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# Demographic Analysis of Pediatric Patients Presenting to the Emergency Department with Head Trauma

## Acil Servise Kafa Travmasi ile Başvuran Pediatrik Hastalarin Demografik Analizi

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**Abstract**

**Objective:** In this study, it was aimed to analyze the demographic characteristics, mortality rates, hospitalization rates, and causes of trauma in pediatric patients admitted to the emergency department with head trauma.

**Materials and Methods:** Pediatric patients admitted to a university hospital emergency department (tertiary emergency service) between 01.01.2015 and 31.12.2020 due to head trauma were included in this study. Demographic data of the patients, computed tomography reports of the heads, inpatient to departments or intensive care units, discharge status, Glasgow Coma Scores, and Glasgow Outcome Scores were evaluated retrospectively and statistically analyzed.

**Results**: 691 patients were included in the study. The median age of the patients was 7.7 years (IQR: 4.2-13.1). It was observed that the most common age range for head trauma was 10-14 years (early adolescence). The most common cause of head trauma was falling (n=501, 72.5%). According to GCS, the most common cause of severe trauma was traffic accidents (n=8, 72.7%).

**Conclusion**: In our study; Contrary to the literature, it has been determined that head trauma occurs most frequently in the 10-14 age group. In our study, we found that the most common cause of head trauma was falling, but the most common cause of death was traffic accidents.

**Keywords**: Craniocerebral Trauma, Emergency Service, Intracranial Hemorrhages, Trauma Centers, Pediatric Emergency Medicine

**&**

**Öz**

**Amaç**: Bu çalışmadan acil servise kafa travması nedeniyle başvuran pediatrik hastaların demografik özelliklerinin analizi, mortalite oranları, hastaneye yatış oranları ve travma nedenlerinin belirlenmesi amaçlanmıştır.

**Gereç ve Yöntemler:** Bu çalışmaya, 01.01.2015-31.12.2020 tarihleri arasında bir üniversite hastanesi acil servisine (üçüncü basamak acil servis) kafa travması nedeniyle başvuran pediatrik hastalar alındı. Hastaların demografik verileri, bilgisayarlı beyin tomografisi raporları, yattığı servis ya da yoğun bakımlar, taburculuk durumları, Glaskow Koma Skor'ları, Glaskow Sonuç Skor'ları geriye dönük değerlendirildi ve istatistiksel olarak analiz edildi.

**Bulgular**: Çalışmaya 691 hasta dahil edildi. Hastaların yaş ortancası 7,7 yıldı (IQR: 4,2-13,1). Kafa travmasının en sık görüldüğü yaş aralığının 10-14 yaş (erken adolesan) olduğu görüldü. Kafa travmasına en sık neden olan durumun düşme olduğu görüldü (n=501, %72,5). GKS'ye göre ağır travmaya en sık sebep olan nedenin trafik kazaları olduğu görüldü (n=8, %72,7).

**Sonuç**: Bizim çalışmamızda; literatürden farklı olarak kafa travmasının en sık 10-14 yaş grubunda meydana geldiği tespit edilmiştir. Çalışmamızda kafa travmasının en sık nedeninin düşme olduğunu fakat en sık ölüm nedeninin trafik kazaları olduğunu tespit ettik.

**Anahtar Kelimeler:** Kafa Travması, Acil Servis, Kafa İçi Kanama, Travma Merkezi, Pediatrik Acil Tıp

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## Introduction

Head traumas in the pediatric age group constitute an important part of admissions to emergency services. In the United States, approximately 600.000 patients aged 18 and under apply to emergency services each year. Approximately 60000 of these patients are hospitalized and 7400 children are lost because of this (1-3). According to the results of a recent study in England; between 2000 and 2011, there was a 10% increase in the number of patients with head trauma admitted to emergency services, but the number of patients who underwent surgery and had a traumatic brain injury (TBI) remained stable (4). It is thought that the number of patients admitted to the emergency services due to head trauma in the childhood age group is high in our country, causing serious mortality and morbidity. In a study conducted in Turkey in 2010, it was determined that most of the head traumas in childhood are simple traumas and the most common etiological factors are falling and traffic accidents (5).

Minor head injuries are common in childhood and do not require any medical or surgical treatment. However, head trauma in infancy and childhood is the single most common cause of death and permanent disability. Measurable deficits occur even after mild to moderate head injury but are significantly greater after a serious injury. It includes cognitive and motor disorders, impaired attention, and psychiatric disorders.

Early recognition and proper management of patients with severe head trauma by physicians are extremely important in terms of reducing morbidity and mortality. Most of the patients who are admitted to the emergency department have minor head traumas (MHT) that do not cause obvious clinical symptoms and signs. In contrast, a small proportion of many patients with MHT have intracranial pathology that requires surgical intervention. For this reason, the approach to head trauma for physicians working in the emergency department can be quite complex and sometimes challenging (6). For this reason, for patients who applied to the emergency department; the mechanism of the trauma should be evaluated in terms of clinical findings and intracranial pathologies to occur, whether patients need surgical treatment should be determined early and complications should be determined quickly. Detection of intracranial damage as soon as possible in patients with head trauma depends on the good determination of risk factors that may cause intracranial damage. In patients with intracranial damage, not being able to make a diagnosis immediately may cause problems, and also multiple laboratory and imaging studies may delay the diagnosis of other life-threatening organ injuries, causing time loss and unnecessary expenses (7).

Emergency departments are where the first evaluation of traumatized children is performed. For this reason, it is important that standard trauma protocols are accepted and that the emergency team evaluates the traumatized child with these protocols. The lack of knowledge of the anatomical and physiological differences between pediatric patients and adults and the lack of clinical experience in emergency management are the two main problems in the approach to pediatric head trauma patients' management. These existing problems may cause permanent disability and death due to inadequate diagnosis and treatment. So, it is important that standard trauma protocols are accepted and that the emergency team evaluates the traumatized child with these protocols. Determining the demographic characteristics of the patients who applied to the emergency service is an important step in creating these protocols.

The primary outcome of the related study is to determine the demographic characteristics and mortality rates of pediatric patients brought to a university hospital emergency department due to head trauma. The secondary outcome is to reveal the computed tomography results, hospitalization rates (intensive care and service admission), operation rates, and Glasgow Outcome Scores of the patients included in the present study.

## Materials and Methods

### Study Design

The present study was carried out with the permission of Bolu Abant İzzet Baysal University Faculty of Medicine Ethics Committee (Date:22/03/2022-Decision No:2022/75). The study was realized within the framework of the Helsinki Declaration principles and ethical rules.

### Selection of the Participants

All patients with head trauma under the age of 18 who applied to İzzet Baysal Training and Research Hospital Emergency Department between 01.01.2016 - 31.12.2020 and were treated as outpatients or inpatients were included in the study. The cases were grouped as 0-2 years (infancy), 3-5 years (game child), 6-9 years (school child), 10-14 years (early adolescence), and 14-18 years (late adolescent).

### Measurements and Outcomes

Demographic data, computed tomography of head (CTH) results, and clinical outcomes of the patients were evaluated retrospectively. Patients whose file data cannot be reached will be excluded from the study. Demographic information of the patients, comorbidities, if any, admission Glasgow Coma Scale (GCS), neurological examination results, mechanism of trauma, other system injuries, radiological imaging results, surgical interventions if performed, hospitalization, and outcomes of patients treated were collected.

Regarding the severity of the head trauma, the patients were classified as a mild head injury is defined as GCS score of 13-15, moderate head injury as GCS 9-12, and severe head injury as GCS 8 or less (8).

The Glasgow Outcome Score (GOS) is an outcome scale that classifies patients with brain injury according to the objective degree of recovery (9).

**GOS**;

1. Death: Severe injury or death without recovery of consciousness
2. Persistent vegetative state: Severe damage with a prolonged state of unresponsiveness and a lack of higher mental functions
3. Severe disability: Severe injury with permanent need for help with daily living
4. Moderate disability: No need for assistance in everyday life, employment is possible but may require special equipment.
5. Low disability: Light damage with minor neurological and psychological deficits.

### Statistical Analysis

SPSS version 25.0 (SPSS Inc., Chicago, Illinois, USA) package program was used for data analysis in the present study. Descriptive data on the sociodemographic and clinical information of the patients are given as n and % or median, interquartile range (IQR) tables. The Kolmogorov-Smirnov test was performed to see if it was normally distributed. Frequency distributions and crosstabs were used as analysis methods. Later, these tables were converted to graphics in the same package program.

## Results

A total of 782 patients were admitted to the emergency clinic during the study. 91 of these patients were excluded from the study due to incomplete data. As a result, 691 patients were included in the statistical analysis. Of the patients, 264 (38.2%) were female and 427 (61.8%) were male. The median age of the patients was 7.7 years (IQR: 4.2-13.1). Considering the age distribution of the patients included in the study; The most common age group for trauma was early adolescence with 203 patients (29.4%). The distribution of cases according to age groups is shown in Figure 1.

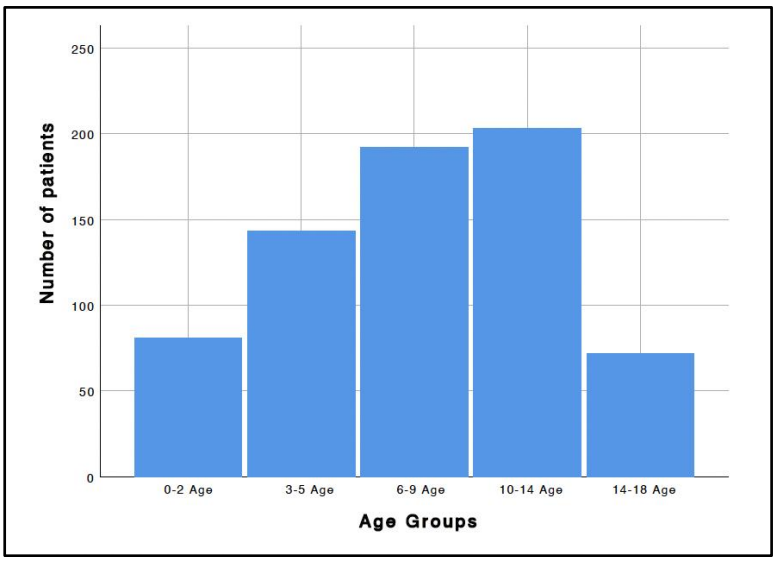


**Figure 1.** Distribution of the Number of Patients by Age Groups

When the CTH results of 691 patients included in the study were examined; It was determined that 367 (53.1%) patients underwent tomography. No traumatic findings were found in 635 (91.6%) of the patients who underwent CTH. Among the 56 (8.4%) patients who underwent CTH and found traumatic findings; Fractures were observed in 42 (6.1%) patients, intracranial hemorrhage in 29 (4.2%) patients, and contusion in 12 (1.7%) patients. The distribution of age groups according to the causes of trauma is shown in Table 1. The distribution of trauma causes according to GCS is shown in Table 2.

**Table 1**

Distribution of Age Groups by Causes of Trauma

| | **Trauma Mechanism** | | | | |
|---|---|---|---|---|---|
| **Age Groups** | **Fall n=501** | **Battered n=48** | **Penetrating Injury n=2** | **Traffic Accident n=97** | **Others n=43** |
| **0-2 Age** | 74 (14.8 %) | 0 | 0 | 1 (1.2%) | 6 (7.4%) |
| **3-5 Age** | 104 (20.8%) | 2 (1.4%) | 0 | 27 (18.9%) | 10 (7%) |
| **6-9 Age** | 155 (80.7%) | 5 (2.6%) | 0 | 18 (9.4%) | 14 (7.3%) |
| **10-14 Age** | 117 (57.6%) | 32 (15.8%) | 2 (1%) | 43 (21.2%) | 9 (4.4%) |
| **14-18 Age** | 51 (70.8%) | 9 (12.5%) | 0 | 8 (11.1%) | 4 (5.6%) |

**Table 2**

Distribution of Trauma Causes by GCS

| GCS | Trauma Mechanism | | | | | |
|---|---|---|---|---|---|---|
| | **Fall** | **Battered** | **Penetrating Injury** | **Traffic Accident** | **Others** | **Total** |
| **Severe** | 2 (18.2%) | 0 | 0 | 8 (72.7%) | 1 (9.1%) | 11 (100%) |
| **Moderate** | 0 | 0 | 0 | 1 (100%) | 0 | 1 (100%) |
| **Mild** | 499 (73.5%) | 48 (7.1%) | 2 (0.3%) | 88 (13%) | 42 (6.2%) | 679 (100%) |
| **Total** | 501 (72.5%) | 48 (6.9%) | 2 (0.3%) | 97 (14%) | 43 (6.2%) | 691 (100%) |

It was determined that 62 (9%) of the patients were hospitalized in departments, 69 (10%) were hospitalized in intensive care units, 1 (0.1%) died in the emergency department, and 559 (80.9%) patients were discharged from the emergency department.

Looking at the Glasgow Outcome Score of patients with brain damage, it was determined that 6 patients got 1 point, 1 patient got 2 points, 5 patients got 3 points, 5 patients got 4 points, and 39 patients got 5 points. The distribution of Trauma Causes according to Glasgow Outcome Score is summarized in Table 3.

**Table 3**

Distribution of Trauma Causes by Glasgow Outcome Score.

| Trauma Mechanism | Glaskow Outcome Scale | | | | | |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **Total** |
| **Fall** | 2 (4.7%) | 0 | 0 | 5 (11.6%) | 36 (83.7%) | 43 (100%) |
| **Traffic Accidents** | 4 (44.4%) | 1 (11.1%) | 4 (44.4%) | 0 | 0 | 9 (100%) |
| **Others** | 0 | 0 | 1 25% | 0 | 3 (75.0%) | 4 (100%) |
| **Total** | 6 (10.7%) | 1 (1.8%) | 5 (8.9%) | 5 (8.9%) | 39 (69.6%) | 56 (100%) |

It was determined that 1 of the 6 patients who died in total died in the emergency department and 5 of them died in the intensive care units. When the causes of mortality were examined, it was determined that 2 patients died due to falling and 4 patients died due to traffic accidents.

When the 6 patients who died were examined according to age groups, it was determined that 2 patients were between the ages of 0-2, 1 patient was between the ages of 3-5, 1 patient was between the ages of 6-9, and 2 patients were between the ages of 10-14.

## Discussion

Head trauma is one of the most common socio-economic problems with its forensic and medical aspects (8). Despite efforts to reduce its incidence, it remains a major problem in pediatric patients. It is the most common childhood injury, resulting in more than 500.000 emergency room visits, 95.000 hospitalizations, and annual costs of $1 billion. It ranks third among the causes of mortality and morbidity in children (10). Mild head trauma, which is very common in childhood, is defined as a head injury that does not cause intracranial injury, has a GCS score of 14-15, and does not leave sequelae in the long term. Among the causes of head trauma, the first place is accidental falls, followed by traffic accidents and sports injuries.

In many studies, when children with head trauma are separated according to age groups, it has been seen that the group with the highest number of patients is children under 5 years old (11). However, in the present study, the highest number of patients were between the ages of 10-14. We think that this difference with the literature is because our hospital is a university hospital in the province, and mild cases mostly apply to the state hospital in the city center. In other studies, as in ours, there was a male gender predominance in all age groups (11, 12). Penetrating trauma was rare in each age group, both of the two patients were in the 10-14 age group.

Today, brain computed tomography (CT) is used as the main imaging method for the rapid detection of children with clinically severe TBI, especially those who need surgery, among the large number of patients admitted to the emergency department. However, it is noteworthy that there has been a significant increase in the number of patients undergoing brain CT imaging in recent years. Although many abnormal findings detected in brain CT do not appear to be an abnormality requiring urgent surgical intervention, the increase in the frequency of CT use continues. However, CT, which is known to increase the risk of cancer due to ionizing radiation, should be used with caution, especially in children. Although the risk of developing lethal cancer from CT in children decreases with age, its frequency varies between 1:1000 and 1:5000 (13). In the last decade, some studies are reporting clinical scores and clinical decision-making rules that help to determine the effective use of CBT in children with mild head trauma (14). Osmond et al. reported that of 3.866 children with mild head trauma, 52.8% had CCT, 4.1% had brain damage, and 0.6% had surgical intervention (15). For this reason, efforts are being made to reduce the frequency of CT use and, on the other hand, to establish guidelines for detecting TBI in the most accurate and precise way.

There is little research in the field of traumatic brain injury, particularly in the pediatric population. Because there are many differences between the brains of adults and the brains of children, the results obtained in studies on adult patients cannot be generalized to the pediatric population. Therefore, it is of great importance to conduct more specific studies from various aspects to obtain evidence-based guidelines for the diagnosis and treatment of pediatric head trauma.

## Conclusions

Parent-oriented strategies and product and environmental regulations are the most effective methods for preventing childhood injuries. Changes to the child's environment, such as stair gates, window guards, smoke alarms, car seats, child protection covers for medication packages, wall-mounted lockers, and a fenced pool, are the most important tools to prevent injuries and head injuries.

**Ethics Committee Approval**: The study was approved by the Non-Interventional Research Ethics Committee of Bolu Abant Izzet Baysal University ((Date:22/03/2022 -Decision No:2022/75)

**Informed Consent**: Written informed consent was obtained from all patients' parents or legal guardians of the children included.

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