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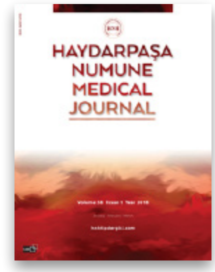

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ORIGINAL ARTICLE

Our Clinical Experiences on Pediatric Head Trauma Cases

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Abstract

Introduction: Head injury is an important cause of morbidity and mortality in the pediatric age group. In this study, we aim to share our experience in the management of childhood head trauma cases.

Methods: Data on the clinical, radiological and demographic characteristics of our children patient group who had head trauma followed by our clinic between the years of 2017 and 2019 were analyzed retrospectively in this study.

Results: 77.6% of the children fell from a height, 10.2% of them were vehicle accidents and 12.2% of them were isolated head trauma. 56.1% of children are between 0-2 years old, 19.4% between 3-7 years old and 24.5% between 8-17 years old. The rate of falling from height in children aged 0-2 years (96.4%), 3-7 age (57.9%) and 8-17 age (50%) groups were significantly higher than children. GKS scores ranged from 4 to 15, with an average of 14.63±1.58 and a median of 15. While 92.9% of the cases were mild head trauma, 5.1% of the cases were middle head trauma, and 2% were severe head trauma. Considering the findings of IT, Linear fracture was found in 49%, epidural hematoma in 42.9%, contusion in 21.4%, subdural hematoma in 19.4%, SAK in 14.3% and collapse fracture in 10.2%. While 77.6% of the children did not have surgery, hematoma surgery was performed in 15.3%, decompressive surgery in 3.1%, hematoma and decompressive surgery in 4.1%. There was an inverse, 50.5% and statistically significant correlation between the initial GCS score and blood sugar.

Discussion and Conclusion: Head trauma, which is a preventable cause of morbidity and mortality, is important in pediatric neurosurgery patient follow-up. Early diagnosis and treatment in these patients reduce many severe consequences from disabilities to death.

Keywords: Computerized tomography; morbidity; mortality; pediatric head trauma; prognosis.

Pediatric head trauma is a common health problem in the pediatric age group and may cause significant morbidity and mortality in this age group [1]. Head traumas constitute 12% of the indications for admission to the hospital during childhood [2]. Because the children had heavier head mass and the thinner calvarium compared to adults, head traumas of the same severity may progress with more severe outcomes in children, and their long-term results may differ [2,3]. According to the severity of traumatic brain injury due to head trauma, head traumas are classified as mild, moderate and fatal [1,3]. In this classification, Glasgow coma scores (GCSs) of the patient at admission to the hospital are considered [4].

Patients with GCS scores 14-15, 9-13, and 3-8 points are classified as having mild, moderate and severe-fatal brain injuries [4]. The causes of head injuries are similar all over the world and mostly preventable. For this reason, etiological and epidemiological studies in this area are important. In this study, we have compiled the etiological and clinical features of our pediatric patients admitted to our hospital due to head trauma in the light of current literature data.

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Materials and Methods

The clinical, radiological and demographic data of the 98 patients under the age of 18 who were admitted to the emergency department of our hospital with head trauma between 2017 and 2019 and followed up and treated by our clinic were retrospectively analyzed. Patients with spinal trauma and vital internal organ injuries were excluded from this study. According to the neurological examinations and computed tomography (CT) findings of the patients (computed brain tomography, fracture of the cranium bones, intracranial hemorrhage or edema), the decision to hospitalize these patients were made.

The decision for hospitalization was also made for patients with positive CT findings, patients with a defect detected in their neurological examination, and/or whose GCS scores were below 15 points, and cases with positive CT findings even if their GCS scores were 15 points. The follow-up and treatment of cases with severe head trauma with GCS scores of ≤9 points were performed in the intensive care unit, and the follow-up of patients with improvement in clinical findings was maintained in our service. Age, gender, GCS scores, causes of trauma, accompanying organ injuries, whether surgery was performed, CT findings, a surgical indication of patients undergoing surgery, duration of hospitalization, whether CPR was performed, need for intensive care follow-up, causes of mortality, blood glucose values at admission, and the relationship between admission GCS scores and blood glucose values were evaluated.

Statistical Analysis

For the statistical analysis of the results obtained in this study, IBM SPSS Statistics 22 (IBM SPSS, Turkey) programs were used. The suitability of the parameters to normal distribution was evaluated with the Shapiro- Wilks test. While evaluating the study data, in the comparison of qualitative statistical methods (mean, standard deviation, median, frequency), one-order chi-square test and Fisher- Freeman-Halton test were used. Spearman's rho correlation analysis was used to examine the relationships between parameters that do not conform to normal distribution. Statistical significance was evaluated at the level of $p<0.05$.

Results

This study was carried out with 98 children including 58 (59.2%) boys and 40 (40.8%) girls, whose ages ranged from one month to 17 years. The mean age of the study population was 4.73±5.58 years (median: 2 years). Blood glucose values ranged from 62 to 321 .mg/dL (mean±SD: 112.41±32.04 .mg/dL; median: 106 mg/dL) (Table 1). The respective proportion of study participants were 0-2 (56%) 3-7 (19.4%), and 8-17 (24.5%) years old.

A statistically significant difference existed between age groups in terms of trauma rates ($p=0.000$; $p<0.05$). The rate of trauma in children aged 0-2 years was significantly higher than children aged 3-7 and 8-17 years ($p1=0.000$; $p2=0.000$; and $p<0.05$, respectively).

Table 1. Distribution of the study parameters

	n	%
Age (year)		
0-2	55	56.1
3-7	19	19.4
8-17	24	24.5
Gender		
Male	58	59.2
Female	40	40.8
Type of trauma		
Fall from a height	76	77.6
Traffic accident	10	10.2
Isolated head trauma	12	12.2
Multitrauma		
Yes	8	8.2
No	90	91.8
GCS		
Mild	91	92.9
Moderate	5	5.1
Severe	2	2
Pupillary response		
Isocoric	96	98
Anisocoric	2	2
CPR		
Yes	1	1
No	97	99
Cerebral CT		
SAH	14	14.3
Subdural Hematoma	19	19.4
Epidural Hematoma	42	42.9
Linear Skull Fracture	48	49
Depressed Skull Fracture	10	10.2
Contusion	21	21.4
Surgery		
No	76	77.6
Hematoma surgery	15	15.3
Decompressive surgery	3	3.1
Hematoma+Decompressive	4	4.1
Intensive Care		
Yes	5	5.1
No	93	94.9
Mortality		
Yes	2	2
No	96	98

A significant difference was not found between 3-7 and 8-17 age group children concerning trauma rates (p> 0.05) (Table 2). The study population consisted of boys (59.2%) and girls (40.8%) without any statistically significant difference in terms of trauma rates (p=0.069; and p>0.05, respectively). The affected children fell from a height (77.6%), injured at a traffic accident (10.2%) and had an isolated head trauma (12.2%). Multitrauma was observed in 8.2% of the cases.

The 0-2 age group of patients who were referred to the hospital consisted of nearly equal numbers of boys and girls (49.1% vs 50.9%). The corresponding distribution of boys and girls in the age groups of 3-7 (78.9% vs 21.1%), and 8-17 (66.7% vs 33.3%) were as indicated in parentheses (Table 3). A statistically significant difference existed between the types of trauma by age groups (p=0.000; p<0.05). The difference arises from children in the 0-2 age group. The rate of falling from height in children aged 0-2 years (96.4%) was significantly higher when compared with 3-7 (57.9%) and 8-17 (50%) age groups (p1=0.000; p1=0.000; p2<0.05). There is no significant difference between 3-7 and 8-17 age group children in terms of trauma types (p>0.05). There is no statistically significant difference between the sexes in terms of trauma types (p=0.350; p>0.05).

Male patients fell from a height in 72.4%, had traffic accidents in 12.1% and isolated head traumas in 15.5% of the cases. Female patients fell from a height in 85%, had a vehicle accident in 7.5% and isolated head trauma in 7.5% of the cases. Admission GCS scores ranged from 4 to 15 points (mean±SD: 14.63±1.58 and median 15 points). According to GCS scores ranging from 4, and 15 points, the patients had mild (14-15 pts: 92.9%), moderate (10-13 pts:), and severe (<9 pts: 2%) head traumas (Table 4). In 98% of the children, the pupillary response was isocoric, while in 2% of them it was anisocoric.

Only one child underwent CPR. Considering the findings of CT, the linear fracture was found in 49%, epidural hematoma in 42.9%, contusion in 21.4%, subdural hematoma in 19.4%, SAH in 14.3% and a compression fracture in 10.2% of the cases (Table 1). While 77.6% of the children did not undergo surgery, hematoma surgery was performed in 15.3%, decompressive surgery in 3.1%, hematoma and decompressive surgery in 4.1% of the cases. Only 5.1% of children were hospitalized in the intensive care unit, and two children (2%) died (Table 1). An inverse and statistically significant correlation was found at a level of 50.5% between the admission GKS scores and blood glucose levels (p=0.000; p<0.05) (Fig. 1).

Table 2. Distribution of the male and female cases according to their age groups

Gender	0-2 age n (%)	3-7 age n (%)	8-17 age n (%)	Total n (%)
Male	27 (49.1)	15 (78.9)	16 (66.7)	58 (59.2)
Female	28 (50.9)	4 (21.1)	8 (33.3)	40 (40.8)
Total	55	19	24	98

Table 3. Evaluation of the type of the traumatic event according to age, and gender of the patients

	Type of traumatic event			
	Fall from a height n (%)	Traffic accident n (%)	Isolated head trauma n (%)	p
Age (year)				
0-2	53 (96.4)	0 (0)	2 (3.6)	0.000*
3-7	11 (57.9)	4 (21.1)	4 (21.1)	
8-17	12 (50)	6 (25)	6 (25)	
Gender				
Male	42 (72.4)	7 (12.1)	9 (15.5)	0.350
Female	34 (85)	3 (7.5)	3 (7.5)	

Fisher Freeman Halton Test; *p<0.05.

Table 4. Correlation between admission GCS scores and blood glucose

	Admission GCS scores -Blood glucose
r	-0.505
p	0.000*

Spearman's rho correlation test; *p<0.05.

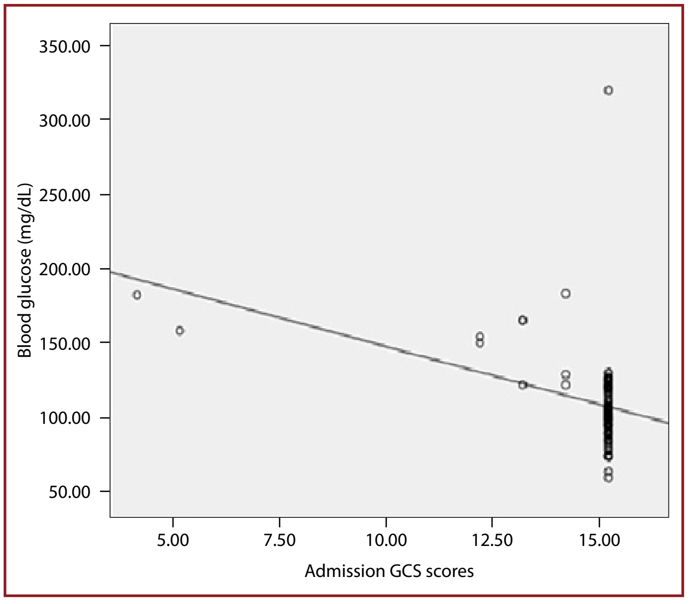

Figure 1. Correlation between the admission GCS scores and blood glucose levels.

Discussion

The most important cause of death in the age group of 15 and under is trauma, and head trauma is the most common childhood trauma [5]. In 80% of pediatric age group patients with multiorgan trauma, head trauma is also present [6]. According to many studies, it was reported that head traumas are responsible for approximately 50% of the deaths in the pediatric age group [7]. Pediatric head injuries, besides being a serious cause of morbidity and mortality, because of its financial burden it is an important health problem even in developed countries.

Although the causes of pediatric head traumas differ according to age groups, there may also be differences in the ranking of etiological causes among societies. For this reason, demographic studies of societies and even provinces are important. In a study, Cooper et al. identified traffic accidents in 59%, falls from a height in 13%, bicycle accidents in 12% and other causes in 16% of the cases of pediatric head trauma [8,9]. When grouped by age, they reported falls in 23%, traffic accidents in 49%, bicycle accidents in 7% and other causes in 19% of children aged 0-15 years [9].

In our study, the most common cause of trauma was fall from a height in 77.6% of the cases followed by traffic accidents and other causes with a rate of 10.2%. However, it should be remembered that there may be etiological differences between the settlements. In a study conducted in Paris, the most frequent reason of falling was falling from the window (72%), while in the Batman province, falling from the roof (35.5-49.5%), and in the Samsun province, stumbling on the ground (70%) were more frequently observed [10,11,12]. The cases we included in our study were between 0-2, 3-7, and 8-17 years of age in 56.1% 19.4% and 24.5% of the cases. The most common cause of head trauma in all age groups was again falling (96.4%, 57.9%, 50%, respectively).

Ökten et al. and Şimşek et al. reported that emergency surgery was required in 23.8%, and 18.2 % of their cases, respectively [13,14]. In our study, the most common CT finding was a linear fracture and none of them required surgical intervention. Similar to the literature data, we operated 22.4% of our cases. Hematoma surgery was performed in 15.3%, decompressive surgery in 3.1%, a combination of hematoma and decompressive surgery in 4.1% of the cases.

In the above-mentioned study, when the patients were evaluated according to their admission GCS scores, moderate and severe head traumas were reported in 16.7% and 29.9% of the cases, respectively [13,14]. Considering the results of our study, according to the GCS scores, mild, moderate, and severe head traumas were detected in 92.9%, 5.1% and 2% of the cases, respectively. According to these results, in our study, severe head trauma cases were less frequently encountered compared to the literature data.

Many parameters affecting prognosis after head trauma have been studied. In particular, increased serum glucose values have been reported to be associated with poor prognosis and increased mortality rates after head trauma [15]. Brain injury after head trauma develops through two separate mechanisms, primary and secondary. The primary mechanism of damage is formed by direct compression of the brain due to trauma or hitting on the surrounding tissues [16]. The secondary injury mechanism is more complex and develops within hours and days. The role of systemic factors is important in this mechanism.

Hypoxemia, hypotension, hypertension, hyperglycemia and hypoglycemia may be among the effective systemic factors [15,16]. Among these, hyperglycemia is the most known systemic factor associated with prognosis. Thus, monitoring and regulation of blood glucose are vital in the follow-up of head trauma patients [15,16]. In our study, the blood glucose levels of the patients ranged between 62 and 321 mg/dl and the median value was 106 mg/dL. There is a statistically significant negative correlation between admission GKS score and blood sugar, which supports the relationship between blood glucose and the clinical condition and prognosis of patients.

Conclusion

Head injuries are among important public health problems in childhood and may cause severe morbidity and mortality. When we look at the etiology, it is seen that most traumas arise from preventable causes. In our study, the most common cause of trauma was fall from a height, and it was observed that it was more common at younger ages. This is a dismal condition, but fortunately, these traumas can be prevented by taking precautions and training. It has been determined that blood glucose levels seriously affect the prognosis associated with head trauma, and the importance of blood glucose monitoring and regulation is emphasized once again in these patients.

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