



## Head Trauma in Children: An Epidemiological Study

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### Abstract

**Introduction:** Brain injury is one of the most common causes of death among victims of trauma in various accidents. The type of accident and outcome could be different in children from adults. Therefore, we aimed to investigate the epidemiology of traumatic head injury in children.

**Materials and Methods:** In this cross-sectional study, 114 patients (age≤15 years) with head trauma, who were admitted to trauma ward of Imam Reza hospital in 2018 were enrolled in the study. Data regarding the demographic characteristics, mechanism of trauma, season of trauma, hemodynamic findings and outcome of the patients were collected.

**Results:** The mean age amongst victims of trauma was 6.52±3.95 years and majority of them (70.2%) were male. Most of traumatic accidents took place in the spring (27.2%) and summer (32.5%). Traffic accidents (pedestrians or passenger) (55.3%) and falling (39.5%) were the most common mechanism of trauma. Also, epidural hematoma (EDH) and brain contusion were the most encountered type of brain injury (1.75%). Nine patients (7.89%) underwent brain surgery. Eventually, eight patients (7.17%) died.

**Conclusion:** Falling and vehicle accidents are the main causes of head injury among children. Increasing the parents' awareness toward these types of accidents and proper preventive measures can reduce traumatic brain injury.

### Keywords

- Head injury
- Brain injury
- Trauma
- Children

## Introduction

Trauma is one of the most important health problems, which threatens thousands of people every day in the world.<sup>1</sup> Major causes of accidents and trauma are using car, speeding up vehicles and failing to observe safety precautions.<sup>2</sup> It is estimated that 10 thousand children die around the world annually of traumatic injuries. Ten percent of prolonged hospitalization in the pediatric age group is due to trauma.<sup>3</sup> Many of these patients have physical and psychological disabilities, and some will never be able to continue to live and work like they had before the traumatic event, and the quality of life of these patients get worse.<sup>3</sup>

Children have formed a large part of Iran's population. Children are exposed to various traumatic events as the most common cause of their disabilities and mortality.<sup>4,6</sup> The three main causes of children's brain injury are falling, car accident and bicycle accident.<sup>7</sup> Intracranial injuries are the most common cause of child traumatic death.<sup>8,9</sup> To reduce the incidence of trauma, it is necessary to identify the risk factors and make precautions such as securing playgrounds, training and enforcing driving laws, using safety devices while using vehicles and protecting children's beds.<sup>10</sup>

Understanding the epidemiology of head trauma among children is necessary for proper preventive measure of these events. Therefore, the present study aims to evaluate the epidemiology of head trauma among children in North-West of Iran.

## Materials and Methods

The research was approved by Ethics committee

of Tabriz University of Medical Sciences (IR. TBZMD.REC.1399.432). This cross-sectional study was conducted in pediatric victims of trauma who were referred to emergency ward of Imam Reza hospital (trauma center), Tabriz, Iran in 2018. Inclusion criteria were head trauma, GCS<14, hospitalization in the ward and age<15 years old. Criteria of exclusion were incomplete hospital record, discharge from emergency room (E.R.) and death in E.R.

The data collection was done via the questionnaire made by the researcher, including Patients' demographic characteristics, vital signs, laboratory results, mechanism and cause of trauma, associated injuries, GCS score, severity of head injury (mild: GCS= 13-15, moderate= 8-13, severe≤8), seasonal variations, Computed tomography (CT) findings, need for surgery and outcome.

Patients were followed up for 6 months after discharge, were asked to visit the clinic and their neurological status were evaluated.

## Statistical analysis

Data was analyzed by SPSS20 statistic software. Descriptive statistic indices (incidence, percentage, standard deviation) supplied our statistical analysis. Chi square test was used for comparing the qualitative data. To contrast quantitative data between groups, one-way ANOVA test was utilized. P value of less than 0.05 proved of statistical significance in our research.

## Results

Of 978 patients with head trauma, 114 patients

(11.56%) were enrolled in the study. Demographic and laboratory data, GCS score, severity of head

injury, imaging and outcome are demonstrated in **Table 1**.

**Table 1:** Demographic, imaging and outcome during hospital stay

variable		frequency
Hb (g/dl)		11.14±1.3
(% ) Hct		32.41±2.78
WBC (m/mm <sup>3</sup> )		13870.94±4781.23
Plt (m/mm <sup>3</sup> )		256000±12500
Na (meq/L)		140.63±2.35
K (meq/L)		4.23±0.46
Cr (mg/dl)		0.64±0.21
Urea (mg/dl)		11.72±4.29
HR		90.1±7.56
Systolic BP (mmhg)		102.5±5.55
Head trauma severity	Mild (GCS=13-15)	93 (81.57%)
	Moderate (GCS=8-13)	14 (12.28%)
	Severe (GCS≤8)	7 (6.14%)
Season		
Spring		31 (27.2%)
Summer		37 (32.5%)
Autumn		26 (22.8%)
Winter		20 (17.5%)
Trauma Mechanism		
Driving accidents (pedestrians or passenger)		63 (55.3%)
Fall from Height		45 (39.5%)
Pure Head Trauma		6 (5.3%)
Injury accompanied with head trauma		75 (65.8%)
Skull fracture		
DF (Depressed Fracture)		2 (1.75%)
Liner fracture		3 (2.63%)
Complex fracture		1 (0.87%)

Abnormality in CT scan	
EDH(Epidural Hematoma)	2 (1.75%)
SDH (Subdural Hematoma)	1 (0.87%)
IVH (Intra Ventricular Hemorrhage)	1 (0.87%)
Cerebral contusion	2 (1.75%)
Outcome	
Alive	106 (92.83%)
Death	8 (7.17%)

Most of patients were male and in the range of 1-15 years age. The most common injury accompanied with head trauma, was upper limb injury (41.2%) and the most common traumatic brain events were EDH and contusion (1.75%). Nine patients (7.89%) underwent brain surgery. Eight patients (7.17%) died. Difference of statistical significance

was not found in duration of hospitalization between the two sex ( $P = 0.66$ ). The mechanism of trauma was not significantly different between the two ( $P=0.48$ ). The need for surgery between the two sexes was not significantly different ( $P=0.53$ ). Death rate was not notably different between the two sexes ( $P = 0.26$ ) **Table 2**.

**Table 2:** Comparison between two sex

	Male	Female	P-Value
Hospitalization (days)	5.24±3.87	3.9±1.56	0.66
GCS	12.3±1.21	13.2±1.4	0.5
Trauma Mechanism			
Driving accidents (pedestrians or passenger)	46 (57.5%)	17 (50%)	0.48
Fall from Height	31 (38.8%)	14 (41.2%)	
Pure Head Trauma	3 (3.8%)	3 (8.8%)	
Need for surgery	6 (7.5%)	3 (8.8%)	0.53
Death	7 (8.8%)	1 (2.9%)	0.26

## Discussion

Head trauma is a major and preventable problem in health care systems, especially among children.<sup>7</sup> In most cases, the main cause of death is brain injury.<sup>11</sup>

In the present study, the incidence of trauma in boys is about 2.5 times higher than girls; Memararzadehet al.<sup>9</sup> and Brehautet et al.<sup>12</sup> found the same results in their study.

Our results showed that trauma occurred more commonly in the spring and summer season, probably due to the more favorable weather conditions for playing outside. Also, Javid et al. demonstrated that trauma occurred more often in the spring and summer.<sup>13</sup>

The most common mechanisms of head trauma in this study were car accidents and falling. In various studies, these two patterns of accident have been identified as the most common mechanisms of trauma.<sup>10,13</sup> Based on the results of Maegele et al.<sup>15</sup> falling was the second cause of head trauma. However, Reid et al.<sup>16</sup> and Styrke et al.<sup>17</sup> have reported that fall from the height was the first cause of head trauma in children younger than 15 years.

In our study, the most common pathologic features, found on brain CT scan were EDH (1.75%) and liner fracture (2.63%), respectively. Borg et al. found 5% abnormality in brain CT scan.<sup>18</sup> Similar to our findings, Dunning et al.<sup>19</sup> reported liner fracture (1%) and EDH (0.4%) as most common findings on brain CT scan but the incidence was less than our study.

According to Amaranath et al.<sup>20</sup> 6.51% of patients had been directly taken to the operating room. In present study, 7.89% of patients underwent surgery. Nevertheless, Borg et al. demonstrated that only 1% of patients needed surgery<sup>18</sup> Also, Dunning et al. demonstrated that 0.6% patients had aneurological operation and 0.1% children died.<sup>19</sup>

The incidence of death in our study was 7%. Previous studies have reported mortality rate of 4.02%-13%.<sup>7, 11, 21</sup>

### Limitations:

We evaluated a small sample of patients which prevents us from generalizing the data to the whole population; as a retrospective study, some patients were not enrolled in the study for lack of information and also we could not include other variables for the analysis.

## Conclusion

In the present study, motor vehicles accidents and falling were the most important causes of head trauma and brain injury, and road accidents were more involved. Improving road conditions, promoting driving culture and improving the quality and speed of services in pre-hospital and emergency departments should be a major planning priority, in order to reduce these incidents and their complications

## Ethical Consideration

This study was approved by Ethics committee of Tabriz University of Medical Sciences with code number IR.TBZMED.REC.1399.432.

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Not applicable

Not applicable

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There is no conflict of interest.

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