THE EVALUATION OF OCULAR TRAUMA IN CHILDREN BETWEEN AGES 0-12*

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SUMMARY: Arıtürk N, Şahin M, Öge İ, Erkan D, Süllü Y. (Department of Ophthalmology, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey). The evaluation of ocular trauma in children between ages 0-12. Turk J Pediatr 1999; 41: 43-52.

Ocular trauma is the leading cause of noncongenital unilateral blindness in children under 20 years old. In this study, 138 patients (36 female, 102 male) with ocular trauma between November 1983 and October 1996 were reviewed retrospectively at the Department of Ophthalmology, Ondokuz Mayıs University Faculty of Medicine. Twenty-four of these patients were blunt trauma and 114 were perforating eye injury. The mean age of the patients was 6.96 ± 3.01 years. Mean post-treatment follow-up was 10.7 months (range 1 to 121 months). Forty-five patients were admitted to the eye clinic within the first 24 hours after trauma. The most frequent finding was hyphema in blunt injury, and corneal laceration in perforating injury. The most frequent cause of injury was wood and stone in blunt trauma and glass and knife in perforating trauma. While the ratio of visual acuities equal to or better than finger counting was 37.5 percent (9 eyes) in blunt trauma cases and 20.2 percent (23 eyes) in perforating trauma cases prior to treatment, it was 79.2 percent (19 eyes) and 55.3 percent (63 eyes), respectively, at last visit examination post-treatment. The most frequent complication was traumatic cataract in blunt trauma and corneal leukoma and anterior synechia in perforating trauma. The results obtained suggested that socioeconomic and sociocultural status and family negligence are important factors in eye injuries in children that occur during games. *Key words: trauma, children, ocular injury.*

Eye injury in childhood is an important cause of unilateral blindness and may result in significant visual impairment. Ocular trauma is second only to cataract as the most common cause of visual impairment[1]; it is estimated that 29-52 percent of all eye injuries occurs in children[1-6]. In the United States, it has been reported that the incidence of eye injuries requiring inpatient hospitalization for children younger than 16 years was 15.2 per 100,000 per year[7]. Ocular injuries in childhood have some different characteristics from those in adults. Children under eight years of age are at particular risk of perforation leading to amblyopia. In addition, pretreatment evaluation is often hindered by inadequate history and poor cooperation during physical and ophthalmologic examination. These factors may have a negative effect on treatment methods and visual outcome. Eye injuries

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in children usually occur accidentally: injuries by the hand or foot of another child or during play and sport. Many of these eye injuries could be prevented, with an increased awareness and subsequent removal of the common risk factors[8, 9]. The best method of prevention of blindness or visual impairment in ocular trauma is not through successful operation, but rather through the prevention of eye injuries.

The aim of this study was to analyze the causes and prognosis of all eye injuries in children between ages 0-12.

Material and Methods

The records of all children between 0-12 years of age who were treated for serious ocular injuries at the Ondokuz Mayıs University Faculty of Medicine, Department of Ophthalmology, from November 1983 to October 1996 were reviewed retrospectively. The following data were recorded for each patient: age, sex, date of injury, type of injury, cause of injury, length of time from injury to hospitalization, diagnosis, treatment, visual outcome and late complications.

Results

A total of 601 patients were admitted to our clinic for the treatment of serious ocular injuries. Of these, 138 were children between 0-12 years of age, thus representing 23 percent of all patients with ocular injuries. These 138 children were included in this study.

Of the 138 children 102 (74%) were boys and 36 (26%) were girls. The mean age was 6.96 ± 3.01 (range 1 to 12 years). The ratio of boys to girls was 3:1. The age and sex distribution of these children with ocular trauma is shown in Table I and Fig. 1. As shown in Fig. 1, the accidents occurred nearly equally at all ages among the girls, while among the boys the frequency increased considerably from the age of eight years.

Of the 138 ocular injuries, 68 (49.3%) were right eye and 70 (50.7%) were left eye. All were monocular injuries.

Table I: Age and Sex Distribution

Age (Year)	Males No. (%)	Females No. (%)	Total No. (%)
0-5 y	31 (22.5)	15 (10.9)	46 (33.3)
6-12 y	71 (51.4)	21 (15.2)	92 (66.7)
Total	102 (73.9)	36 (26.1)	138 (100)

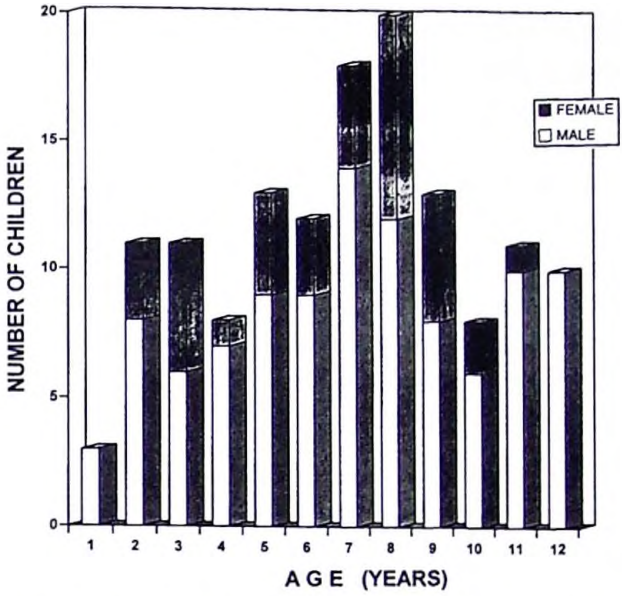

Fig. 1: Age and sex distribution of patients with ocular injuries.

Types of injury are presented in Table II. As can be seen, blunt injury was in 24 patients (17.4%) and perforating injury was in 114 patients (82.6%). The length of time from injury to hospitalization was within the first 24 hours in 45 patients (32.6%), and from 96 hours and over in 12 patients (9.0%). Among admissions within the first 24 hours, blunt injury was seen in 8 and perforating injury in 37 (Table III).

Table II: Types of Injury According to Age Groups

	0-5 y n(%)	6-12 y n(%)	Total n(%)
Blunt	3 (6.5)	21 (22.8)	24 (17.4)
Perforating	43 (93.5)	71 (77.2)	114 (82.6)
Total	46 (100)	92 (100)	138 (100)

Table III: Distribution of Patients by Length of Time from Injury to Hospitalization According to Types of Injury

	Types of Injuries		
Time	Blunt Trauma	Perforating Trauma	Total
First 24 hours	8	37	45
24-48 hours	3	57	60
72 hours	11	10	21
96 hours and over	6	6	12

The injured children were divided into the following age groups: zero to five years of age (infants and preschool) and six to 12 years of age (elementary school). Of those zero to five years of age, blunt injury was in three patients and perforating injury in 43 patients. Of those six to 12 years of age, blunt injury was in 21 patients and perforating injury in 71 patients. The ratio of perforating to blunt injury was 14:1 in the zero to five years of age group and 3:1 in the six to 12 years of age group. Perforating injuries are more frequent than blunt injuries and are more frequent in the zero of five years of age group than in the six to 12 years of age group. Most of the blunt and perforating injuries occurred in children ages five to nine, especially in elementary school children aged seven to eight.

The prevalence of injuries occurring in each month of the year is presented in Figure 2. The largest number of accidents took place in the October to December and May to August periods.

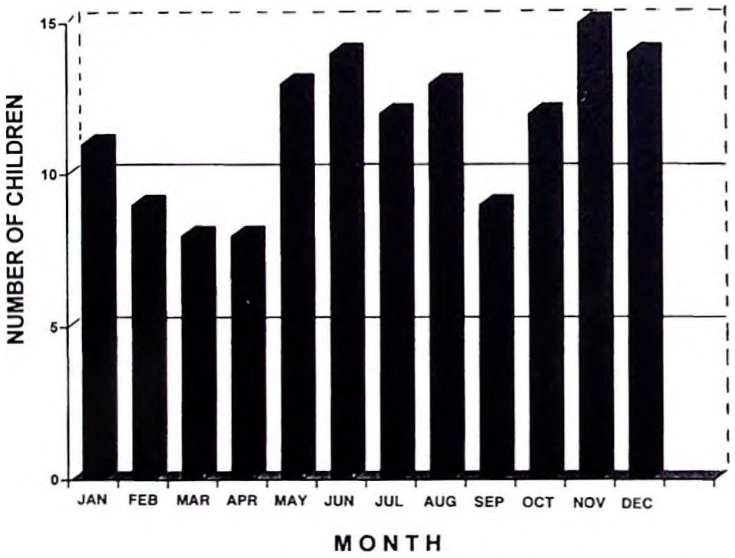

Fig. 2: Distribution of patients with ocular injuries according to month.

The causes of injuries are shown in Table IV. The most common causes of injury were sharp objects (31 patients, 22.45%), wood (19 patients, 13.8%), fall (14 patilents, 10.1%) and toys (12 patients, 8.7%). The most common causes of blunt injuries were wood (37.5%) and stone (25%) and of perforating injuries were sharp objects (such as glass and knife, 27.2%) and fall (10.5%).

The diagnosis of the traumatic eye injuries are presented in Table V. The most frequent primary admitting diagnoses were hyphema (54.3%), corneal laceration (52.9%), traumatic cataract (22.5%), and traumatic iridocyclitis (12.3%). The most frequent primary admitting diagnosis was hyphema in blunt injury and corneal

laceration in perforating injury. The mean post-treatment follow-up was 10.7 months (range 1 to 121 months). Visual outcomes for all patients are presented in Table VI. Analyzing the visual outcome in 118 children with eye injuries (20 children with unknown acuity were excluded), more than half of the children (69.5%) had very good visual acuity in the long term. While the initial visual acuity was > 0.1 in 32 patients, in final visual acuity this number increased to 82. The initial visual acuity was no light perception in 12 patients, and final visual acuity was no light perception in 16 patients. Of these, 14 were perforating injury and two were blunt injury. There was a correlation between the type of injury and the final visual outcome.. Anterior segment perforating injuries, whether alone or in combination with other ocular injuries, demonstrated an even worse prognosis for final visual outcome. In 16 eyes with no light perception, phthisis bulbi occurred in two, enucleation was required in two, and evisceration was required in nine eyes. Enucleation and evisceration during hospitalization were performed in 11 eyes.

Of the 138 children admitted for ocular trauma, 12 were treated medically and 126 required surgical treatment. The late complications observed are presented in Table VII. The most frequently recorded late complications of eye injuries were leukoma in 58 (42%), anterior and posterior synechia in 48 (34.8%), traumatic cataract in 33 (23.9%) and secondary glaucoma in 9 (6.5%) eyes.

Table IV: Causes of Eye Injury According to Types of Injury

Causes	Types of Injury		Total
	Blunt Trauma no (%)	Perforating Trauma no (%)	
Sharp objects (knife, glass)	–	31 (27.2)	31 (22.5)
Wood	9 (37.5)	10 (8.8)	19 (13.8)
Branches	2 (8.3)	9 (7.9)	11 (8)
Toys	3 (12.5)	9 (7.9)	12 (8.7)
Bush	–	10 (8.8)	10 (7.2)
Rod	1 (4.2)	9 (7.9)	10 (7.2)
Fall	2 (8.3)	12 (10.5)	14 (10.1)
Stone	6 (25)	2 (1.8)	8 (5.8)
Wire	–	6 (5.3)	6 (4.4)
Gun powder	1 (4.2)	–	1 (0.7)
Gun shot (bullet)	–	1 (0.9)	1 (0.7)
Paper	–	1 (0.9)	1 (0.7)
Nail	–	1 (0.9)	1 (0.7)
Pencil	–	1 (0.9)	1 (0.7)
Unknown	–	12 (10.5)	12 (8.7)
Total	24 (100)	114 (100)	138 (100)

Table V: Ocular Findings in Initial Ocular Examination

Ocular Findings	Types of Injury: Blunt Trauma no (%)	Types of Injury: Perforating Trauma no (%)	Total
Hyphema	12 (50)	63 (55.3)	75 (54.3)
Corneal erosion	2 (8.3)	–	2 (1.5)
Perforation of cornea	–	73 (64)	73 (52.9)
Perforation of sclera	1 (4.2)	5 (4.4)	6 (4.4)
Combination	–	37 (32.5)	37 (26.8)
Retinal and macular edema	1 (4.2)	4 (3.5)	5 (3.6)
Traumatic iridocyclitis	9 (37.5)	8 (7)	17 (12.3)
Traumatic cataract	3 (12.5)	28 (24.6)	31 (22.5)
Retinal and vitreous hemorrhage	–	5 (4.4)	5 (3.6)
Intraocular foreign body	–	2 (1.8)	2 (1.5)
Retinal detachment	1 (4.2)	–	1 (0.4)

Table VI: Initial and Final Visual Acuity in Children with Ocular Trauma According to Types of Injury

	Initial Visual Acuity						
Types of injury	NLP	P+P-	P+P+	CF-0.1	0.2-0.5	0.6-1.0	Undetermined
Blunt	3	5	4	4	3	2	3
Perforating	9	26	26	11	10	2	30
	Final Visual Acuity						
Types of Injury	NLP	P+P-	P+P+	CF-0.1	0.2-0.5	0.6-1.0	Undetermined
Blunt	2	–	1	2	8	9	2
Perforating	14	10	9	21	19	23	18

* Last visit examination.
NLP: No light perception, P+P-: Light perception, no projection, P+P+: Light perception and projection, CF: Counting fingers.

Table VII: Post-Treatment Complications

Complications	No.	%
Corneal leukoma	58	42
Anterior and posterior synechia	48	34.8
Narrowing anterior chamber	5	3.6
Traumatic cataract	33	23.9
Lens dislocation	7	5.1
Secondary glaucoma	9	6.5
Phthisis bulbi	2	1.5
Endophthalmitis	1	0.7
Retinal detachment	5	3.6

Discussion

Different rates of occurrence of ocular trauma in children have been reported in various studies. Canavan et al.[4], reporting on 2,032 traumatic eye injuries, found that 38.4 percent were sustained by children. Eye injury in childhood was reported as 34.4 percent by Niiranen[10], 47 percent by Rapoport[3], 29 percent by Maltzman[6] and 22 percent by Grin[11]. In our series, 23 percent of ocular traumas at Ondokuz Mayıs University Hospital occurred in children between the ages 0-12. These results were similar to those in the other series.

The rate of ocular trauma among boys was much higher than that among girls. In our study, the ratio of boys to girls was 3:1, similar to other surveys[3, 10, 12]. However, Nelson et al.[9] reported a ratio of 2:1 in children who were evaluated as outpatient in the emergency room. Cascairo et al.[13] reported a ratio of 2.6:1 in a study combining both inpatient and outpatient injuries.

As for seasonal increases in prevalence in other series, a higher prevalence in the second quarter of the year was noted[9, 11]. Usually, the distribution of ocular injury is equal for each month. In our study, the distribution of ocular injuries showed higher prevalence during May to August and October to December, the most obvious reasons being the warm weather and prolonged daylight during school holiday months and snow-related injury and winter sports-related injuries during the winter months. Turkey's increase in eye injuries during October to December may also be due to the pick-up of wood and bush for winter preparation. Grin[11] reported that the largest number of accidents took place during April to June and the smallest number during January to March. Cascairo and coworkers[13] reported a higher prevalence in March, April and August. The 0-12 years of age group includes preschool and elementary school children.

In this study, the incidence of eye injury occurred most commonly among children seven to eight years of age. Among girls, ocular injury occurred equally at all ages, while among boys it increased from the age of eight, with the largest number of injuries occurring in children eight to 10 years of age[10, 11, 14]. This is presumably due to the high physical contact and aggressive nature of play among boys. Most of the injuries occurred outdoors and during play or sport[3, 7, 10, 13].

In evaluating types of injury, we found that blunt injury accounted for 17.4 and perforating injury for 82.6 percent. In other studies, the rate of blunt injury was higher than perforating injury. The rate of perforating injury was reported as 30.5 percent by Rapoport[3], 27 percent by Rudd[15], 19 percent by Takvam[16], 8.9 percent by Niiranen[10], and 34.5 percent by Grin[11]. In our study, percentage of perforating injury obtained was much higher than in other studies. Also, we found that perforating injury in the zero to five years of age group was higher than in childen six to 12 years of age. Despite visual outcome being directly

related to the severity of ocular injury, children under eight years of age are at particular risk of perforation leading to amblyopia. In addition, the eye may become disfigured from corneal scarring and a squint may develop. For this reason, preventive measures should be taken to avoid or lessen the number of eye injuries among children.

Geographical location, climate, population, and sociocultural and socioeconomic status affect the type of injury and cause of injury. According to statistical studies undertaken in 1993, 33 percent of the general population in our country are between 0 to 15 years of age. The number of children per family is about 3.3 in rural areas and 2.5 in urban areas[17]. As the population of children and the number of children per family increases, the attention and supervision of parents over children tends to decrease. This situation results in an increase in the number of accidents and cases of eye trauma. The cause of an increased prevalence of perforating eye traumas among male children is probably due to the aggressive nature of toys, the inclusion of dangerous parts in manufactured toys, and the high interest of male children in perforating and cutting devices. We suspect that the high level of perforating trauma observed in our study is a result of the reference nature of our clinic as a university hospital in north and northeast Anatolia. Blunt traumas result from extraocular injury and generally do not require hospitalization. These patients are usually outpatient and they apply to the state hospital emergency service. All cases in our study were severe enough to require hospitalization. Furthermore, the cases admitted to our clinic were perforating traumas referred from other clinics which were not able to manage the patients.

The most frequent causes in our study were perforating injuries by glass or sharp objects (22.5%), wood (13.8%), toys (8.7%), and falls (10.1%). The most frequent causes as reported in other studies are stone (19.6%) and sharp objects (16.6%) by Rapoport[3], sport accidents (15%) and motor vehicle accidents (12%) by Cascairo[13], and accidental injuries by the hand or foot of another child (12%) by Nelson[9]. Niiranen and Raivio[10] reported that 21 percent resulted from thrown missiles (a snowball being the most common) and that 16 percent resulted from being shot with arrows. Takvam[16] reported that the most common cause of injury was projectiles (21.5%) followed by sticks. These results show that climate variations, sociocultural specifications and customs in each country are all effective as underlying factors for eye traumas.

Eye traumas can adversely affect the psychologic growth of children. The worst result is loss of light perception and blindness. In this study, the rate of cases who lost their light perception was 11.6 percent. This was 9.1 percent (2/22) of cases with blunt trauma, and 14.5 percent (14/96) of those with perforating trauma. Rudd et al.[15] reported the ratio of blindness in traumatic globe perforation of children under 16 years of age as 7.1 percent (3/42). This ratio was reported as 1.6 percent of blunt traumas and 9.3 percent of perforating traumas by

Rapoport et al.[3], two percent of all of cases by Cascairo[13], 29 percent of corneoscleral perforations by Barr[18], and 23.4 percent of cases of perforating injuries with no intraocular foreign body by Elder et al.[19] Our ratio was also high, as seen in other studies. In this study, the biggest proportion of eye injuries (87 cases) happened in or before 1990. This ratio has declined within the last few years. We believe that progression in diagnostic and therapeutic modalities in our clinic was the major factor in improving the results.

The most effective way to prevent blindness from trauma is not a successful therapy, but is prevention of the injury. For this purpose the most important requirement is education. Parents, teachers, and children must be educated about eye injuries and their consequences. A better supervision of parents over their children and more care in selecting toys for children seem to be appropriate. It is also very important for the significance of eye traumas to be stressed frequently by the media. In addition, movies on television and computer games that contain violence should be strictly inspected because they could adversely affect the psychologic status of children and lean them toward aggressiveness.

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