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Clinical and Imaging Consequences in Pediatric Head Trauma

Pediyatrik Kafa Travmalarında Klinik ve Görüntüleme Sonuçları

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Abstract

Objective: Cases of childhood head trauma constitute a common patient group in emergency departments and computed tomography (CT) is a frequently preferred imaging method for these cases. We aimed to retrospectively evaluate the cranial tomography results of pediatric patients, along with their admission clinics, hospitalization, and survival status.

Method: Four-hundred pediatric patients admitted to the emergency department with head trauma between 1 January 2019 and 31 December 2020 were included in this retrospective cross-sectional study. Demographic characteristics, trauma patterns, symptoms, clinical findings, CT findings, hospitalization, consultation, and survival status of the patients were recorded and evaluated.

Results: The mean age of evaluated patients was 6.87±4.96 (range 0-17) years. Among the 400 cases in the study, the most common type of trauma was falling in 260 (65%) cases, the most common symptom was headache in 99 (24.8%) cases, and 264 (66%) patients had CT imaging. Although 137 (34.3%) of all patients had no complaints, they had CT imaging. Although 56 (14%) of all patients did not have any complaints, there was a lesion in their tomography. While 288 patients had no CT lesions, the most common CT findings included 80 (20%) cephalohematomas and 21 (5.3%) fractures, respectively. The relationship of clinical symptoms with both the presence of radiological imaging and the presence of a lesion on CT was significant (p=0.001). Four (1%) patients were in the exitus group.

Conclusion: Tomography imaging is a very important examination in pediatric patients with head trauma and is directly related to symptoms, clinic, and mortality. There is a requirement for multicenter prospective studies on this subject to establish realistic and reliable algorithms for cranial CT preference in patients.

Keywords: Child, emergency department, head trauma, tomography

Öz

Amaç: Pediyatrik kafa travma olguları acil servislere sıklıkla başvurmaktadır ve bilgisayarlı tomografi (BT) bu olgularda sıklıkla tercih edilen bir görüntüleme yöntemidir. Acil serviste değerlendirilen kafa travmalı çocuk hastaların kraniyal tomografi sonuçlarını, klinik bulgularını hospitalizasyon ve sağkalım durumları eşliğinde retrospektif olarak değerlendirmeyi amaçladık.

Yöntem: Bu retrospektif kesitsel çalışmaya 1 Ocak 2019 ile 31 Aralık 2020 tarihleri arasında acil servise kafa travması ile başvuran 400 çocuk olgu dahil edildi. Hastaların demografik özellikleri, travma mekanizmaları, semptomları, klinik bulguları, BT bulguları, yatış, çıkış, konsültasyon ve sağkalım durumları kaydedilerek değerlendirildi.

Bulgular: Çalışmadaki hastaların yaş ortalaması 6,87±4,96 (dağılım 0-17) idi. Çalışmadaki 400 olgu içerisinde, en sık görülen travma tipi 260 (%65) olgu ile düşme, en sık görülen semptom 99 (%24,8) olgu ile baş ağrısı idi ve 264 (%66) hastanın BT görüntülemesi vardı. Tüm hastaların 137'sinin (%34,3) şikayeti olmamasına rağmen BT görüntülemesi vardı. Tüm hastaların 56'sının (%14) herhangi bir şikayeti olmamasına rağmen tomografisinde lezyon vardı. İki yüz seksen sekiz hastanın BT lezyonu yokken, en sık BT bulguları sırasıyla 80 (%20) sefalohematom ve 21 (%5,3) kırık idi. Klinik semptomlarının hem radyolojik görüntüleme varlığı hem de BT'de lezyon varlığıyla ilişkisi anlamlıydı (p=0,001). Dört (%1) hastada mortalite gözlendi.

Sonuç: Kafa travmalı çocuk hastalarda BT görüntülemesi oldukça önemli bir tetkik olup, semptom, klinik ve mortalite ile direk ilişkilidir. Hastalarda kraniyal BT tercihi için gerçekçi ve güvenilir algoritmalar oluşturulması amacıyla bu konuda çok merkezli prospektif çalışmalara ihtiyaç vardır.

Anahtar kelimeler: Acil servis, çocuk, kafa travması, tomografi

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Introduction

Trauma is a condition that is increasingly common in developed or developing countries and can cause serious health problems. Although it is seen at all ages, it is a public health problem that can occur with different etiologies, frequently in children, and it causes morbidity and mortality as well as serious loss of workforce (1). In trauma cases in childhood, head traumas are quite common with isolated or accompanying traumas. From an early age, children apply to emergency services due to head trauma for many reasons. In addition to traumas occurring during birth, fall cases in infancy and childhood, child abuse, and traffic, domestic and sports accidents at advanced ages are the most common causes of head trauma (1,2).

It is very important to determine whether patients who present to the emergency department with head trauma need emergency intervention and surgical treatment after a rapid evaluation (3). Trauma is a common cause of mortality in children, and head trauma is the most common cause of death among trauma cases (1,2).

Head injuries can cause many symptoms, depending on the type, severity, and location of the injury. The child's neurological symptoms may include loss of consciousness, headache, dizziness, nausea and vomiting, difficulty walking, slurred speech, amnesia, seizures, and hemiparesis or hemiplegia. Cranial computed tomography (CT) is generally preferred to evaluate the initial intracranial injury. Head trauma is the most common indication for CT imaging in the emergency department in pediatric patients (2,4,5). It is currently the gold standard for the emergency diagnosis of intracranial injuries. Although pathology is not observed in more than 90% of CT scans, signs of injury requiring acute intervention are detected in up to 1% of cases (6). It can be thought that most of the CTs expose patients to radiation unnecessarily and may be harmful in the long term (7,8). On the other hand, failure to perform clinically indicated CT imaging as a part of the evaluation of a patient with traumatic brain injury may result in an overlooked injury and direct and immediate harm to the patient (9).

In our study, we aimed to retrospectively evaluate the cranial tomography results of pediatric patients with head trauma in the emergency department, along with their admission clinics, hospitalization, and survival status.

Materials and Methods

Study Design and Population

This retrospective, observational and cross-sectional study included 400 patients aged 0-18 years, who applied to the emergency medicine clinic between January 01, 2019 and December 31, 2020 due to isolated head trauma. During this two-year period, 96,864 patients presented to our emergency department's trauma department, with 10,260 having a head injury statement. Among 4,102 pediatric patients aged 0-18 years, 400 patients with isolated head trauma without additional trauma and no missing data in the hospital registry system were included in the study. Demographic characteristics, trauma patterns, symptoms, clinical findings, tomography findings, hospitalization, discharge, consultation, and survival status of the patients were recorded and evaluated. The data were obtained from the hospital automation system. In the study, patients who fell from a height of 1 meter or less were considered "fall", and patients who fell from a height of 1 meter or more were considered "fall from height".

Patients under the age of 18 years, whose isolated head trauma admission records were specified in the patient file or forensic report records were evaluated. Patients with complete history, physical examination findings, radiological data, neurosurgery consultation information, hospitalization information, discharge or mortality status in the patient file and hospital automation system were included in the study. Patients aged 18 years and over, who had trauma in an additional localization (spinal, thoracic, abdominal, or extremities) other than head trauma, and whose patient file and data we evaluated in the hospital automation system were missing, were excluded from the study. In addition, cases with a history of congenital or acquired chronic central nervous system involvement were not included in the study.

Data about the patients' age, gender, type of trauma, clinical symptoms, clinical findings, whether CT examination was performed or not, the presence of a lesion in CT, the presence of neurosurgery consultation, hospitalization status and location, survival and mortality status were recorded. The patients were divided into five groups according to the type of trauma: "Fall, fall from height, traffic accident, collision, assault". The patients were divided into nine groups according to their clinical symptoms as "no, nausea vomiting, headache, dizziness, unconsciousness, sleep tendency, headache + nausea vomiting, headache + dizziness, seizure". The patients were divided into two groups according to whether they had radiological CT imaging or not. The patients were divided into eight groups as "no, cephalohematoma, fracture, contusion, epidural hemorrhage, fracture + epidural hemorrhage, fracture + pneumocephalus, fracture + multiple hemorrhage" according to the presence of lesions in CT imaging. In addition, the patients were divided into two groups according to the presence of neurosurgery consultations, three groups as "discharge from emergency, service admission, intensive care hospitalization" according to their hospitalization status, and two groups as "healing/discharge, exitus" according to their survival status. The study was conducted in accordance with the Declaration of Helsinki, and Ethics Committee approval was received on November 18, 2021 with the number E-10840098-772.02-5921 from Medipol University. The study was made in accordance with the Declaration of Helsinki for human research. It meets ICMJE criteria, including all relevant legislation.

Statistical Analysis

IBM SPSS Statistics 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) software was used in the analysis. The Kolmogorov-Smirnov test was utilized to assess the normality of continuous variables. In the study, categorical variables were presented as frequency (n) and percentage (%), whereas continuous variables were presented as mean ± standard deviation and median (smallest and largest) values. Since the age parameter of the variables did not follow a normal distribution, the Kruskal-Wallis H test was utilized to compare the means of the groups. Using the chi-square analysis, the gender variable was compared to trauma mechanisms. All other tests analyzed categorical variables using the chi-square test. The statistical significance level in the study was accepted as $p<0.05$.

Results

There were 200 (50%) male participants in the study. The average age of all patients was 6.87±4.96 years (range: 0 to 17 years; males: 6.70±4.68, females: 7.03±5.23). There was a significant relationship between age and trauma types ($p=0.001$). In 260 (65%) patients, falls represented the most common type of trauma. There were 54 (13.5%) collision cases, 42 (10.5%) fall from height cases, 24 (6%) assault cases, and 20 (5%) traffic accident cases. Male patients accounted for 15 (3.8%) of assault cases. There was no relationship between gender and types of trauma ($p=0.232$, Table 1).

There was access to tomography for 137 (34.3%) of the patients who had no complaints. CT imaging was performed on 45 (11.3%) of 49 (12.3%) individuals with nausea and vomiting. Of the 99 (24.8%) cases with headache, the most prevalent symptom, approximately 47 (11.8%) had no imaging. CT scans were performed on all 7 (1.8%) patients with seizures or multiple symptoms. The relationship between CT imaging and symptoms was statistically significant ($p=0.001$, Table 2).

In the evaluation of trauma types by the presence of CT examination and the presence of a lesion on CT, 264 (66%) of all patients had a cranial CT. While CT imaging was conducted on 181 (45.3%) patients in the fall group, CT imaging was performed on 33 (8.3%) of 42 (10.6%) patients

Table 2. Relationship between the presence of cranial imaging and clinical symptoms

Cranial CT	No	Yes	All patients	p
	n (%)	**n (%)**	**n (%)**	
Clinical symptom				
No complaint	75 (18.8)	137 (34.3)	212 (53)	
Nausea vomiting	4 (1)	45 (11.3)	49 (12.3)	
Headache	47 (11.8)	52 (13)	99 (24.8)	
Dizziness	8 (2)	12 (3)	20 (5)	**0.001**
Unconsciousness	1 (0.3)	7 (1.8)	8 (2)	
Sleep tendency	1 (0.3)	4 (1)	5 (1.3)	
Headache +nausea vomiting	0 (0)	2 (0.5)	2 (0.5)	
Headache + dizziness	0 (0)	3 (0.8)	3 (0.8)	
Seizure	0 (0)	2 (0.5)	2 (0.5)	

Chi-square analysis, bold values indicate significance of p<0.05, CT: Computed tomography

Table 1. Age, gender and trauma mechanism

Trauma mechanism		All patients	Fall	Fall from height	Traffic accident	Collision	Assault	p
		Mean ± SD						
Age (year)		6.87±4.96	6.17±4.56	6.38±5.10	7.80±5.51	6.87±4.96	7.92±5.05	**0.001***
		n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	
Gender	**Male**	200 (50)	135 (33.8)	15 (3.8)	9 (2.3)	26 (6.5)	15 (3.8)	0.232**
	Female	200 (50)	125 (31.3)	27 (6.8)	11 (2.8)	28 (7.0)	9 (2.3)	
	Total	400 (100)	260 (65)	42 (10.5)	20 (5)	54 (13.5)	24 (6.0)	

SD: Standard deviation, *Kruskal-Wallis-H test and **chi-square analysis, bold values indicate significance of p<0.05

admitted with fall from height. The association between the type of trauma and the existence of cranial CT imaging (p=0.004) and the presence of a lesion on cranial CT was statistically significant (p=0.001, Table 3).

CT scans revealed lesions in 66 (16.5%) of male patients and 46 (11.5%) of female patients. On CT, there was no association between gender and the presence of lesions (p=0.117). Although 56 of the patients (14%) had no complaints, tomographic imaging revealed a lesion. The relationship between patients' clinical symptoms and the existence of the lesion on radiological imaging was statistically significant (p=0.001, Table 4).

Table 4. Relationship of the presence of cranial CT lesion with gender and clinical symptoms

Cranial CT lesion & clinical symptom	No	Yes	All patients	p
	n (%)	n (%)	n (%)	
Gender				
Male	134 (33.5)	66 (16.5)	200 (50)	0.117
Female	154 (38.5)	46 (11.5)	200 (50)	
Clinical symptoms				
No complaint	156 (39)	56 (14)	212 (53)	
Nausea vomiting	28 (7)	21 (5.3)	49 (12.3)	
Headache	79 (19.8)	20 (5)	99 (24.8)	
Dizziness	18 (4.5)	2 (0.5)	20 (5)	**0.001**
Unconsciousness	2 (0.5)	6 (1.5)	8 (2)	
Sleep tendency	2 (0.5)	3 (0.8)	5 (1.3)	
Headache, nausea, vomiting	1 (0.3)	1 (0.3)	2 (0.5)	
Headache, dizziness	1 (0.3)	2 (0.5)	3 (0.8)	
Seizure	1 (0.3)	1 (0.3)	2 (0.5)	

Chi-square analysis, bold values indicate significance of p<0.05, CT: Computed tomography

Three (0.8%) patients in the exitus group were unconscious, while one (0.3%) suffered headache. When CT lesions were analyzed in this group, it was observed that 1 patient (0.3%) had no CT lesions while 1 patient (0.3%) had only a contusion. An association between CT results and survival was revealed (p=0.001, Table 5).

Twenty-three patients (5.7%) in the service admission group and four patients (1%) in the intensive care hospitalization group exhibited tomographic lesions (p=0.001). Survival was observed in 396 (99%) patients (p=0.001). While 20 (5%) patients without CT abnormalities did not receive neurosurgical consultation, 49 (12.3%) patients had both CT findings and consultation reports. The relationship between consultation requests and CT findings was statistically significant (p=0.001, Table 6).

Discussion

Studies have shown that 50% of childhood deaths are caused by head trauma. Pediatric head traumas are also a frequent reason for admission to emergency services and can occur by many different mechanisms. In addition, it causes serious morbidity rates and financial burden in terms of health even in developed countries (10). Head trauma can occur for

Table 3. Relationship of trauma mechanisms with the presence of cranial CT imaging and CT findings

Trauma mechanism & cranial CT	Fall	Fall from height	Traffic accident	Collision	Assault	All patients	p
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Cranial CT imaging							
No	79 (19.8)	9 (2.3)	8 (2)	28 (7)	12 (3)	136 (34)	**0.004**
Yes	181 (45.3)	33 (8.3)	12 (3)	26 (6.5)	12 (3)	264 (66)	
Cranial CT finding							
No	186 (46.5)	22 (5.5)	15 (3.8)	44 (11)	21 (5.3)	288 (72)	
Cephalohematoma	60 (15)	8 (2)	2 (0.5)	7 (1.8)	3 (0.8)	80 (20)	
Fracture	10 (2.5)	9 (2.3)	1 (0.3)	1 (0.3)	0 (0)	21 (5.3)	
Contusion	1 (0.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.3)	**0.001**
Epidural hemorrhage	1 (0.3)	1 (0.3)	0 (0)	0 (0)	0 (0)	2 (0.5)	
Fracture + epidural hemorrhage	1 (0.3)	0 (0)	1 (0.3)	1 (0.3)	0 (0)	3 (0.8)	
Fracture + pneumocephalus	1 (0.3)	1 (0.3)	0 (0)	1 (0.3)	0 (0)	3 (0.8)	
Fracture + multiple hemorrhage	0 (0)	1 (0.3)	1 (0.3)	0 (0)	0 (0)	2 (0.5)	

Chi-square analysis, bold values indicate significance of p<0.05, CT: Computed tomography different reasons in every age group. Studies on this subject are very important in order to determine the differences in etiological causes and demographic data among societies. In the study conducted by Cooper et al. (11), 59% of pediatric traumas were reported as traffic accidents, 13% as falls from a height, 12% as bicycle accidents, and 16% as other causes. In the study of Efendioğlu et al. (12), the most common cause of trauma was shown to be falls (77.6%), traffic accidents (10.2%), and other causes (10.2%). In our study, we evaluated 400 pediatric patients with head trauma with a mean age of 6.87±4.96 years. In addition, we attribute the significant relationship between age and trauma type to the change in social interaction according to age groups and the age determines the type of trauma that the child is likely to be exposed to. With 260 (65%) of the patients in the fall group and 42 (10.5%) in the fall from height group, it was similar to other studies. These were followed by traffic accident and assault cases. Assault cases were also more common in boys. We attribute the high incidence of falling and falling from a height in our region to active childhood and insufficient parental involvement. The fact that assault cases are more prevalent among boys may also be due to the fact that boys are more likely to engage in joking and physical contact compared to girls.

Table 5. Relationship between clinical symptoms and survival

Survival	Healing/discharge	Exitus	All patients	p
	n (%)	n (%)	n (%)	
Clinical symptom				
No complaint	212 (53)	0 (0)	212 (53)	
Nausea vomiting	49 (12.3)	0 (0)	49 (12.3)	
Headache	98 (24.5)	1 (0.3)	99 (24.8)	**0.001**
Dizziness	20 (5)	0 (0)	20 (5)	
Unconsciousness	5 (1.3)	3 (0.8)	8 (2)	
Sleep tendency	5 (1.3)	0 (0)	5 (1.3)	
Headache, nausea, vomiting	2 (0.5)	0 (0)	2 (0.5)	
Headache, dizziness	3 (0.8)	0 (0)	3 (0.8)	
Seizure	2 (0.5)	0 (0)	2 (0.5)	
Cranial CT finding				
No	287 (71.7)	1 (0.3)	288 (72)	
Cephalohematoma	80 (20)	0 (0)	80 (20)	
Fracture	21 (5.3)	0 (0)	21 (5.3)	**0.001**
Contusion	0 (0)	1 (0.3)	1 (0.3)	
Epidural hemorrhage	2 (0.5)	0 (0)	2 (0.5)	
Fracture + epidural hemorrhage	3 (0.8)	0 (0)	3 (0.8)	
Fracture + pneumocephalus	2 (0.5)	1 (0.3)	3 (0.8)	
Fracture + multiple hemorrhage	1 (0.3)	1 (0.3)	2 (0.5)	

Chi-square analysis, bold values indicate significance of p<0.05, CT: Computed tomography

The clinical presentation of children with head trauma can be extremely variable, depending on the severity of the trauma. In general, neurological examination findings appear at the time of injury, and new clinical signs may indicate further progression of pathological changes due to head injuries. Some authors recommend using clinical symptoms and signs as screening tools to determine which patients need radiographic imaging following head trauma (13). Some authors have stated that abnormalities in neurological examination and clinical symptoms are not reliably present in children with traumatic brain injury (14). In the study of pediatric patients with head trauma, Hacioglu (15) revealed that the most common complaint was vomiting, followed by headache, loss of consciousness, amnesia, and seizures. In the study conducted by Andrade et al. (16) on 1,006 pediatric trauma patients, it was observed that 35% of the patients complained of somnolence, 33.5% of them vomiting, and 20% of them headache. In our study, 212 (53%) of our patients did not have any complaints. Headache (24.8%) was the most common complaint, followed by nausea, vomiting, and dizziness, respectively. In addition, 56 (14%) patients had a lesion in their CT although they had no complaints. Even though there are no complaints, we believe that the high rate of post-traumatic

Table 6. Relationship of hospitalization, survival, and consultations with CT findings

Cranial CT lesion & hospitalization/prognosis	No	Yes	All patients	p
	n (%)	n (%)	n (%)	
Hospitalization				
Discharge from emergency	286 (71.5)	85 (21.3)	371 (92.8)	**0.001**
Service admission	1 (0.3)	23 (5.7)	24 (6)	
Intensive care hospitalization	1 (0.3)	4 (1)	5 (1.3)	
Survival				
Healing/discharge	287 (71.8)	109 (27.2)	396 (99)	**0.001**
Exitus	1 (0.3)	3 (0.8)	4 (1)	
Neurosurgery consultation				
No	268 (67)	63 (15.8)	331 (82.8)	**0.001**
Yes	20 (5)	49 (12.3)	69 (17.3)	

Chi-square analysis, bold values indicate significance of p<0.05, CT: Computed tomography admission is a result of the ease of access to health services in modern times and the anxious attitude of parents of pediatric patients. Considering that the headache complaint is typically considered as equivalent to the pain in the trauma localization, the frequency of the absence of any complaints may be higher.

Short-term disadvantages of CT use include higher healthcare costs, more sedation procedures, longer emergency department stays, and increased parental discontentment. Early exposure to ionizing radiation, which is linked to an increased risk of cancer and mortality, is the most significant long-term disadvantage of CT use (8). Unfortunately, the increased use of CT leads to increased costs as well as increased radiation exposure, and its benefit, therefore, needs to be carefully evaluated (17). McKinlay et al. (18), in their study with 159 cases with head trauma, showed that children could not fully explain their complaints to the family, and as a result, the clinical severity could not be fully understood. In the study of Hacioglu (15) with 2,321 patients, cranial CT imaging was performed on 1,708 (71.46%) patients. In this study, in which cephalohematoma was not counted among the CT findings, bone fractures were the most common, followed by subdural hemorrhage, in 146 (6.11%) patients (15). In the study of Atmış et al. (19), epidural bleeding was observed most frequently after bone fracture. In the study, 264 (66%) patients had cranial CT imaging. The frequency of CT scanning was higher in cases of falls and falls from height. We believe that this number has increased due to both the severity of trauma and the prevalence of falls. We attribute the higher lesion frequency in CT, compared to other studies, to the fact that we defined cephalohematoma as a pathological lesion in our study. We attribute the high rate of patients with no complaints, who have not undergone imaging, and the high rate of patients who have undergone imaging despite having no complaints to the fact that numerous physicians have adopted varying perspectives and evaluation methods on this issue. A group of physicians requested tomography imaging in response to concerns such as legal malpractice and documented instances of positive CT findings in the absence of complaints.

Despite the fact that patient clinics and follow-ups determine the imaging plan and results, studies may report different recommendations. In a study involving 916 patients conducted by Güzel et al. (20), it was determined that CT was performed on 318 patients, CT was abnormal in 19.8% of those patients, and 13.8% of all patients required hospitalization. In a recent study conducted in England, it has been determined that the number of pediatric patients with head trauma who have sought emergency care has increased over the past decade, while the number of traumatic brain injuries and surgical interventions has remained unchanged. In recent years, mortality and length of hospital stay have decreased according to the same study (21).

Studies on hospitalization and mortality in head traumas have been conducted. Işık et al. (22) evaluated 851 children with head trauma, who also had additional trauma, and discovered a 3.8% mortality rate. Furthermore, Cecen et al. (23) examined 157 pediatric patients under the age of three years, who had moderate to severe trauma with head trauma, and they discovered a 3.18% mortality rate. In our study, 4 (1%) cases resulted in clinical death. There were 4 (1%) patients who were discharged from the intensive care unit with full recovery, and 1 (0.3%) patient who were exitus. Three (0.8%) patients died in the emergency department. We think that the reason why most of the cases resulted in death in the emergency room is due to the high severity of the trauma, the instability of the clinic, and the fact that they occur without being hospitalized. We attribute the survival of 99% of the patients to the fact that our hospital is a qualified trauma center and that it is due to the effective evaluation of the trauma patient. Furthermore, we attribute the higher mortality rate in comparable articles to the fact that moderate-to-severe cases were evaluated in other studies and our patients had isolated head trauma with no additional injuries. In addition, the high number of applications and the fact that the severity of trauma in most of them is not severe enough to result in mortality can also be cited as a reason.

Study Limitations

One of the limitations of our study may be that the way of grouping the risk and severity of trauma in children presenting with head trauma could not be done adequately in the emergency department. Uncertainty about the rate of protective equipment and precautions during trauma and the inability to predict which type of trauma will result in more severe consequences can be counted among the limitations. In addition, the possibility that the data obtained from pediatric patients in both history and physical examination are not realistic due to communication and interaction difficulties can be stated as another limitation.

Conclusion

The data show that the mechanism, clinical symptoms, and findings in head trauma cannot provide clear data for CT imaging with current analyses and studies. In general, the choice of imaging differs according to the clinician's experience and evaluation of the patient, and forensic concerns. We think that a large number of multicenter prospective studies are needed to standardize this medically and to establish certain criteria among physicians and health institutions.

Ethics

Ethics Committee Approval: Ethics committee approval was received on 18.11.2021 with the number E-10840098-772.02-5921 from Medipol University.

Informed Consent: Our study is retrospective and was carried out on data processing data without using patient names.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Concept: B.A., A.C., B.D., Design: B.A., A.C., B.D., B.Ç., Data Collection or Processing: B.A., B.D., H.K., Analysis or Interpretation: B.A., A.C., B.Ç., Literature Search: B.A., B.D., H.K., B.Ç., Writing: B.A., H.K.

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References

1. Marin JR, Weaver MD, Yealy DM, Mannix RC. Trends in visits for traumatic brain injury to emergency departments in the United States. JAMA 2014;311(18):1917-1919.
2. Menoch MJ, Hirsh DA, Khan NS, Simon HK, Sturm JJ. Trends in computed tomography utilization in the pediatric emergency department. Pediatrics 2012;129(3):690-697.
3. Osmond MH, KlassenTP, Wells GA, Correll R, Jarvis A, Joubert G, et al. CATCH: a clinical decision rule for the use of computed tomography in children with minor head injury. CMAJ 2010;182(4):341-348.
4. Larson DB, Johnson LW, Schnell BM, Goske MJ, Salisbury SR, Forman HP. Rising use of CT in childvisits to the emergency department in the United States, 1995-2008. Radiology 2011;259(3):793-801.
5. Miglioretti DL, Johnson E, Williams A, Greenlee RT, Weinmann S, Solberg, LI, et al. The useof computed tomography in pediatrics and the asso-ciated radiation exposure and estimated cancer risk. JAMA Pediatr 2013;167:700-707.
6. Kuppermann N, Holmes JF, Dayan PS, Hoyle JD, Atabaki SM, Holubkov R, et al. Pediatric Emergency Care Applied Research Network (PECARN). Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. Lancet 2009;374(9696):1160-1170.
7. Pearce MS, Salotti JA, Little MP, McHugh K, Lee C, Kim KP, et al. Radiation exposure from CT scans in childhood and subsequent risk of leukaemia and brain tumours: a retrospective cohort study. Lancet 2012;380(9840):499-505.
8. Mathews JD, Forsythe AV, Brady Z, Butler MW, Goergen SK, Byrnes GB, et al. Cancer risk in 680 000 people exposed to computed tomography scans in childhood or adolescence: data link-age study of 11 million Australians. BMJ 2013;346:f2360.
9. Schonfeld D, Fitz BM, Nigrovic LE. Effect of theduration of emergency department observation oncomputed tomography use in children with minorblunt head trauma. Ann Emerg Med 2013;62(6):597-603.
10. Ceylan D, Yaldız C, Kızılçay G, Gündüz Y. Head Traumas in Childhood: Retrospective Evaluation of 357 Cases. Türk Nöroşirürji Dergisi 2013;23(3):255-260.
11. Cooper A, Barlow B, DiScala C, String D. Mortality and truncal injury: the pediatric perspective. J Pediatr Surg 1994;29(1):33-38.
12. Efendioğlu M, Akar E, Emon ST, Çalışaneller AT. Our Clinical Experiences on Pediatric Head Trauma Cases. Haydarpasa Numune Med J 2020;60(4):412-416.
13. Quayle KS, Jaffe DM, Kuppermann N, Kaufman BA, Lee BC, Park TS, et al. Diagnostic testing for acute head injury in children: when are head computed tomography and skull radiographs indicated? Pediatrics 1997;99(5):E11.
14. Lloyd DA, Carty H, Patterson M, Butcher CK, Roe D. Predictive value of skull radiography for intracranial injury in children with blunt head injury. Lancet 1997;349(9055):821-824.
15. Hacioglu NS. Retrospective evaluation of the characteristics of patients with head trauma under the age of 18 who applied to the emergency department. Specialization Thesis in Medicine. Uludag University Faculty of Medicine. 2018.
16. Andrade FP, Montoro R Net N, Oliveira R, Loures G, Flessak L, Gross R, et al. Pediatric minor head trauma: do cranial CT scans change the therapeutic approach? Clinics (Sao Paulo) 2016;71(10):606-610.
17. Martin C, Falcone RA. Pediatric traumatic brain injury: an update of research to understand and improve outcomes. Curr Opin Pediatr 2008;20(3):294-249.
18. McKinlay A, Ligteringen V, Than M. A comparison of concussive symptoms reported by parents for preschool versus school-aged children. J Head Trauma Rehabil 2014;29(3):233-238.
19. Atmış A, Tolunay O, Çelik T, Gezercan Y, Dönmezer Ç, Reşitoğlu S, et al. Dilemma in Pediatric Head Trauma: Is Cranial Computed Tomography Necessary or Not in Minor Head Traumas? J Pediatr Emerg Intensive Care Med 2016;3(1):27-31.
20. Güzel A, Ceylan A, Tatli M, Başoğul M, Ozer N, Kahraman R, et al. [Falls from height in childhood in Diyarbakir province: a questionnaire study combined with clinical data]. Ulus Travma Acil Cerrahi Derg 2009;15(3):277-284.
21. Marlow R, Mytton J, Maconochie IK, Taylor H, Lyttle MD. Trends in admission and death rates due to paediatric head injury in England, 2000-2011. Arch Dis Child 2015;100(12):1136-1140.
22. Işık HS, Gökyar A, Yıldız Ö, Bostancı U, Özdemir C. [Pediatric head injuries, retrospective analysis of 851 patients: an epidemiological study]. Ulus Travma Acil Cerrahi Derg 2011;17(2):166-172.
23. Cecen A, Is M, Celikoglu E. Falls and motor vehicle accidents as the most common causes of moderate and severe head injuries in children age 3 and younger. Bagcilar Medical Bulletin 2017;2(3):60-66.