

Received: 12 February 2014 • Accepted: 03 March 2014

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doi:10.15412/J.JBTW.01030303

# Epidemiological evaluation of penetrating ocular trauma in patients under the age of sixteen

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## ABSTRACT

Evaluation of epidemiological factors and the contributing factors in occurrence of penetrating ocular trauma in patients under the age of 16. This descriptive - analytical study was carried out on 100 children affected by penetrating eye trauma, who were referred to ophthalmology emergency room, Feiz Hospital, in one year. For each patient, age, gender, time and place of occurrence of trauma, education level of parents, being alone at the time of trauma, and the type of trauma were recorded and analyzed. The mean age of patients was 7±3.8 years (2-16 years old), and of the patients evaluated 69 patients were male. The trauma occurred at home in 57 cases, and 47% of injuries took place in the morning. Knife was the most common cause of injury (26%). 29 patients were alone at the time of trauma. The most frequent type of injury was corneal laceration. All the traumas were unilateral. Careful observation of children by parents, particularly in the morning, plays an important role in decreasing the number of penetrating traumas. Moreover, supervising outdoor activities and games is of great importance.

**Key words:** penetrating eye trauma, child, education

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## 1. INTRODUCTION

The epidemiology of penetrating eye injuries has been studied in order to develop preventive strategies. With this work, we evaluated eye injuries occurring over a period of 11 and half years to categorize high-risk behaviours. Since early diagnosis and treatment appear to improve prognosis, prognostic indicators of poor visual outcome and clinical findings would help health care providers make this diagnosis more efficient to study. Penetrating eye injuries are a leading cause of unilateral non-congenital visual loss. Children account for up to 50% of all ocular trauma, thus representing the highest incidence. Eye trauma is one of the most common causes of ocular injuries. Out of the annual 2.4 million cases of eye injuries in the USA, almost 35% occur in individuals under the age of 17. Eye injuries usually cause uni-ocular vision and non-congenital unilateral blindness in children (1-5). Physical trauma can be penetrating or non-penetrating. Most penetrating traumas lead to severe visual activity loss. There are few studies available on characteristics of paediatric ocular injuries. In recent years home has been the most common place for occurrence of significant paediatric ocular injuries. Moreover,

introduction of bonfire and the possibility of contact of children and juvenile with these factors have provided the context for occurrence of ocular traumas. There are differences in the epidemiological characteristics of paediatric ocular trauma in different parts of the world. Also, each region has its particular characteristics which require appropriate planning for preventive measures. Therefore, it seems reasonable to evaluate the epidemiological properties of paediatric ocular trauma in our region as well as the factors effective in its occurrence. Then, by improving the knowledge of parents about the factors and reducing the exposure with the contributing factors, potential complications could be reduced (6-9).

## 2. MATERIALS AND METHODS

In this descriptive cross-sectional study, we included 100 patients aged less than 16 years, who had been admitted to the Imam Khomeini Hospital at the Kermanshah University of Medical Sciences for the management of eye injuries. The necessity for admission to the hospital was determined by an ophthalmologist after detailed eye examinations in the emergency room (ER). We determined the initial visual acuity

in the patients, examined the globe and its adnexa, and performed slit-lamp examination and dilated fundus examination (if possible). In very young and uncooperative children, visual acuity was tested with age-appropriate methods. We also recorded characteristics such as age, sex, interval between trauma and presentation to the ER, type of activity at the time of injury, the type and extent of ocular trauma, whether the patient was managed with or without surgical intervention and the ocular condition (visual and anatomical status) at the time of discharge. The classification of ocular trauma was based on a modified form of International Ocular Trauma Classification and Birmingham Eye Trauma Terminology. For frequency distributions, percentages were calculated as the number of positive responses divided by the total number of patients in whom there was mention of the variable in the chart. This denominator does not always equal the total number of patients in the study because in some cases not all measures were documented in the medical record. For continuous variables means  $\pm$  6 standard deviations (SDs) are reported for normally distributed variables; medians with interquartile ranges (IQRs) are reported for variables with skewed distribution. Ninety-five percent confidence intervals (95% CIs) were calculated using In Stat 2.01 (Graph Pad Software, San Diego, CA). For comparisons of nominal variables, chi-square testing of two-by-two contingency tables was performed. For comparisons of continuous variables, Student's t-test was used. Significance in each of these cases was defined as a two-tailed p-value <0.05.

### 3. RESULTS AND DISCUSSION

In the current study, 100 children and juveniles with penetrating ocular trauma were evaluated. The mean age of the patients was  $7 \pm 3.8$  years (2-16 years old). Of the patients, 69 were boys. The mean age of boys and girls were  $6.7 \pm 3.8$  and  $7.2 \pm 3.8$  years, respectively, which were not significantly different, according to

Table 1, knife was the most frequent cause of penetrating injury (6%), followed by wooden stick injury (17%).

the Student's t-test result ( $p=0.61$ ).

#### 3.1. Place of occurrence of injury

The injury occurred at home in 57 cases, in the playground in 6 cases, in streets in 21 cases, and in other places in 6 cases. The prevalence of injuries occurred at home was 59.4% and 51.6% in boys and girls respectively. The frequency of school injuries were 7.2% and 16.1% in boys and girls respectively; while the rate was 20.3% and 22.6% for injuries occurred in streets in boys and girls respectively. The results of Fisher's exact test demonstrated that the place of occurrence of ocular trauma was not significantly different in boys and girls ( $p=0.63$ ).

#### 3.2. Relationship between place of occurrence of injury and patient's age

The mean ages of patients who experienced injury at home in school, playground, street and other places were  $6.8 \pm 3.9$ ,  $7.2 \pm 3.9$ ,  $8 \pm 5$ ,  $7.8 \pm 3.4$ , and  $5.2 \pm 1.6$  years respectively. According to the results obtained by variance analysis test place of occurrence of injury and patient's age were not significantly related ( $p=0.59$ ).

#### 3.3. Time of injury

Of the injuries, 47% occurred in the morning (47.8% boys and 45.2% girls), 39% in the evening (36.2% boys and 45.2% girls), and 14% at night (15.9% boys and 9.7% girls) ( $p=0.064$ ).

#### 3.4. Relationship between time of injury and patient's age

The mean ages of patients in whom the injury occurred in the morning, evening and at night were  $5.9 \pm 3.5$ ,  $8.3 \pm 3.8$ , and  $7.4 \pm 3.6$  years respectively and the variance analysis results indicated that there is not a statistically significant relationship between time of injury and patient's age ( $p=0.009$ ).

#### 3.5. Cause of injury

As shown in

Table 1. Frequency of cause injury in the both sex

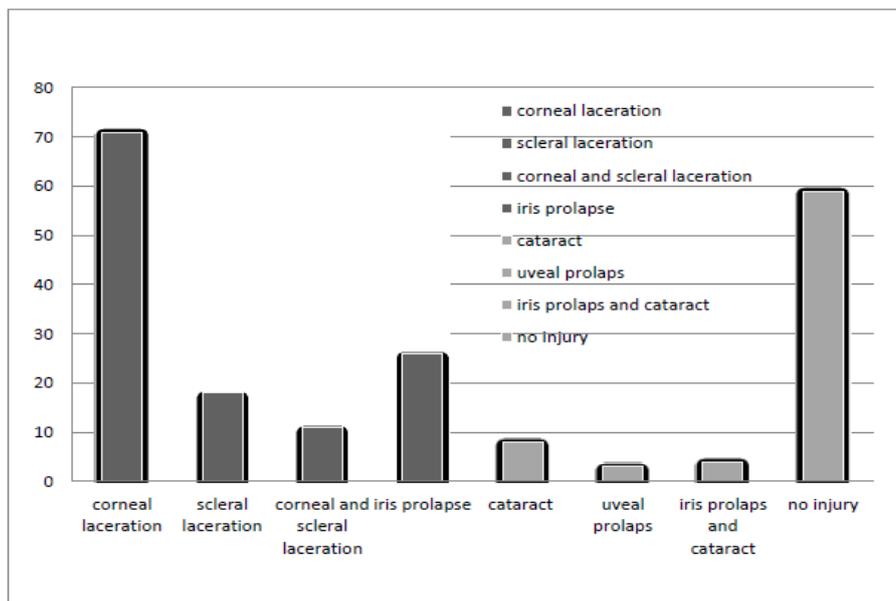
Cause injury	girl		boy		Total	
	number	percent	number	percent	number	percent
knife	26	26	17	24.6	9	29
wood	17	17	13	18.8	4	12.9
glass	14	14	8	11.6	6	19.4
stone	9	9	5	7.2	4	12.9
stationary	8	8	6	8.7	2	6.5
Incendiary material	5	5	5	5.8	1	3.2
other	35	15	11	15.9	4	12.9
Total	100	100	89	100	31	100

Knife was the most common cause of injury in both genders (24.6% in boys and 29% in girls). Fisher's exact test did not find a significant relationship between gender and cause of injury ( $p=0.89$ ). Frequency distribution of cause of injury in different age groups is shown in Table 1. The highest and lowest mean ages related to injury with bonfire (8 years) and stationery (5.5 years) respectively. The education level of fathers of the injured children was under high school diploma, high school diploma, and academic level in 65%, 26%, and 9% of cases respectively. With regard to the education level of the mothers, 76% were under high school diploma, 21% had high school diploma, and 3% had academic education. In the children studied, 53.8%, 57.7%, and 77.8% of injuries occurred at home in children whose fathers' education level was below high school diploma, high school diploma, and academic level respectively. Therefore, the place of occurrence of injury and father's education level did not have significant statistical relationship ( $p=0.93$ ). In children with mothers' level of education below high school diploma, high school diploma, and academic level 61.8%, 33.3% and 100% of ocular injuries occurred at home, respectively. Thus, the two factors were not statistically related ( $p=0.098$ ). Analysis of the effect of father's education level on

the cause of injury showed that the cause of injury in 21%, 26.9%, and 55.6% of children whose father's level of education was below high school diploma, high school diploma, and academic level were knife respectively. This shows that the two factors were not statistically related ( $p=0.77$ ). Moreover, it was observed that 28.9% and 19% of children of mothers with the education level below high school diploma and high school diploma were respectively injured by knife, while in children whose mothers had academic education level there were no cases of knife injury. However, the statistical tests did not find a significant relationship between mother's level of education and the cause of injury ( $p=0.097$ ). At the time of injury 29 patients were alone and 71 children were not alone. The mean age of the two groups were respectively  $3\pm0.6$  and  $4\pm0.5$  years, and the mean age of the two groups were statistically different with respect to the results obtained by Student's t-test ( $p=0.007$ ). Considering gender distribution, 16 boys and 13 girls were alone at the time of injury (23.2% versus 41.9%). The Chi-square test did not show significant difference between the two genders. In 71% of children, the main injury was corneal laceration, while in 18% and 11% of the cases, the injury were sclera laceration and lacerations of cornea and sclera respectively (exact test indicated that the types of main ocular injury were not significantly different ( $p=0.63$ ).

Chart 1). Frequency distribution of main injuries of the two genders are illustrated in Diagram 3, and the results of Fisher's

Chart 1. Frequency ratio of kind of injury main injury and side injury



According to the results obtained, 28.2%, 27.8%, and 9.1% of corneal, sclera, and corneal and sclera lacerations were respectively caused by knife trauma. Furthermore, 12.7%, 27.8%, and 27.3% of corneal, sclera, and corneal and sclera lacerations were respectively caused by wooden stick trauma. As the results of statistical tests demonstrated, the cause and type of injury were not statistically related ( $p=0.42$ ). In all cases, the injury was unilateral, and there was no case of bilateral ocular trauma. Considering the agitation and uncooperativeness of children under 10, careful evaluation of visual acuity at the time of admission was not possible, and in children between 10-16 years old the mean visual acuity at the time of admission was

finger count at 3-meter distance. Ocular injury is a well-established cause of preventable visual loss in young individuals the epidemiology of ocular injuries varies from community to community, region to region and with time. In the current study, the mean age of participants was  $7\pm3.8$  years. The aim of the study was to evaluate children and juveniles under the age of 16. With regard to the age distribution 69% of patients were male. Since men are more adventurous than women, the rate of ocular trauma has been reported to be higher in men almost in all the studies carried out so far (10, 11). However, the higher rate of ocular injury in adolescents is related to factors such as occupational factors and underlying diseases, while the

frequency in childhood and infancy mainly relates to the fact that boys have higher activity, higher rate of presence in public areas and outdoors and higher involvement in dangerous tasks. In the current study more than half of ocular traumas occurred at home which can be explained by the age range of the patients. They spent most of their time indoors and expose to the risk factors at home. In the study carried out by ONYEKONWU in Nigeria 51% of the injuries occurred at home. (12). In the current study, almost half of the injuries occurred in the morning, which seems to be reasonable with regard to the activity range of children. Higher rate of occurrence of injuries in the morning is compatible with higher rate of injuries at home. In previous studies, the time of the highest prevalence of injuries was not evaluated. According to the results obtained, knife was the most common cause of penetrating ocular injury (26%) followed by injury with wooden stick (17%) and glass. Yaya carried out a study in Central Africa on 194 children under the age of 15 and found that 25.9% of traumas occurred by corporeal punishment, 19.3% during playing and 18.8% in fighting. However, he did not evaluate penetrating and non-penetrating traumas separately(13). In the study performed by GRIESHABER in South Africa on 194 children under the age of 15, it was observed that 66% of the traumas occurred during playing; and wooden stick, wire and glass were the most common causes of trauma (comprised the cause of 48% of the traumas). In the current study, 55% of the injuries occurred at home and in 85% of the case the injuries occurred while no one was taking care of the child. BEBY carried out a study on 57 patients under the age of 14 in Lyon, France and reported that sharp objects were the most common cause of penetrating trauma and these traumas occurred mostly at home (14). In another study by Liu, which was carried out in Taiwan on 156 children, it was reported that scissors, stationery, glass and glasses, and knife were the causes of injury in 13.5%, 12.2%, 7.7% and 6.4% of cases respectively. Moreover, most patients were boys who were injured at home and in contrast with our findings knife was the least common cause of injury. (15) Injury with knife and sharp objects usually occurs because of providing inadequate care to children, and exposure and playing with such devices may lead to major ocular injuries in children. Furthermore, in some cases the fight of children in the street, school and thoughtless use of sharp objects may lead to occurrence of major ocular trauma. In developed countries, including the USA, this has become a social problem in recent years and the rate of pediatric injuries, particularly ocular traumas has been increasing (16, 17). Bella-Hiag carried out a study in Cameroon to evaluate the causes of ocular trauma in patients under the age of 15 (mean age: 7 years and 3 months). It was reported that 40.2% of injuries (penetrating and non-penetrating were not differentiated) occurred during playing with their peers, and 23.7% of the injuries occurred as a result of the corporeal punishment by parents or teachers (3). This is while none of the injuries in the current study was the result of corporeal punishment. In the study performed by Dasgupta on 28 patients with penetration traumas under the age of 15, the most frequent causes of injury were wire and pencil(18)In another study by Gordon in Lesotho, Africa it was reported that sharp-ended objects, shot of blowgun, bonfire and toys were the

most common causes of the injury which was somehow different from the results of previous studies.(19). In the study carried out by Oskuei in Tehran, it was reported that in adults, 82% of the traumas occurred due to working place events and only 20% occurred at home. With regard to the difference in the age group of the participants his results were completely different with those obtained in the current study. An important issue in the age groups under 16 is children's contact with explosive and flammable materials that are used by juveniles in different events and may lead to undesirable events, particularly ocular injuries. Another problem is preparation of explosive materials by some children, which leads to ocular trauma and disabilities particularly in events such as the last Wednesday of the year. In the current study, although parents' level of education did not have a significant effect on the type of injury, and the relationship was not evaluated in previous studies, it seems that when the parents' level of education is higher, it directly and indirectly influences the health of children positively. Considering the direct effects, the higher level of education leads to providing higher level of safety for children, and with regard to the indirect effect, the higher level of education will lead to lower number of children and probably providing better care. The issue can be evaluated in future studies with larger sample size. Another subject which was considered in the current study as well as previous ones, was leaving the children alone and access of children to factors causing injury. Improving public knowledge about the problem is necessary. Finally another issue about the penetrating ocular trauma was the type of injury occurred in the eye, which was mostly corneal laceration (71%). In the study carried out by Oskuei only 27.2% of ocular traumas were corneal laceration, while the rate reported to be 40% by Liu ML (15).

#### 4. CONCLUSION

With respect to the results obtained better surveillance of parents and other care providers of children particularly at home and in the morning play an important role in decreasing the rate of the trauma. Furthermore, keeping sharp-ended objects such as cutlery and stationery out of reach of children particularly in lower age groups is an important issue. Supervision of the outdoor activities and games of children is of great importance in this regard. Moreover, teachers and school administrative can prevent such injuries by giving advice and providing adequate care for children's behaviour.

#### ACKNOWLEDGMENT

No mentioned any acknowledgment by authors.

#### AUTHORS CONTRIBUTION

This work was carried out in collaboration between all authors.

#### CONFLICT OF INTEREST

Authors have declared that no conflict interests exist.

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