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Epidemiological Comparison between Two Decades of Pediatric Head Injury Hospitalization in Turkey in 2000-2010 and 2011-2020

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ABSTRACT

AIM: To understand the changing trends in pediatric head injury in a university hospital comparing two decades.

MATERIAL and METHODS: The medical records of pediatric patients hospitalized for head injuries were evaluated retrospectively between 2000 and 2020 to investigate the epidemiological differences between decades. The patient files were evaluated in terms of age, sex, mechanism of trauma, whether there was additional trauma, radiological findings, Glasgow coma score (GCS), and Rankin scores.

RESULTS: A difference was found between the ages of the patients who were hospitalized for head trauma in 2000–2010 (first decade) and 2011–2020 (second decade) ($p<0.001$). The admission rate of children in the preschool age group was higher in the second decade ($p<0.05$), whereas the admission rate of school-age children and adolescents was higher in the first decade ($p<0.05$). The admission rate of patients who had head trauma due to traffic accidents was higher in the first decade ($p<0.05$). The rate of linear fracture was higher in the second decade (29.90% vs. 55.60%, $p<0.05$). The incidence of epidural hemorrhage was higher in patients admitted in the first decade (18.50% vs. 7.90%, $p<0.05$).

CONCLUSION: Some classical information has changed over the years. Multicenter studies with a higher number of patients will correct the changing knowledge about pediatric head trauma.

KEYWORDS: Epidemiology, Fall, Pediatric head injury

ABBREVIATIONS: HI: Head injury, **GCS:** Glasgow coma score, **CT:** Computed tomography

INTRODUCTION

Head injury (HI) is a common condition causing significant morbidity and mortality in the pediatric population (4,6). Its long-term effects on the social and cognitive development of children increase its importance.

In the USA, more than 64,000 children are hospitalized for HI and 650,000 pediatric patients have been admitted to the emergency department yearly (3). In the USA, more than 3,000 deaths from pediatric head trauma occur annually (5). In the United Kingdom, the presentation with HI in children increased by 10% in a decade (4).

The most common mechanism that causes HI in children are falls from a height and traffic accidents, which depend on the patients' age. Falls and child abuse are more common in

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younger children, whereas traffic accidents and sports-related injuries play a greater role in older children. Most pediatric HIs are minor, but a small number of severe HIs may have lifelong effects on the individuals, causing significant emotional and physical defects.

The most common mechanisms that cause head injuries in children are falls and traffic accidents which are well known causes. Head injuries still remain a common cause of hospitalization and dead in pediatric age group. There is a lack of data about changing trends of head injury over the years.

With the above background, this study aimed to understand the changing trends in pediatric HI in a university hospital comparing two decades.

MATERIAL and METHODS

The medical records of the pediatric patients who were hospitalized for HIs were evaluated retrospectively in the period from 2000 to 2020 to investigate the epidemiological differences between decades. Patient files were evaluated in terms of age, sex, mechanism of the trauma, whether there was additional trauma, radiological findings, Glasgow coma score (GCS), and Rankin scores.

Both the primary admissions and the ones that were transferred from another hospital were included. GCS were assessed on admission. The enrolled children were divided into 3 age brackets: 0-6 years (preschool), 6-13 years (school period) and 14-17 years (adolescent). The severity of injury was classified into 3 groups in accordance with the GCS. Scores of 'mild', 'moderate', and 'severe' were used for GCS scores of 13-15, 9-12, and 3-8, respectively. Those with missing data in their patient files and those with a history of suspicious head trauma were excluded from the study.

This study was approved by the institutional ethics committee of Bursa Uludag University School of Medicine (2022-1/8). The informed consent form was obtained from the parents or legal guardians of the patients.

Statistical Analysis

The consistency of age to normal distribution was examined with the Shapiro–Wilk test. The Mann–Whitney U test was performed to compare age, GCS, and Rankin scores. Categorical variables were given as n (%) values and compared using the Chi-square test. IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. The type I error rate was set at 5% for statistical analysis.

RESULTS

One thousand seven hundred forty five patients were included to the study. A difference was found between the ages of the patients who were hospitalized for head trauma in the period from 2000 to 2010 (first decade) and from 2011 to 2020 (second decade) ($p<0.001$) (Table I). The median age of the patients admitted in the first decade was 5 years, whereas it was 6 years in those admitted in the second decade. When examined according to age groups, a difference was noted between the admission periods ($p<0.001$). The rate of children in the preschool age group was higher in the second decade ($p<0.05$), whereas the admission rate of school-age children and adolescents was higher in the first decade ($p<0.05$). No difference was found between the admission periods according to sex distribution ($p=0.436$) (Table I).

The causes of head trauma differed according to the periods ($p<0.001$). In the subgroup analyses, the admission rate of patients who had head trauma due to falls was higher in the second decade ($p<0.05$). Moreover, the admission rate of patients who had head trauma due to traffic accidents was higher in the first decade ($p<0.05$). However, the admission rates of patients who had head trauma due to impact and beatings did not differ according to the admission period ($p>0.05$). The rate of additional trauma was observed at a higher rate in patients admitted in the first decade ($p<0.001$). Additional trauma was observed in 53.30% of the patients who were hospitalized in the first decade compared with 35.80% hospitalized in the second decade. The severity of trauma in patients with additional trauma (n=701) did not differ according to the admission period ($p=0.228$) (Table II).

The pathological findings in computed tomography (CT) were not different according to the admission periods ($p=0.566$).

Table I: Age and Gender Distribution of Patients Admitted According to Periods

	2000-2010 (n=437)	2011-2020 (n=1308)	p-value
Age (years)	5 (2:10)	6 (1:7)	**<0.001[a]**
<6 years(preschool)	222 (50.80%)	846 (64.70%)	
6-13 years (school period)	155 (35.50%)	354 (27.10%)	**<0.001[b]**
14-17 years (adolescent)	60 (13.70%)	108 (8.30%)	
Gender			
Female	151 (34.60%)	476 (36.60%)	**<0.001[b]**
Male	286 (65.40%)	829 (63.40%)	

Data were presented as median(25^{th} percentile: 75^{th} percentile) and n%. ***a:*** *Mann-Whitney U Test,* ***b:*** *Chi-Square Test.*

While CT findings were observed in 76.70% of the patients hospitalized in the first decade, this rate was 78% in the second decade. Moreover, a difference was observed in the distribution of CT findings according to the decades that patients had symptoms (n=1305; p<0.001). In the subgroup analyses of CT findings, the rate of linear fracture was higher in the second decade (29.90% vs. 55.60%, p<0.05). The incidence of epidural hemorrhage was higher in the first decade (18.50% vs. 7.90%, p<0.05). The incidence of subdural hemorrhage on CT was also higher in the first decade (10.40% vs. 6%, p<0.05). On the contrary, no difference was found between the admission periods according to the incidence of SAH–contusion–intracerebral hematoma–mix findings (p>0.05). The rate of linear fracture+epi-/subdural hematoma/SAH finding was higher in the first decade (19.10% vs. 12.80, p<0.05), and the incidence of depression fracture was higher in the first decade (11.30% vs. 7.80%, p<0.05). No difference was noted between the admission periods in terms of the incidence of compression fracture+epi-/subdural hematoma/SAH/contusion (p>0.05) (Table III).

The rate of those who underwent surgery was higher in the first decade (p<0.001). While 31.80% (n=139) of the patients admitted in the first decade underwent surgery, the rate of those who underwent surgery in the second decade was 8.90% (n=116).

GCS and Rankin scores of the patients differ according to the admission period (p<0.001 and p<0.001). The GCS score was higher in patients who were hospitalized in the second decade, and the Rankin score was higher in the first decade (Table IV).

Table II: Comparison of the Causes of Trauma and the Incidence of Additional Trauma according to the Decades

	2000-2010 (n=437)	2011-2020 (n=1308)	p-value[b]
Cause of Trauma			
Fall	255 (58.40%)	1006 (76.90%)	**<0.001**
Traffic accident	146 (13.40%)	211 (16.70%)	
Crush	29 (6.60%)	71 (5.40%)	
Beaten	7 (1.60%)	20 (1.50%)	
Additional trauma	233 (53.30%)	468 (35.80%)	**<0.001**
Impact of additional trauma (n=701)			
Mild	195 (83.70)	387 (82.70)	0.228
Moderate	37 (15.90)	71 (15.20)	
Severe	1 (0.40)	10 (2.10)	

Data were presented as n%. ***b:*** *Chi-Square Test.*

Table III: Comparison of Computed Tomography Findings by Periods

	2000-2010 (n=437)	2011-2020 (n=1308)	p-value[b]
Presence of CT Evidence	335 (76.70%)	1020 (78%)	0.566[b]
CT Evidence (n=1305)			
Lineer Fracture	100 (29.90%)	567 (55.60%)	**<0.001**
Epidural Hemorrhage	62 (18.50%)	81 (7.90%)	
Subdural Hemorrhage	35 (10.40%)	61 (6%)	
SAH-Contusion-Intracerebral Hematoma-Mix	17 (5.10%)	57 (5.60%)	
Lineer Fracture+Epi/Subdural Hematoma/SAH	64 (19.10%)	131 (12.80%)	
Depression Fracture	39 (11.60%)	80 (7.80%)	
Depression Fracture +Epi/Subdural Hematoma/SAH/Contusion	18 (5.40%)	43 (4.20%)	

Data were presented as n%. ****:*** *Calculated over n=701 patients with additional trauma.* ***b:*** *Chi-Square Test.*

Table IV: Comparison of Glasgow Coma Scale and Rankin Scores of Patients Admitted according to Decades

	2000-2010 (n=437)	2011-2020 (n=1308)	p-value[a]
GCS	15 (11:15) 12.78 (±3.65)	15 (15:15) 14.36 (±2.01)	**<0.001**
Rankin	0 0.77 (±1.80)	0 0.25 (±0.89)	**<0.001**

Data were presented as median (25th percentile: 75th percentile) and mean (st. deviation). ***a:*** *Mann-Whitney U Test.*

DISCUSSION

Population-based data on HIs are very important to understand the changing epidemiology of HIs. To our knowledge, this is one of the largest series of pediatric HIs to date, especially focusing on the changing trends between decades that may be a mirror to modernization.

In the epidemiological studies by Kool et al. and Trefan et al., children aged <5 years have the highest incidence rate, and male patients had higher HI incidence than female patients in all age groups (1,6). In our study, a difference was found in the ages of the patients between decades. The mean age of the patients with HI was increased in the second decade. We could not detect any sex difference between decades. These differences between the literature and our study may be due to cultural differences.

We found that the causes of head trauma differed between decades. The rate of falls from a height was significantly higher in the first decade than in the second decade. This difference between the two decades may be due to the construction of higher buildings in cities. Despite improvements in road safety, an increase in the number of traffic accidents was observed between 2010 and 2020, contrary to literature (2). The lack of mortality increase in these years can also be attributed to the increase in road safety or increased safety measures in cars.

Trefan et al. pointed that CT was performed in only 30.4% of children with HI and that 8.9% of these patients had simple skull fractures (6). In our series, linear fractures detected by CT were more common in the second decade. The possible reason is that more patients undergo radiological imaging in the emergency department. The incidence rates of depression fractures and epidural and subdural hematoma and surgery rates were higher in the first decade.

In this study, the GCS score was higher in the second decade, and the Rankin score was higher in the first decade. These findings are an indication that the patients presenting in this period have milder head trauma or received more effective first aid or emergency room management.

Limitations

The main limitation of this study is that it was conducted in a single center. In addition, patients could not be evaluated according to their socioeconomic status. Finally, the lack of information about child abuse limits the generalization of the results of this study.

CONCLUSION

In this study, we found that some classical information has changed over the years. Thus, multicenter studies with a higher number of patients will provide correction of the changing knowledge about pediatric head trauma.

AUTHORSHIP CONTRIBUTION

Study conception and design: MOT
Data collection: AIO, MB
Analysis and interpretation of results: GO
Draft manuscript preparation: MOT
Critical revision of the article: MOT, AIO, MB, GO
Other (study supervision, fundings, materials, etc...): GO
All authors (MOT, AIO, MB, GO) reviewed the results and approved the final version of the manuscript.

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