Cases with trauma as a result of traffic accidents were not included in the study.

### Statistical Analysis

Analysis of the findings was made using SPSS 17.0 statistics software. The Chi-square conformity test was applied. Categorical measurements of the obtained data were stated in numbers (n) and percentages (%). The value of  $p < 0.05$  was accepted as statistically significant.

## RESULTS

The total number of patients who presented due to trauma at all the departments of Kayseri Training and Research Hospital between August 2013 and August 2014 was 103,129, of whom 39,008 were aged 18 years or younger (Table 1). Of these patients, a total of 953 aged under 18 years presented for forensic reasons, not including traffic accidents. Two patients were excluded as their data could not be obtained. The final evaluation was made for 951 patients. The mean age of the patients was 11.93 years. The number of patients presenting with forensic trauma at an early age was seen to be greater and this reduced at the age of 9 years and was then determined to increase after the age of 9 years (Table 2). The total 951 patients comprised 703 (73.9%) males and 248 (26.1%) females with a female:male ratio of 0.352.

According to the international diagnostic code (ICD) of the International Statistical Classification, the patients presented at the trauma unit with 19 different diagnostic

codes. The patients presented with trauma due to falls, assaults, electric shock, stab wounds and foreign body trauma (Table 3). The reasons for presentation were determined as physical assault in 521 (54.7%) cases, fall from heights in 220 (23.0%), assault in 79 (8.3%), burn injury in 19 (2.0%), stabbing and penetrating injuries in 7 (0.7%), family violence in 4 (0.4%), sexual abuse in 2 (0.2%), assault due to drug use in 2 (0.2%), attempted suicide in 3 (0.3%), intoxication in 2 (0.2%), and other causes in 92 (9.7%). The group of 'other causes' consisted of trauma patients who presented at the ED trauma unit with suspicious trauma and lesions as well as patients presenting with reasons other than those stated.

The leading cause of presentation was physical assault, followed by fall, stab wound and burn injury. Patients in these groups comprised 88.1% of the total patients. In all the patient groups, the male:female ratio was  $>3$ . The month when most patients presented was May and the fewest patients presented in February, thus seasonally, spring and summer were determined as the seasons when most patients presented (Table 4).

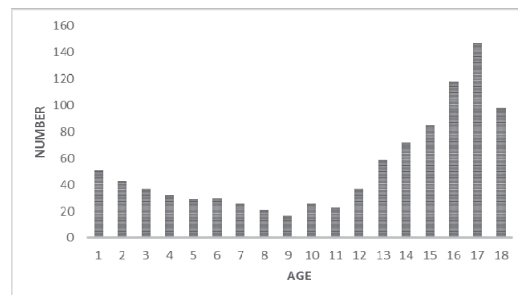
A total of 163 (17%) patients were hospitalised, with the longest period of hospitalisation of 60 days (Table 5). The mean time spent in the Emergency Department was 80.2 minutes for the total patient group; the mean discharge time was 68 minutes for those who were discharged in good health while this was 124 minutes for those who were admitted as inpatients. Of the total forensic trauma patients, 41% were discharged within the first hour and 75.6% within two hours as 6% remained in the Emergency Department for 4 hours or longer. No case died during the study period.

**Table 1.** Number of applications during the period of the study.

Number of patients admitted to our hospital in a year*	3.268.389
Number of patients admitted to our emergency clinic trauma unit	103.129
Number of patients admitted by legal causes	16,337
Number of trauma patients under the age of 18	3.908
Number of forensic trauma under the age of 18 (excluding traffic accidents)	953
Number of patients enrolled in the study	951

\*Year 2014

**Table 2.** Number of cases according to ages.



**Table 3.** Application causes.

Forensic causes of trauma	Number	Percentage
Physical assaults	521	54.8
Falls	220	23.1
Assault	79	8.3
Burns	19	2.0
Stabbing and penetrating injuries	7	0.7
Family Violence	4	0.4
Suicide	3	0.3
Sexual Crimes and Abuse	2	0.2
Assault and drug use	2	0.2
Intoxication	2	0.2
Other	92	9.7
<b>Total</b>	<b>951</b>	<b>100.0</b>

**Table 4.** Number of cases according to months.

Months	Number of cases	Percentage
2	65	6.8
3	86	9.0
4	91	9.6
5	97	10.2
6	81	8.5
7	83	8.7
8	88	9.3
9	73	7.7
10	74	7.8
11	75	7.9
12	68	7.2
<b>Total</b>	<b>951</b>	<b>100.0</b>

**Table 5.** Hospitalisation durations.

Hospitalisation duration in days	Number of cases	Percentage	Total Percentage
0	788	82.9	82.9
1	137	14.4	97.3
2	5	0.5	97.8
3	12	1.3	99.1
4	3	0.3	99.4
5	2	0.2	99.6
6	1	0.1	99.7
11	1	0.1	99.8
16	1	0.1	99.9
60	1	0.1	100.0
<b>Total</b>	<b>951</b>	<b>100.0</b>	

The age distribution of the cases was 0-2 years 23%, 2-4 years 14%, 4-6 years 11%, 6-8 years 6%, 8-10 years 6%, 10-12 years 10%, 12-14 years 12% and 14-16 years 18%. The highest rate was of cases of a very young age and the rate decreased, only to increase again after the age of 10 years.

## DISCUSSION

To be able to understand the full meaning of forensic trauma, the term 'child abuse' must be understood. In recent years, this definition has changed. Non-accidental trauma (NAT) is an injury induced to the child intentionally or as a result of obvious neglect (5). This latter definition has been determined as "Child abuse". Child abuse is a major source of injury for children. If not

detected, NAT is likely to recur and could be fatal. Upon detecting signs of child abuse, it is the duty of any medical provider to report it and save a life (6). Types of child abuse are physical, emotional, sexual and neglect. The definitive evaluation of forensic trauma patients may also be life-saving. In this study, paediatric forensic cases were examined and to be able to make a definitive evaluation, traffic accidents were not included.

When the demographic and presentation characteristics were examined, the rate of male patients in the current study of 76% was consistent with similar studies in Turkey (1, 2). This high rate could be related to the fact that male children in this region are raised in an unencumbered environment (3). Several studies have reported that male children are less supervised than female children (7). The male:female ratio of stab wounds was found to be very high. Trauma types such as physical assault, firearms injuries, stab wounds and legal trauma were seen less in females than in male children, which could be related to the nature and games of female children (3).

The mechanisms of trauma were determined as falls with 47.3% and physical assault with 21.3%. According to data from studies of trauma incidences in Northern Ireland, trauma incidence was reported as 23.2/100,000 and cases of traffic accidents and falls comprised 71% (8). The presence and location of bruises and contusions on the patient are important. While bruises and contusions associated with fall are generally seen on the knees and elbows of children, such bruises and contusions may be seen in areas such as the back, ears and hips in children who have been exposed to violence (6, 9). Bruises may be in the shape of the object which was used to apply violence. There may be signs of binding around the legs and neck (1). Vascular bleeding and purpura may develop because of constriction. Widespread redness and petechiae may be seen on the face due to strangling or throttling. Bruises turn yellow in approximately 18 hours (1). The colour of wounds and contusions provide information about the time of the incident and the degree of violence to which the child was exposed.

Another important point is thermal injuries. These are generally seen in children aged below 6 years. If there are signs of burns or scalds on any uncommon part of the body, a forensic event should be suspected. Cigarette or lighter burns may be seen (2, 9). Fractures are often seen in children and every case with an atypical location should be approached with suspicion (9, 10). When evaluating the mechanism of skull fractures, forensic cases must not be overlooked.

Head trauma is another forensic reason (8). It is generally overlooked in forensic diagnosis. Whether or not it is a forensic case can be understood by cross-questioning in courts. After excessive shaking of a child, respiratory problems, irritability and severe vomiting may also be seen (8,11). Internal organ damage may occur after kicking and punching the chest and abdomen. Abdominal pain which is not the result of an accident should be treated with suspicion (12, 13). Whatever the

conditions, care must be taken when a forensic event is suspected. The social status of the patient and their family is not important (14, 15). When patients who present at the Emergency Department are thought to be a forensic case, the forensic authorities must certainly be informed and forensic follow-up should be provided. Although a very small proportion of the patients presenting at hospital constitute pediatric forensic trauma cases, it is important that these cases are considered as forensic patients.

The mean time in the Emergency Department was 80.2 minutes for the total patient group: 68 minutes for those who were discharged and 124 minutes for those who were then admitted as inpatients. The time spent in the Emergency Department was extremely short. While pediatric patients are at the Emergency Department trauma unit, it is important that they suffer the least amount of psychological trauma. Of the total forensic trauma patients, 41% were discharged within the first hour and 75.6% within two hours and 6% remained in the Emergency Department for 4 hours or longer. These results show that diagnosis and treatment could be made in the early stages for the cases of pediatric forensic trauma.

When the cases are evaluated according to the month of presentation, the highest rates were seen to occur in March, April, May and August. Similar to this study, Gökren et al. also found the highest rates of pediatric trauma patients in spring and summer time (16).

The prolonged duration of hospitalisation may be considered to be due to the need for additional consultations. A total of 163 cases were hospitalised with a rate of 17%. None of the cases resulted in mortality. In the literature, mortality rates have been reported as 1.6%-3% (1, 10).

## CONCLUSION

In this study, significant differences in trauma were determined according to gender. The rate of stab wounds was determined to be significantly greater in male children. Studies must be made to reduce the tendency of male cases to violence. It must be a priority to protect children from trauma and when taking protective measures, there must be no differentiation between male and female children. As the rates of hospitalisation were high, there must be sensitivity to the subject of admitting pediatric forensic trauma cases to hospital. If necessary, hospitalisation is recommended for monitoring pediatric forensic trauma cases. Education is important for children, families and individuals and institutions dealing with children. For pediatric forensic cases to feel that they are in a safe environment, evaluation in the Emergency Department should be conducted in a separate unit. It is recommended that a separate pediatric trauma unit is prepared for minor traumas and simple forensic traumas. During the period in hospital, frequent quality control

assessments should be made and the necessary documentation and statistical evaluations must be kept up-to-date and must be regularly checked. For future studies, follow-ups must be provided with advanced documentation and software systems.

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