© Military Pharmacy and Medicine • 2012 • 1 • 113 – 117

Emergency Medicine

The epidemiology of intracranial injuries in children

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Received: 2011.10.12 • **Accepted:** 2012.03.01 • **Published:** 2012.03.27

Summary:

Introduction: This article constitutes an assessment of epidemiological and clinical aspects of intracranial injuries in children. **Material and Method:** The investigation was conducted among all children aged up to 18 years admitted to the Regional Specialist Hospital in Lodz in 2011 due to an intracranial injury. Factors taken into consideration were: sex and age of the patient, time and mechanism of injury, neurostatus according to GCS, as well as mortality as a result of intracranial injury. **Results:** The study group included 214 patients (144 boys and 70 girls). The average age in the group was 11. The average duration of hospitalization was 3.89 days. All of the patients underwent head tomography which showed brain concussion in 212 cases. The remaining two cases were: traumatic cerebral oedema and traumatic subarachnoid haemorrhage. **Conclusions:** Boys aged 17 and 18 were the ones who suffered from intracranial injuries the most frequently. The majority of patients with intracranial injury obtained 15 points in the Glasgow Coma Scale. The most frequent intracranial injury was brain concussion.

Key words: trauma, child, emergency, brain.

Introduction

Children with craniocerebral traumas are the dominant group among paediatric patients hospitalized because of injuries [1-3]. The course is different from that in case of adults, which is why in this group, unexpected, life-threatening complications are the most likely to occur. [2-4].

A general condition of the vast majority of admitted patients is good, with minor head traumas [5,6,7-10]. "Minor" does not mean "insignificant" or "trivial". Sara A. Schutzman, MD, believes that attempts to decrease the mortality rate due to head injuries in children should not focus exclusively on the treatment of the most serious and quite serious injuries, but also on the prevention of dangerous complications of the minor injuries [11-12]. One of the most frequent types is intracranial injury, including brain concussions [13]. Considering the fact that there are hardly any epidemiological data referring to intracranial injuries in children, the authors decided to undertakethis issue.

Aim of the study

The purpose of the paper was to assess the epidemiological and clinical aspects of intracranial injuries in children.

Material and Method

In this paper, the cases of children admitted to the Regional Specialist Hospital in Lodz because of intracranial injuries were retrospectively analyzed.

The analysis took into account factors such as the age of the patients, their sex, time (of day and year) and mechanism of injury, and patient's neurostatus.

The analysis covered the year 2010 and was based on medical documentation. It was conducted in accordance with regulations on the protection of personal data, which were meticulously attended to.

In the analysis, the following tests were used: Student's t-test, Wilcoxon rank-sum test, chi-squared test, and chi-squared test for contingency tables. Cramer's V coefficient was also utilized.
The significance level for all the tests was $\alpha=0.05$.

Results

A group of 214 paediatric patients treated for intracranial injuries was selected. A large majority of the group were boys (n=144; 67%). Girls constituted 33% of the study group (n=70; p<0.001). Sex distribution of the group is shown in Figure 1.

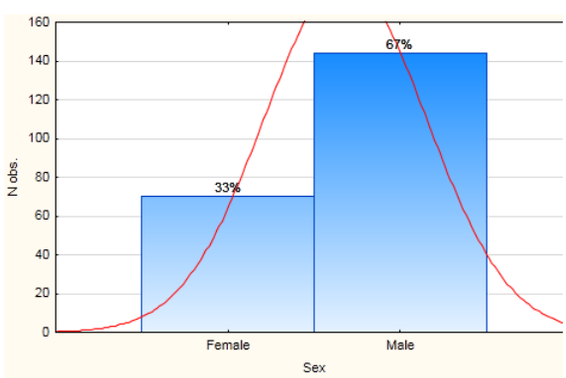

Figure 1: Sex distribution in the study group.

The average age of the group was 11.26±4.96. No statistically significant difference in the average age of girls and boys was observed (p=0.6474; Fig.2).
The most dominant group with intracranial injury were people aged 16 and 17 years (n=30; 14% for each of the groups), followed by those aged 12 years (n=19; 9%). Children under 1 year of age were the least numerous group (n=2; 1%). The analysis

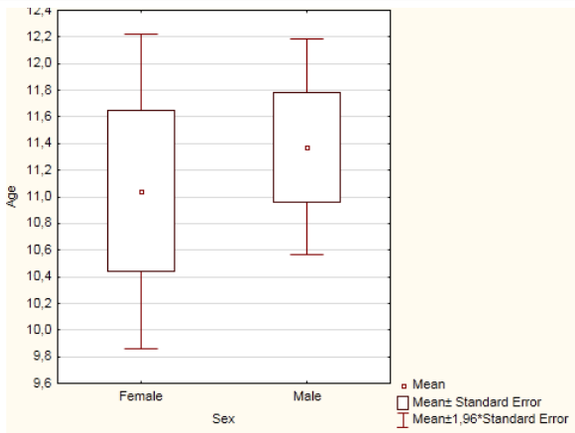

Figure 2: Box plot of patients' age in the study group.

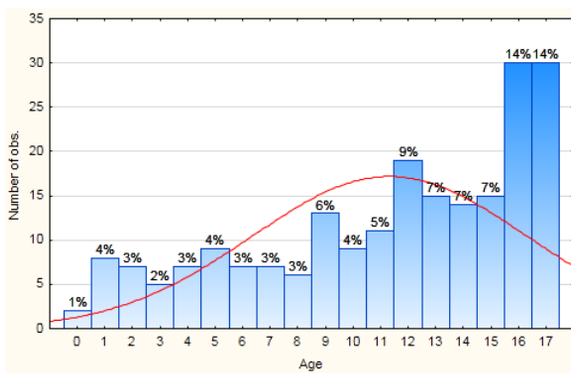

Figure 3: Age distribution in the study group

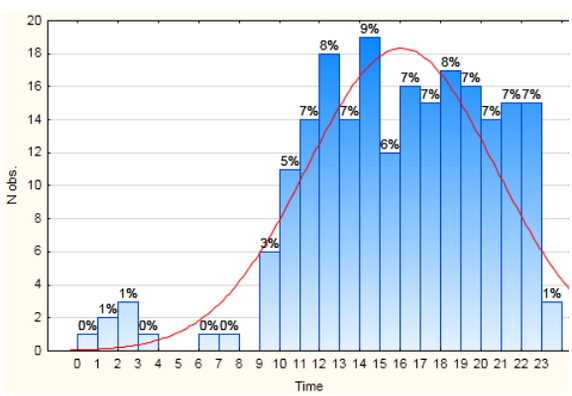

Figure 4: Distribution of the cases of intracranial injuries depending on the hour

revealed a statistical difference in the age of paediatric patients with intracranial injuries (p<0.001; Fig.3).

The analysis was conducted with a focus on the frequency of intracranial injuries in the diurnal cycle. Medical assistance to intracranial injuries was usually sought at around 2 p.m. (n=19%; 9%), followed by midday (n=18; 8%) and 6 p.m. (n=17; 8%). Cases of intracranial injuries were much less frequent at nights and in the early mornings. No cases were observed between 4 and 5.59 a.m. or between 8 and 8.59 a.m. (p<0.001; Fig.4).

The analysis on the basis of a division into four separate periods (midnight – 5:59 a.m., 6:00–11.59 a.m., midday–5:59 p.m., 6–11:59 p.m.) indicated that most of the intracranial injuries among patients under study were inflicted in the afternoon (midday – 5:59 p.m.). As many as 94 cases of intracranial injuries were observed during that period, which amounted to 44% of the study group. In the period from 6 to 11:59 p.m., 80 cases were observed (37%), whereas in the morning period (6-11:59 a.m.) 33 cases occurred (15%). In the period between midnight and 5:59 a.m. the lowest number of cases was observed (n=7; 3%). The distribution of intracranial injuries over the diurnal cycle is shown in Figure 5.

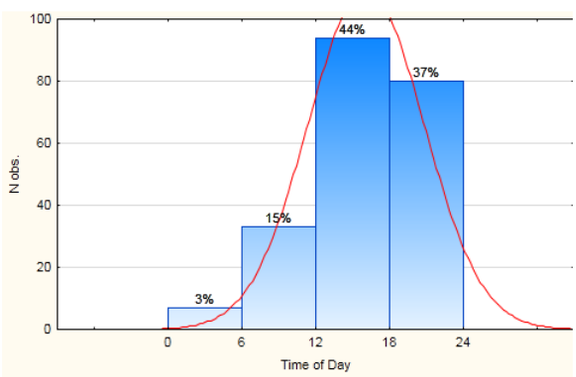

Figure 5: Distribution of the cases of intracranial injuries depending on the time of day

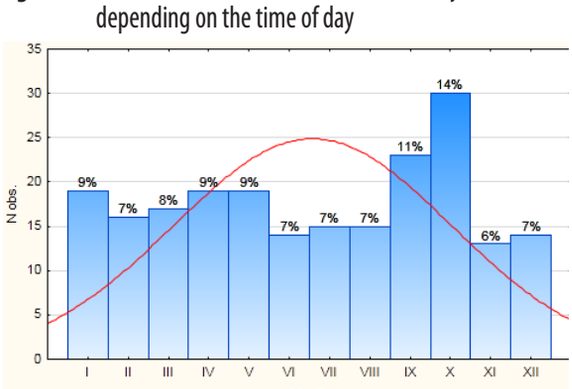

Figure 6: Distribution of the cases of intracranial injuries depending on the month

The analysis was conducted with the focus on the month of admission to hospital. It revealed that the intracranial injuries were most frequent in October (n=30; 14%), followed by September (n=23; 11%), whereas the lowest number of cases was observed in November (n=13; 6%; Fig.6).

The analysis on the basis of months divided into seasons revealed a statistically significant difference in the number of cases of intracranial injuries in the study group ($p<0.001$). The patients sustained intracerebral injuries most frequently in autumn (31%), followed by spring (26%), whereas the cases were least frequent in summer (21%; Fig.7).

Taking into consideration the frequency of intracerebral injuries in the course of the week, most of them were inflicted on Sunday (n=39; 18%), followed by Monday (n=36; 17%), whereas the lowest frequency was observed on Saturday (n=16; 7%). The Shapiro-Wilk test showed a statistically significant difference in the occurrence of intracerebral injuries depending on the day of the week ($p<0.001$; Fig.8).

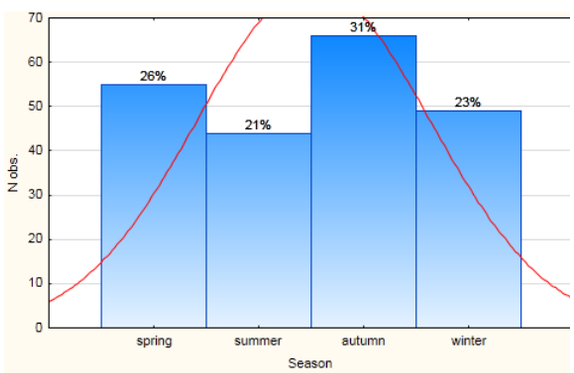

Figure 7: Distribution of cases of intracranial injuries depending on the season of the year.

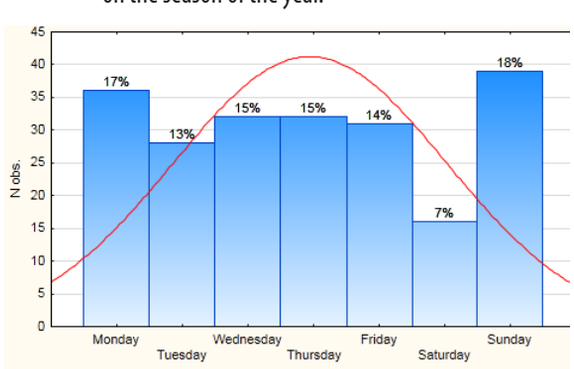

Figure 8: Distribution of cases of intracranial injuries depending on the day of the week.

The survival rate until hospital discharge amounted to 100% in the study group. The average hospitalization time was 3.89±2.44 days, whereas the longest hospitalization period was 24 days ($p<0.01$; Fig.9).

The most frequent cause of intracranial injury was falling down on a level surface, which accounted for 42% of the investigated injuries. This cause was followed by collision-free bicycle accidents (n=22;

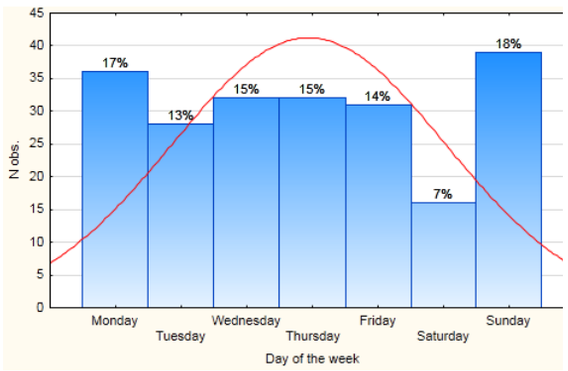

Figure 9: The duration of hospitalization in the study group.

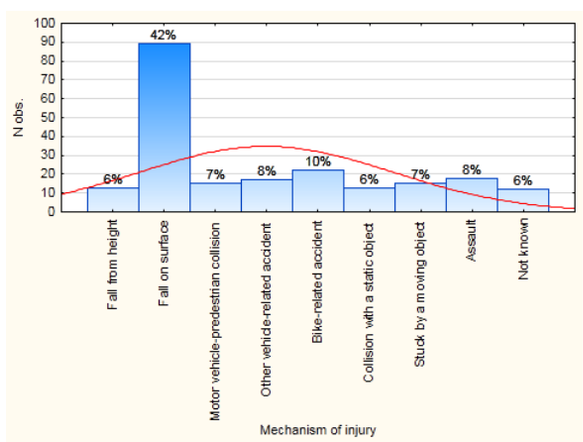

Figure 10: Mechanism of injury in the study group.

10%) and beatings (n=18; 8%). "Being hit by a car" was the cause of 15 cases of intracranial injuries, whereas other road traffic accidents accounted for 8% of them (n=17; p<0.001). The distribution of the injury mechanism is shown in Figure 10.

During medical examinations, patients with head injuries were also assessed neurologically, with the Glasgow Coma Scale. As many as 89% of patients (n=191) were rated 15 points according to GCS; 18 of them were rated 14 points. Two patients were rated 12 points and another two 11. Only one person was rated 13 GCS points.

All patients underwent a CT of the head. Brain concussion was diagnosed in 212 cases; the remaining two diagnoses were traumatic cerebral oedema and traumatic subarachnoid haemorrhage.

Discussion

Over the last two decades, a decline in the number of head injuries has been observed both in Western Europe and in the United States [9-10, 14]. This results from preventive measures being widely applied in those countries – there is a downside trend in the number of road traffic accidents as well as in the number of injuries themselves [14]. Unfortunately, this is not the case in Poland. There is a steady increase in the number of patients treated for head injuries. Predominant causes of injuries remain the same. However, as stated by many authors in the last decade, more and more of those injuries are caused by road traffic accidents and acts of violence [4,15].

Our research showed a great deal of similarity to the results presented in the literature. Among patients of the Regional Specialist Hospital in Lodz there were 214 paediatric cases with intracranial injuries. Boys were the dominant subgroup (n=144; 67%); girls accounted for 33% of the whole population (70 cases). Male dominance in the groups of patients with intracranial injuries was also indicated by other authors (Tarantino – 56% [8], Atabaki – 64.1% [5], Isik – 65% [16], Kleiven – 67.7% [17], Gassner – 68% [13], Cadotte – 69.6% [3], Brown – 83% [18]).

The average age of patients suffering from intracranial injuries in the study group was 11.26 years and was much higher for boys than for girls. The age connected with the highest number of head injuries was 17 and 18 years (14% of each group), whereas the second peak was 12 years of age (9%). The lowest number of those injuries was observed in the group under 1 year of age (1%). These results seem to indicate that patients suffer from intracranial injuries most frequently after they become qualified to drive vehicles. A lower average age of patients suffering from intracranial injuries was observed by Atabaki (8.9 years of age) [5].

The analysis of the material showed some statistically significant differences in the occurrence of head injuries depending on the month (p<0.001). An increase of the intracranial injury cases in autumn months and a decrease in summer months was observed. Similar trends can be observed in the distribution based on seasons (p<0.001). However, research conducted by Duus indicated otherwise – he observed an increase in head injury cases in spring and summer months [18].

The peak number of head injuries can be observed in the afternoon (2 and 6 p.m.), which may result

from an increased activity of people, connected with their return home from the place they stay at during the day. Different authors claim that the most frequent cause of serious head injuries is road traffic accidents, regardless of the patient's age. Seat belts and airbags used in an appropriate way as well as improved road infrastructure and reduction of speed can decrease the risk of fatal and serious head injuries by about 45-55% [4].

The cause of 42% of head injuries was "falling down on a level surface"; road traffic accidents accounted for 15% (including "being hit by a vehicle", which accounted for 7% of all cases). Intracranial injuries were inflicted as a result of violence in 8% of the investigated cases. These results are not discrepant from those presented by other authors (Ingebrigtsen – 62%, 21%, 7% [19], Agrawal – 65%, 25.6%, 9.4% [1]). The dominance of road traffic accidents among the causes of intracranial injuries was indicated by Cadotte (60.3%) [3]. Falling down was observed to be the most frequent cause of intracranial injuries also by Alexoiu [20], Brown (53%) [21], DiScala (58.4%) [22] and Isik (70%) [16]. Road traffic accidents were mentioned as the most frequent cause of head injuries by Lopez (56% of cases) [23].

Conclusions

- Intracranial injuries are most frequent among boys of 17 and 18 years of age.
- Most of the patients suffering from intracranial injuries receive 15 points in the Glasgow Coma Scale.
- The most frequent intracerebral injury is brain concussion.

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