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Epidemiology And Demography Of Open Globe injury in Children

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Abstract

Objective: To reveal the epidemiology and demographics of open globe injury in children.

Methods: In the study, the medical files of 185 patients aged 15 years and younger who applied to the Dicle University Faculty of Medicine Ophthalmology clinic between April 2017 and April 2019 with open globe injury were retrospectively analyzed. Patients were classified according to age, gender, etiology of trauma, location of trauma, and time of trauma and recorded.

Results: A total of 185 eyes of 185 children were included in this study. Of the 185 children, 111 (60%) were boys and 74 (40%) were girls. The mean age of the 185 patients was 7.26 ± 3.80 years. Patients applied to our hospital 1-36 hours after the İnjury. 101 (54.5%) of the injuries were in the right eye and 84 (45.5%) in the left Regarding the localization of injuries, there were 131 (70.8%) corneal, 32 (17.3%) corneoscleral, 9 (4.9%) limbal, and 13 (7%) scleral cases. These injuries were most commonly caused by 92 (49.7%) metallic objects, 22 (11.9%) glass, and 17 (9.2%) wood pieces. Regarding the time of injury, 43 (23.2%) injuries occurred during 1–3 months, 59 (31.8%) occurred during 4–6 months, 50 (27.1%) occurred during 7–9 months, and 33 (17.9%) occurred during 10–12 months. The places where the injuries occurred were 102 (55.1%) houses, 68 (36.8%) outdoors, and 15 (8.1%) schools.

Conclusions: Open globe injuries in children were most common in boys, in the age group of 1–5 years, in the right eye, and in the cornea as localization. It was observed that these injuries were mostly caused by metal objects in the 4th to 6th months.

Keywords: Pediatric, open globe injury, epidemiology, demography, rural

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Çocuklarda Açık Glob Yaralanmasının Epidemiyolojisi ve Demografisi

Öz

Amaç: Çocuklardaki açık glob yaralanmasının epidemiyolojisini ve demografisini ortaya koymaktır.

Yöntemler: Çalışmada Nisan 2017-nisan 2019 tarihleri arasında Dicle üniversitesi tıp fakültesi göz kliniğine açık glob yaralanması nedeni ile başvurmuş 15 yaş ve altındaki 185 hastanın tıbbi dosyaları retrospektif olarak incelendi. Hastaların yaşı, cinsiyeti, travmanın etyolojisi, travmanın yeri ve travmanın zamanı sınıflandırılarak kaydedildi.

Bulgular: Çalışmaya 185 (185 göz) çocuk hasta dahil edildi. Bu hastaların ortalama yaşı 7.26 ± 3.80 yıl idi. Hastaların hastanemize başvuru zamanı yaralanmadan sonraki 1-36 saat idi. Bu yaralanmaların 101 (%54,5)'ü sağ gözde ve 84 (%45,5)'i sol gözde idi. Yaralanmanın lokalizasyonuna göre ise 131 (%70,8)'i korneal, 32 (%17,3)'i korneoskleral, 9 (%4,9)'u limbal, 13 (%7,0) skleral idi. Bu yaralanmalar en sık 92 (%49,7)'i metalik obje, 22 (%11,9)'i cam, ve 17 (%9,2)'i ağaç parçası tarafından oluşmuştu. Yaralanmaların oluştuğu döneme göre 43 (%23,2)'i 1-3 ayda, 59 (%31,8)'i 4-6 ayda, 50 (%27,1)'i 7-9 ayda ve 33 (%17,9)'u 10-12.ayda idi. Yaralanmaların oluştuğu mekan ise 102 (%55,1)'i ev, 68 (%36,8)'i dış mekan ve 15 (%8,1)'i okul idi.

Sonuç: Çocuklarda açık glob yaralanmaları en sık erkeklerde, 1-5 yaş grubunda, sağ gözde ve lokalizasyon olarak korneada olduğu görüldü. Bu yaralanmaların en çok 4. ile 6. aylarda ve sıklıkla metal nesneler tarafından oluştuğu görüldü.

Anahtar kelimeler: Pediatrik, açık glob yaralanması, epidemiyoloji, demografi, kırsal.

INTRODUCTION

Ocular trauma can cause open or closed globe injury, and the visual outcomes are worse in cases of open globe injury[1,2]. The Birmingham Eye Trauma Terminology (BETT) has defined open globe injury as a full-thickness damage of the eyeball (cornea or sclera)[3]. Open globe injuries in children are the most common cause of non-congenital blindness[4]. Although 35% of eye injuries occur below the age of 17 years, 18% of them occur below the age of 12 years[5].

Studies conducted in the USA have reported a probability of 15.2/100,000 of eye injury among children[6]. However, there is a limitation of studies along with contradictory reports on the factors that determine and affect the prognosis in such injuries[7-9]. The probability of the occurrence of decreased vision or blindness due to eye injuries worldwide has been reported to vary between 2% and 14%[10-12]. Eye injuries are one of the main causes of childhood monocular vision loss along with amblyopia[13]. They are also the second most common cause of eye surgery after strabismus surgery in children[14]. Eye injuries are one of the important public health problems, and several factors such as the socioeconomic level of the family, the educational level, and cultural habits play a role in the formation and consequence of these injuries[11,15,16]. The majority of these injuries can be prevented via correct education of the parents and the child and taking the necessary measures. This can consequently and easily solve the financial burden and social problems that may arise due to eye injuries. Several surgical procedures that are performed for treating open globe injuries require prolonged hospitalization, which in turn increases the expenditure for both the patient's family and the government. Despite the advancements in medical and surgical technology, the result may not be satisfactory. Even when the outcomes are good, amblyopia may still be the major problem for vision level in children aged <8 years[17].

A severe decrease in visual acuity can have a negative effect on the child and the family both physically and psychologically[18]. Therefore, we believe that it is important to determine the etiological factors and demonstrate their

demographic characteristics to prevent such injuries and take the necessary measures. This would in turn help us select the appropriate treatment and increase the level of vision after treatment. Therefore, this study was conducted to determine the epidemiology and demography of open globe injuries that cause severe permanent visual loss in children.

METHODS

Our study, which was planned retrospectively, was approved by the Dicle University Ethics Committee (number: 69, date: 06.02.2020). Our study was conducted in accordance with the principles of the Declaration of Helsinki The parents of the children included in our study were informed in advance and consent was obtained for the study.

The medical files of 185 patients aged ≤15 years who applied to Dicle University Medical School between April 2017 and April 2019 for open globe. The demographic data of the patients, the eye that was injured, the etiology, the localization, and the periodic history were recorded. Patients were divided into three groups according to their ages as follows: Group 1, 1–5 years; Group 2, 6–10 years; and Group 3, 11–15 years. Regarding the eye exposed to the trauma, it was classified as right and left eye, and the localization was classified as corneal, corneoscleral, limbal, and scleral. The etiological factors responsible for the injuries were classified as metal, glass, tree, stone, toy, pen, blunt injury, sparkler-flare explosion, body parts, and electronic items. Regarding the period of injuries, it was categorized as January, February, and March (1st to 3rd month); April, May, and June (4th to 6th month); July, August, and September (7th to 9th month); and October, November, and December (10th to 12th month). Regarding the place where the injury occurred, injuries that occurred at home were termed as home and those that occurred in outdoor places such as a street and farm were termed outside injuries, and if the injury occurred at school, it was classified as school.

Globe injuries were classified according to the BETT definition, wherein the eyeball consists of the sclera and the cornea. The injury of the eyeball is divided into open and closed globe injuries.

1-Closed globe injury: This indicates an incomplete damage of the eyeball. It is divided into two subcategories as follows: a) Contusion: There is no damage to the eyeball, but there is damage such as choroid rupture and angle resection due to the effect of trauma and b) Laceration: This indicates the damage of the eyeball with a sharp object and not the full layer.

2-Open globe injury: This type of injury implies the full coat damage of the eyeball. It is divided into the following four subcategories: a) Rupture: This is full-floor damage of the eyeball with a blunt body, b) Perforating injury: This indicates damage of the entrance and exit of the eyeball, c) Penetrating injury: This implies damage of the eyeball that is only at the entrance, and d) damage due to an intraocular foreign body[8].

The aim of our study was to determine the eye (right or left), localization, cause, location, and the time of open globe injuries in children.

RESULTS

A total of 185 eyes of 185 children were included in this study. Of the 185 children, 111 (60%) were boys and 74 (40%) were girls. The mean age of the 185 patients was 7.26 ± 3.80 years. According to the age groups, 72 (38.9%) were in Group 1, 60 (32.4%) were in Group 2, and 53 (28.6%) were in Group 3 (Table 1).

Table 1: Gender distribution according to age groups.

Period	Gender		Total
	Male	Female	
	n (%)	n (%)	n (%)
1-5 years	39 (54.2)	33 (45.8)	72 (38.9)
6-10 years	31 (51.7)	29 (48.3)	60 (32.4)
11-15 years	41 (77.4)	12 (22.6)	53 (28.6)
Total	111 (60.0)	74 (40.0)	185 (100)

Open globe injury occurred in the right eye in 101 (54.5%) children and in the left eye in 84 (45.5%) children. Patients applied to our hospital 1-36 hours after the İnjury. The distribution of the groups according to age and gender according to eye injuries is shown in Table 2.

Table II: Distribution of gender and age groups according to which eye was injured.

Eye	Gender		Total	Group-1	Group-2	Group-3	Total
	Male	Female		(1-5 years)	(6-10 years)	(11-15 years)	
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	(n)
Right	59 (58.4)	42 (41.6)	101 (54.5)	42 (41.6)	31 (30.6)	28 (27.8)	101
Left	52 (61.9)	32 (38.1)	84 (45.5)	30 (35.7)	29 (34.6)	25 (29.7)	84

Regarding the localization of injuries, there were 131 (70.8%) corneal, 32 (17.3%) corneoscleral, 9 (4.9%) limbal, and 13 (7%) scleral cases. The age and gender distribution of the groups according to the localization of the injuries is shown in Table 3.

Table III: Distribution of gender and age groups according to the localization of the injury.

Localization	Gender		Total	Group-1	Group-2	Group-3	Total
	Male	Female		(1-5 years)	(6-10 years)	(11-15 years) n (%)	(n)
	n (%)	n (%)	n (%)	n (%)	n (%)		
Corneal	77 (58.8)	54 (41.2)	131 (70.8)	52 (39.6)	42 (32.0)	37 (28.2)	131
Corneoscleral	22 (68.8)	10 (31.2)	32 (17.3)	15 (46.9)	9 (28.1)	8 (25.0)	32
Limbal	6 (66.7)	3 (33.3)	9 (4.9)	3 (33.3)	4 (44.4)	2 (22.3)	9
Scleral	6 (46.2)	7 (53.8)	13 (7)	2 (15.3)	5 (38.4)	6 (46.1)	13
Total			185(100)				185

Regarding the etiology of the injury, 92 (49.7%) patients were exposed to metal objects (knife, wire, fork, needle, skewer), 22 (11.9%) children suffered due to glass, 17 (9.2%) children were affected by trees (tree branch, such as wood), 14 (7.6%) children were exposed to stone injury, 11 (5.9%) children suffered due to pen injury, 9 (4.9%) due to body parts (such as nails, elbow), 8 (4.3%) had blunt injury, 6 (3.2%) children were exposed to sparkler cartridge, 3 (1.6%) patients were injured with a toy, 2 (1.1%) children were exposed to electronic item injury (vacuum cleaner handle, charger), and 1 (0.5%) patient was injured by an animal (pigeon pecking). The age and gender distribution of the groups according to the causes of injury is shown in Table 4.

Table IV: Distribution of gender and age groups according to causes of injury.

Cause of injury	Gender		Total	Group-1 (1-5 years)	Group-2 (6-10 years)	Gruop-3 (11-15 years)	Total
	Male n (%)	Female n (%)	n (%)	n (%)	n (%)	n (%)	(n)
Metallic	56 (60.9)	36 (39.1)	92 (49.7)	46 (50.0)	30 (32.1)	16 (17.3)	92
Glass	12 (54.5)	10 (45.5)	22 (11.9)	6 (27.2)	7 (31.9)	9 (40.9)	22
Tree	12 (70.6)	5 (29.4)	17 (9.2)	6 (35.3)	3 (17.7)	8 (47.0)	17
Stone	9 (64.3)	5 (35.7)	14 (7.6)	3 (21.4)	4 (28.5)	7 (50.0)	14
Pencil	7 (63.6)	4 (36.4)	11 (5.9)	1 (9.0)	7 (63.7)	3 (27.3)	11
Body parts	5 (55.6)	4 (44.4)	9 (4.9)	2 (22.2)	2 (22.2)	5 (55.6)	9
Blunt injury	3 (37.5)	5 (62.5)	8 (4.3)	5 (62.5)	1 (12.5)	2 (25.0)	8
Sparkler	4 (66.7)	2 (33.3)	6 (3.2)	0 (0.0)	3 (50.0)	3 (50.0)	6
Toy	1 (33.3)	2 (66.7)	3 (1.6)	2 (66.7)	1 (33.3)	0 (0.0)	3
Electronic devices	1 (50)	1 (50.0)	2 (1.1)	1 (50.0)	1 (50.0)	0 (0.0)	2
Animal	1 (100)		1 (0.5)	0 (0.0)	1 (100.0)	0 (0.0)	1
Total			185				185

Depending on the period of injury, of the 185 study patients, 43 (23.2%) suffered the injury during the 1st to 3rd month, 59 (31.8%) during the 4th to 6th month, 50 (27.1%) during the 7th to 9th month, and 33 (17.9%) during the 10th to 12th month. The age and gender distribution of the groups according to the time of injury is shown in Table 5.

According to the location of the injuries, 102 (55.1%) occurred at home, 68 (36.8%) in outdoor areas, and 15 (8.1%) at school. The age and gender distribution of the groups according to the place where the injuries occurred is shown in Table 6.

Table V: Gender and age distribution according to the period of injury.

Period	Gender		Total	Group-1 (1-5 years)	Group-2 (6-10 years)	Group-3 (11-15 years)	Total
	Male n (%)	Female n (%)	n (%)	n (%)	n (%)	n (%)	(n)
1-3 month	28 (65.1)	15 (34.9)	43 (23.2)	18 (41.8)	12 (28.0)	13 (30.2)	43
4-6 month	34 (57.6)	25 (42.4)	59 (31.8)	16 (27.1)	25 (42.4)	18 (30.5)	59
7-9 month	31 (62.0)	19 (38)	50 (27.1)	24 (48.0)	14 (28)	12 (24)	50
10-12 month	18 (54.5)	15 (45.5)	33 (17.9)	14 (42.4)	9 (27.3)	10 (30.3)	33
Total			185(100)				185

Table VI: Distribution of gender and age according to location of injury.

Place where trauma occurred	Gender		Total	Group-1 (1-5 years)	Group-2 (6-10 years)	Group-3 (11-15 years) n (%)	Total
	Male n (%)	Female n (%)	n (%)	n (%)	n (%)		(n)
House	59 (57.8)	43 (42.2)	102 (55.1)	52 (51.0)	32 (31.3)	18 (17.7)	102
Outside	43 (63.2)	25 (36.8)	68 (36.8)	17 (25.0)	20 (29.4)	31 (45.5)	68
School	9 (60.0)	6 (40.0)	15 (8.1)	3 (20.0)	8 (53.3)	4(26.7)	15
Total			185 (100)				185

DISCUSSION

Open globe injury in children was most common in boys, in the age group of 1–5 years, in the right eye, and in the cornea as localization. A metallic body (knife, fork, scissors) was the most common etiology, and the injury frequently occurred during the 4th to 6th month.

In the present study, the male:female ratio in terms of open globe injury was 1.5. Previous research has also reported a similar ratio in the range of 1–5.5[19,20]. Because boys are more active and adventurous, and their games are aggressive, they are more involved in social life and are at high risk of being exposed to trauma. For this reason, it is believed that boys are more exposed to injuries. The average age in our study was 7.26 years. Previous studies have reported both older ages and the same age range as that of our study[21]. In our study, it was observed that open globe injury was dominant in the right eye by 54.5% in all age groups. This result is consistent with previous studies, which have reported right eye predominance in open globe injury[11,22].

In the present study, open globe injury in Group 1 was more common among the age groups, which is compatible with previous studies[23,24]. This could be because children in this age group have poor motor skills, and they are curious and try to imitate elders, which make them vulnerable to trauma. Regarding the

distribution of sex according to age groups in children with open globe injury, the ratio of male:female in Groups 1 and 2 was closer to each other, whereas the proportion of boys in Group 3 increased by almost four times. This could be because boys in this age group start working as assistants (in workplaces, farms, etc.) and deal with more traumatic sports.

Depending on the localization of the injury, the risk of corneal injury increases. This risk has been reported to be 58%–85.7% in various studies[25,26.] In our study, it was 70.8% compatible with those studies. In our study, the rate of corneal injury was found to be high in all age groups. In terms of age groups, the rates of corneal and corneoscleral injuries were higher in Group 1. Since the cornea is subjected to direct trauma, this region is considered to be the cause of injuries in open globe injury. Good visual results have been reported in injuries limited to the cornea and not exceeding 25% of the diameter of the cornea[27]. Limbal injuries appeared to be predominant in Group 2. This is believed to be due to the beginning of school age in this period and the high level of pen-related injuries in this age group. Scleral injuries were observed to be predominant in Group-3. This could be because children in this age group are more involved in street, park, garden, and work areas, and they are engaged in aggressive sports.

In our study, metallic objects contributed to 49.7% of the injuries. Metallic objects (knife, fork. etc.) have been reported to be the most common reason for open globe injury in children[28,29]. According to age groups, injuries caused by metallic bodies were the etiological factor in Groups 1, 2, and 3, which is the most common cause of open globe injury. Metallic objects are materials that can be found and used easily in almost every household. The reason why it was high in Group 1 is that children's motor functions are not well developed in this age group, and they can easily reach them and use them as toys to imitate adults. It was observed that the rates of injuries caused due to glass and wood (branch, etc.), stone, and body parts were higher in Group 3 than in other age groups. This could be because children in this age group start playing outside the home, work in areas such as farms, and involve in joking or quarreling with friends and in sports.

In the present study, it was observed that the period with injuries was most frequently during the 4th to 6th month. Past research has shown that injury periods differed according to the climatic characteristics and the lifestyle of the countries and regions. For example, in Canada, there were minimal injuries during summer[30]. On the contrary, open globe injuries occur most frequently in the summer months in the Van region of Turkey[31].

According to the distribution of age groups, the injury period was higher in Group 1 (7th to 9th month), whereas in Group 2 (4th to 6th month), there were more injuries, and there was no obvious difference between the periods in Group 3. During the 4th to 6th and 7th to 9th months, due to the favorable climatic conditions in our region, children find more opportunities to play outside, which consequently increases the probability of exposure to trauma.

In our study, it was observed that the place where injuries were the most common was the home environment, with a prevalence of 57.8%. Most of the previous studies have reported a similar result[32,33]. The group distribution according to the place of trauma is listed as follows: in Group 1, injuries were more frequent at home; in the Group 2, injuries were more frequent at school; and in Group 3, injuries were more frequent outdoors. Children in Group 1 spent most of their time at home because they are dependent on their families. Injuries in this age group are believed to be high due to their families' carelessness and inattention at home. Group 2 is the age when children start going school and begin to socialize. Certain materials

in the new environment (school) and aggressive and uncontrolled games among new friends increase the risk of trauma. It is believed that the rate of injuries in Group 2 was higher in school due to this reason. Group 3 is the period when children help their families with work, aggressive sports and games are held among friends, aggressive games are played, and children spend time in jokes and outside. Therefore, injuries in Group 3 are considered to be high outdoors.

Open globe injury has a worse prognosis than closed globe injury[34]. These injuries may lead to long-term visual impairment, amblyopia, and blindness. This can cause a worse psychological trauma for both the child and his/her family. At the same time, surgery costs and long hospital stay would lead to an economic burden on the family and the government. If we can adequately demonstrate the etiology and demography of open globe injuries in children, we can raise the awareness of families and society. Thus, we can take easier measures to combat these injuries, as a result of which we can prevent trauma and reduce such consequences.

In conclusion, if we can adequately demonstrate the etiology and demography of open globe injury in children, we can raise the awareness of families and the community. Thus, we can take easier precautions to combat these injuries and consequently prevent trauma.

Ethics Committee Approval: Our study, which was planned retrospectively, was approved by the Dicle University Ethics Committee (number: 69, date: 06.02.2020). Our study was conducted in accordance with the principles of the Declaration of Helsinki The parents of the children included in our study were informed in advance and consent was obtained for the study.

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