ORIGINAL ARTICLE

Epidemiological and clinical findings of ocular trauma in a public hospital in Türkiye

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ABSTRACT

BACKGROUND: The aim of this study is to characterize the sociodemographic, epidemiological, and clinical characteristics of ocular injuries in a secondary-level public hospital in Türkiye, identify the risk factors in the region, raise awareness on this issue, and propose solutions for injury prevention.

METHODS: This hospital-based retrospective cross-sectional study was conducted using data from patients who were followed up and treated for ocular trauma between January 2021 and January 2023 in a secondary-level public hospital located in the Middle Black Sea region of Türkiye. All patients, regardless of age, diagnosed with eyeball, eyelid, and orbital trauma were included. The age and gender of the patients, the situation or object that caused the injury, the location where the injury occurred, the type of injury according to the Birmingham Eye Trauma Terminology System (BETTS), initial and final visual acuities, and treatment outcomes were analyzed.

RESULTS: Medical records of 83 patients aged between two and 93 years were evaluated. Ocular trauma predominantly occurred in individuals aged 18 to 35 years (35%), with males comprising the majority (74.6%). Closed globe injury was the most common type of injury (73.5%), while injuries without globe involvement accounted for 18.1%, and open globe injuries comprised 8.4%. The most common cause of ocular injuries was falling (22.9%), with 47.3% of the patients in this group being 60 years of age or older. The most frequently implicated object in open globe injuries was wood, accounting for 42.8%. It was observed that injuries occurred most frequently on the streets (38.6%), followed by incidents at home (31.3%) and in the workplace (22.8%). Perforating injuries and ruptures were associated with the worst prognosis for final outcome.

CONCLUSION: Falls in older adults were the most common cause of trauma. Preventive measures should be implemented to address the causes and risk factors of fall-related eye injuries in the elderly. Raising awareness among society and authorities about the causes and consequences of eye injuries is essential. By doing so, these injuries can be effectively prevented.

Keywords: Ocular trauma; eye injuries; epidemiology; closed globe injury; open globe injury; visual acuity; prevention.

INTRODUCTION

Ocular trauma, which can have significant social and psychological effects on individuals and societies, remains a major public health concern. The causes of eye injuries vary depending on geography, demographics, and social environments, as well as across different age groups. However, a significant proportion of these injuries can be prevented by identifying risk factors, raising awareness, and implementing necessary precautions, particularly in specific settings such as homes, workplaces, and schools.[1,2]

Scruggs et al.,[3] in their study analyzing records from 28,340 patients in the National Trauma Data Bank between 2003 and 2007, reported that between 40,000 and 60,000 individuals in the United States experience unilateral blindness due to ocular trauma each year. Abbott et al.[4] reviewed international literature on high-risk situations for eye injuries and found that 18 million people worldwide have blindness in one eye

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due to trauma, while one in 250,000 children experiences a serious eye trauma annually. The treatment costs for ocular injuries were reported to exceed 88 million dollars annually in the United States in 2006[5] and more than 155 million dollars in Australia.[6] Additionally, the loss of workforce and decreased performance among affected individuals indirectly increase these costs.

The loss of one eye corresponds to 24% of whole-body disability. If there is blindness in both eyes, this rate increases to 85%.[7] Even if vision improves with appropriate patient management and treatment from the moment of injury, vision loss may still occur, affecting the person's daily life and professional skills. For this reason, multifaceted approaches to trauma prevention are becoming increasingly important. Open globe injuries carry the highest risk of blindness. In a study by Lee et al.[8] evaluating 155 surgically treated open globe injuries, the authors reported that work-related injuries accounted for more than one-third of all cases, with 96.3% occurring in young adult men. One of the most striking findings of this study was that 89.1% of work-related open globe injuries occurred due to inadequate use of protective eyewear. Given that these devastating injuries can be prevented with simple and cost-effective measures, ophthalmologists and lawmakers have a significant responsibility in addressing this issue.[9]

This article presents the sociodemographic and epidemiological characteristics of eye injuries, as well as the clinical features, follow-up, and treatment outcomes of patients treated at a public hospital serving a relatively dense population in the Middle Black Sea region of Türkiye. These epidemiological data will help authorities identify risk factors in the region and develop evidence-based preventive strategies.

MATERIALS AND METHODS

In this retrospective study, the data of 83 patients who applied at the Department of Ophthalmology at Merzifon State Hospital in Amasya due to eye injury between 2021 and 2023 were evaluated. Every stage of the research was conducted in accordance with the Declaration of Helsinki and was approved by the Merzifon State Hospital Ethics Committee with its decision dated October 23, 2023, and numbered E-44269710-929-227406639. Since the study was designed as a retrospective medical record review, it was exempt from the requirement for informed consent. Patients diagnosed with eyeball and/or adnexal injuries, who were followed up and treated, and whose relevant parameters were fully recorded, were included in the study, regardless of restrictive factors such as age, gender, and type of injury. Patients with incomplete demographic or clinical data were excluded from the study.

Trauma patients, including those with eye injuries, typically first present to the hospital's emergency department or are transported by emergency medical personnel. These patients often have multiple traumas resulting from traffic accidents or are elderly individuals who have sustained falls and are unable to mobilize. In the absence of a portable hand-held biomicroscope, anterior segment and fundus examinations cannot be performed with a standard biomicroscope in this patient group. These patients were initially evaluated in the emergency department to determine whether urgent surgical intervention was required. An external examination was performed using a penlight, with the eyelids gently opened to assess for any signs of open globe injury. Pupillary light reflexes were then evaluated. A retinal examination was conducted using a +20 diopter lens and indirect ophthalmoscopy. A comprehensive ophthalmological examination was performed on all patients who could be assessed under clinic conditions. The ocular adnexa, eye movements, and pupillary light reflexes were evaluated. Visual acuity was measured using Landolt C and logMAR (Logarithm of the Minimum Angle of Resolution) charts, depending on the patient's age group. The anterior segment structures were assessed using a slit lamp, while the retina and optic nerve were examined with a +90 diopter lens. When necessary, a Goldmann three-mirror contact lens was used for a more detailed evaluation of the peripheral retina. B-scan ocular ultrasound was performed on patients whose posterior segment examination was hindered by media haze. Intraocular pressure was measured using Goldmann applanation tonometry. Orbital computed tomography was performed on patients requiring an assessment for orbital wall fractures or the presence of intraocular or intraorbital foreign bodies.

All information obtained from these examinations and imaging, along with details of treatment progress and follow-up, was recorded. In addition, demographic information of the patients and details about the injury, including location, time, cause, type, and the object responsible for the injury, were obtained. To classify injuries, we used the Birmingham Eye Trauma Terminology System (BETTS), which was developed to more accurately determine the epidemiological data of eye injuries, establish a common terminology among ophthalmologists, and ensure standardization. BETTS is widely used for this purpose (Fig. 1). BETTS was designed by Kuhn et al.[10-12]

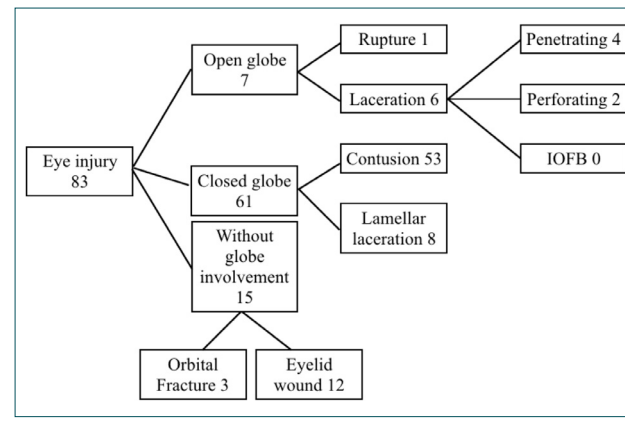

Figure 1. Eye injuries were grouped according to the Birmingham Eye Trauma Terminology System (BETTS).

in 1996 to provide a clear and comprehensive definition of eye injuries. The original BETTS is a classification system primarily based on the integrity of the eyeball and categorizes injuries into three main groups: closed globe injuries, open globe injuries, and injuries without globe involvement. The modified BETTS classification expanded the system to include periocular injuries, considering the presence of a foreign body.[13] Injuries were classified into three zones. Zone I includes the cornea and/or limbus, Zone II includes the sclera up to 5 mm beyond the limbus, Zone III includes injuries extending more than 5 mm beyond the limbus, potentially affecting the retina.[14] Ocular trauma scores (OTS) of the patients were also evaluated.[15]

Statistical Analysis

Data analysis was performed using the SPSS software (version 27.0; IBM Inc., Chicago, IL, USA) with a 95% confidence level. Frequency and percentage (n (%)) statistics were calculated for categorical (qualitative) variables. The Chi-square test was used to compare relationships between group variables and their frequencies. A p-value of 0.05 or less was considered statistically significant.

RESULTS

Between January 2021 and January 2023, a total of 101 patients were admitted due to ocular trauma. Eighteen patients with incomplete demographic data, missing examination information, or discontinuity in follow-up were excluded from the study. Data from 83 patients who met the inclusion criteria were analyzed. The majority of patients (74.6%) were male, and this male gender dominance persisted across all age groups. Although the difference decreased in patients aged 60 and above, no statistically significant difference was detected (p=0.193). The highest injury rate was observed in the 18-35 age group (35%), followed by the 36-59 age group (29%). The distribution of ocular trauma by age group and gender is presented in Table 1.

Closed globe injuries accounted for 73.5% of total injuries and were more common in men (53%). Open globe injuries were also more frequently observed in men (7.2%), comprising 8.4% of total injuries. Injuries affecting structures other than the eyeball constituted 18.1% of total injuries and were more prevalent in men (14.5%). There was no statistically significant relationship between gender and injury type (p=0.760). Gender distribution according to types of eye injuries is provided in Table 2. Closed globe injuries were most frequently detected in the 18-35 age group (31.3%), followed by the 36-59 age group (24.1%). Open globe injuries were most common in the 36-59 age group. Extraocular injuries were predominantly observed in children and individuals aged 60 and above. The relationship between age groups and injury type was found to be statistically significant (p<0.05). The distribution of eye injury types by age group is shown in Table 3.

Falls were the most common cause of injury, accounting for 22.9% of total cases, and were particularly prevalent in individuals aged 60 years and above (10.8%) (p<0.05). Injuries resulting from physical attacks were the second most common cause, with the highest occurrence in the 18-35 age group (9.6%), comprising 19.2% of total injuries. Metallic objects were responsible for 14.5% of total injuries, with the highest frequency in the 18-35 age group (9.6%) (p<0.05). The distribution of injury-causing factors by age group is presented in Table 4. It was observed that closed globe injuries were most commonly caused by physical attacks (14%) and falls (11%). A significant proportion of open globe injuries (42.8%) resulted from contact with wooden objects. Orbital fractures were more frequently associated with falls and physical assaults, while eyelid injuries were most commonly caused by falls. The relationship between injury causes and injury types is detailed in Table 5.

The most common locations where injuries occurred were streets (38.6%) and homes (31.3%). Street-related injuries occurring were most frequently observed in the 18-35 age group (18.1%) (p<0.05), followed by the 36-59 age group (15.7%). Home-related injuries were most prevalent in individuals aged 60 and above (13.3%) (p<0.05). Workplace injuries were most commonly reported in the 18-35 age group (12.0%), accounting for 22.8% of total injuries. The distribution of injury locations by age group is presented in Table 6.

Table 1. Distribution of ocular trauma by age group and gender

Age Group	Gender n (%)		Total n (%)
	Female	Male	
0-17	4 (26.6)	11 (73.3)	15 (18.0)
18-35	6 (20.6)	23 (79.3)	29 (35.0)
36-59	4 (16.6)	20 (83.3)	24 (29.0)
≥60	7 (46.6)	8 (53.3)	15 (18.0)
Total	21 (25.3)	62 (74.6)	83 (100.0)

Table 2. Classification and distribution of ocular trauma by gender

Type of Ocular Trauma	Male n (%)	Female n (%)	Total n (%)
Closed-Globe	44 (53.0)	17 (20.5)	61 (73.5)
Open-Globe	6 (7.2)	1 (1.2)	7 (8.4)
Penetrating	3 (3.6)	1 (1.2)	4 (4.8)
Perforating	2 (2.4)	-	2 (2.4)
Rupture	1 (1.2)	-	1 (1.2)
Without Globe Involvement	12 (14.5)	3 (3.6)	15 (18.1)
Total	62 (74.7)	21 (25.3)	83 (100.0)

Table 3. Classification and distribution of ocular trauma by age group

Type of Ocular Trauma	0-17 n (%)	18-35 n (%)	36-59 n (%)	≥60 n (%)	Total n (%)
Closed-Globe	8 (9.6)	26 (31.3)	20 (24.1)	7 (8.5)	61 (73.5)
Open-Globe					7 (8.4)
Penetrating	-	-	2 (2.4)	2 (2.4)	4 (4.8)
Perforating	1 (1.2)	-	1 (1.2)	-	2 (2.4)
Rupture	-	-	1 (1.2)	-	1 (1.2)
Without Globe Involvement	6 (7.2)	3 (3.7)	-	6 (7.2)	15 (18.1)
Total	15 (18.0)	29 (35.0)	24 (29.0)	15 (18.0)	83 (100.0)

Table 4. Distribution of injury-causing agents by age group

Agent of Trauma	0-17 n (%)	18-35 n (%)	36-59 n (%)	≥60 n (%)	Total n (%)
Metallic Object	-	8 (9.6)	2 (2.4)	2 (2.4)	12 (14.5)
Wood	1 (1.2)	3 (3.6)	6 (7.2)	3 (3.6)	13 (15.6)
Body Part/Physical Assault	2 (2.4)	8 (9.6)	6 (7.2)	-	16 (19.2)
Traffic Accident	2 (2.4)	5 (6.0)	4 (4.8)	1 (1.2)	12 (14.5)
Stone	-	-	1 (1.2)	-	1 (1.2)
Glass	2 (2.4)	-	-	-	2 (2.4)
Fall	4 (4.8)	2 (2.4)	4 (4.8)	9 (10.8)	19 (22.9)
Plastic Object	1 (1.2)	2 (2.4)	1 (1.2)	-	4 (4.8)
Nerf Gun	1 (1.2)	-	-	-	1 (1.2)
Toy	2 (2.4)	-	-	-	2 (2.4)
Shotgun/Airgun	-	-	1 (1.2)	-	1 (1.2)
Total	15 (18.1)	28 (33.7)	25 (30.1)	15 (18.1)	83 (100.0)

Bold values indicate the most frequent cause of injury in each age group. These values are statistically significant ($p<0.05$).

Table 5. Relationship between injury causes and trauma types

Cause of Injury	n (%)	Closed-Globe	Open-Globe	Orbital Fracture	Eyelid Wound
Metallic Object	12 (14.5)	9	1	- (2)	2 (1)
Wood	13 (15.6)	9	3	-	1 (1)
Body Part/Physical Assault	16 (19.2)	14	1	- (4)	1 (3)
Traffic Accident	12 (14.5)	9	1	1 (2)	1 (4)
Stone	1 (1.2)	1	-	-	-
Glass	2 (2.4)	2	-	-	- (1)
Fall	19 (22.9)	11	-	2 (2)	6 (3)
Plastic Object	4 (4.8)	4	-	- (1)	-
Nerf Gun	1 (1.2)	1	-	-	-
Toy	2 (2.4)	1	-	-	1
Shotgun/Airgun	1 (1.2)	-	1	-	-
Total	83 (100.0)	61	7	3 (11)	12 (13)

Values in parentheses indicate cases accompanying closed or open globe injuries.

Table 6. Distribution of injury locations by age group

Place of Injury	0-17 n (%)	18-35 n (%)	36-59 n (%)	≥60 n (%)	Total n (%)
Street	2 (2.4)	**15 (18.1)**	13 (15.7)	2 (2.4)	32 (38.6)
Home	6 (7.2)	4 (4.8)	5 (6.0)	**11 (13.3)**	26 (31.3)
Work	-	10 (12.0)	7 (8.4)	2 (2.4)	19 (22.8)
School	6 (7.2)	-	-	-	6 (7.2)
Total	14 (16.8)	29 (34.9)	25 (30.1)	15 (18.1)	83 (100.0)

The bold values represent the most frequent occurrences within each age group. Their frequency in the respective groups is statistically significant ($p<0.05$).

It was found that 96.7% of closed globe injuries resulted in a final visual acuity between 0.40 and 0.00 ($p<0.05$). Final visual acuity was ≤ counting fingers (CF) in 42.8% of open globe injuries, affecting patients with perforating injuries and ruptures. Among patients with penetrating injuries, 75% had a final visual acuity between 0.40 and 0.00. All injuries involving structures other than the eyeball resulted in a final visual acuity between 0.40 and 0.00. Table 7 provides an overview of final visual acuity by type of eye injury.

It was determined that 13.1% of closed globe injuries required lifelong follow-up, 3.2% required surgical intervention, and 3.2% resulted in permanent damage. It was determined that all open globe injuries (100%) required lifelong follow-up, surgical intervention, and resulted in permanent damage. Surgical intervention was necessary in 14.2% of orbital fractures and in 12% of eyelid injuries. Table 8 presents the final outcomes by injury type.

Among injuries caused by metallic objects, 16.6% required lifelong follow-up, 16.6% required surgical intervention, and 8.3% resulted in permanent damage. It was determined that injuries caused by wooden objects required lifelong follow-up in 30.7% of cases, surgical intervention in 30.7%, and resulted in permanent damage in 23%. Among injuries resulting from physical attacks, 18.7% required lifelong follow-up, 12.5% required surgical intervention, and 6.2% led to permanent damage. Injuries resulting from traffic accidents required lifelong

Table 7. Relationship between ocular trauma type and final vision

Type of Ocular Trauma	≤CF n (%)	VA 1.00-0.50 n (%)	VA 0.40-0.00 n (%)	Total n (%)
Closed-Globe	-	2 (2.4)	59 (71.1)	61 (73.5)
Open-Globe	3 (3.6)	1 (1.2)	3 (3.6)	7 (8.4)
Penetrating	-	1 (1.2)	3 (3.6)	4 (4.8)
Perforating	2 (2.4)	-	-	2 (2.4)
Rupture	1 (1.2)	-	-	1 (1.2)
Without Globe Involvement	-	-	15 (18.1)	15 (18.1)
Total	3 (3.6)	3 (3.6)	77 (92.7)	83 (100.0)

Visual acuity values are based on the logMAR (Logarithm of the Minimum Angle of Resolution) chart.
Bold values indicate statistical significance ($p<0.05$).

Table 8. End-point outcomes of injuries by trauma type

	Number of Injuries	Need for Lifelong Follow-up	Surgical Intervention	Permanent Impairment
	n	n (%)	n (%)	n (%)
Closed-Globe	61	8 (13.1)	2 (3.2)	2 (3.2)
Open-Globe	7	7 (100.0)	7 (100.0)	7 (100.0)
Orbital Fracture	3 (11)*	-	2 (14.2)	-
Eyelid Wound	12 (13)*	-	3 (12.0)	-
Total	83	15 (18.0)	14 (16.8)	9 (10.8)

*Values in parentheses indicate cases accompanying closed or open globe injuries.

follow-up in 8.3% of cases, surgical intervention in 16.6%, and caused permanent damage in 8.3%. Additionally, 5.2% of injuries caused by falls required surgical intervention. Table 9 presents the final outcomes by injury cause.

The most common risk factors for falls were female gender (68.4%), advanced age (47.3%), and the use of antihypertensive medication (47.3%). Visual impairment (visual acuity of 20/200 or worse in the fellow eye) and physical disability were present in 15.7% of total injuries. A history of recurrent falls and the use of a walking aid was noted in 10.5% of patients. The prevalence of neurological and psychiatric diseases was found to be 5.2%. Table 10 presents the risk factors associated with fall-related eye injuries.

Table 10. Risk factors for fall-related ocular trauma

	n (Total 19 Patients) (%)
Female gender	13 (68.4)
Advanced age (≥60 years)	9 (47.3)
Use of antihypertensive medications	9 (47.3)
Visual impairment*	3 (15.7)
Physical disability	3 (15.7)
Neurological disease	1 (5.2)
Recurrent fall history	2 (10.5)
Psychiatric disorders	1 (5.2)
Use of a walking aid	2 (10.5)

*Visual impairment was defined as a best-corrected visual acuity of ≤20/200 in the unaffected eye.

DISCUSSION

Eye injuries are among the leading causes of vision loss and blindness, impacting a person's social and professional life. The cause, location, and mechanism of trauma vary depending on geographic region, lifestyle, and cultural and socioeconomic factors.[16-18] This has been demonstrated in studies evaluating different age groups, including childhood, adulthood, and old age.[19-21] Although scoring systems exist to estimate prognosis, predicting outcomes is often difficult. Morbidity secondary to trauma can be reduced through awareness, education, adherence to established guidelines and regulations.

In a recent study, Swain et al.[22] reported that 24 million people in the United States had experienced eye injuries, with 1.5 million suffering from visual impairment and 147,000 becoming completely blind. McCarty et al.[23] reported the prevalence of ocular trauma as 21.1% among individuals over the age of 40 in Australia. In rural areas in India, the prevalence of ocular trauma among individuals aged 15 years and older was reported as 10.6%.[22-24] Studies providing precise epidemiological data on ocular trauma are limited in Türkiye, as in many other countries. However, some studies in Türkiye offer insight into this issue. In one study in our country evaluating 816 patients from different age groups who had lost an eye due to various causes, trauma was identified as the most common etiological factor, accounting for 587 cases (71.9%).[25] Bayar et al.[26] reported that between 2017 and 2019, 21 pediatric patients diagnosed with ocular trauma were followed up and treated over a two-year period. They reported that 15 patients (71.4%) had open globe injuries, while six patients (28.5%) had closed globe injuries. Karagöz et al.[27] reported that 294 patients with open globe injuries were followed up and treated in their hospitals over an 11-year period between 2000 and 2011. They also documented the location of injuries, causes, objects or materials responsible for the injuries, injury types by age group, clinical features, and treatment outcomes.

In our study, 74.6% (62) of the 83 patients with eye injuries

Table 9. End-points outcomes of injuries by primary cause

	Total Cases	Need for Lifelong Follow-up	Surgical Interventionn	Permanent Impairment
	n	n (%)	(%)	n (%)
Metallic Object	12	2 (16.6)	2 (16.6)	1 (8.3)
Wood	13	4 (30.7)	4 (30.7)	3 (23)
Body Part/Physical Assault	16	3 (18.7)	2 (12.5)	1 (6.2)
Traffic Accident	12	1 (8.3)	2 (16.6)	1 (8.3)
Stone	1	1 (100)	-	1 (100)
Glass	2	-	1 (50)	-
Fall	19	-	1 (5.2)	-
Plastic Object	4	2 (50)	1 (25)	1 (25)
Nerf Gun	1	1 (100)	-	-
Toy	2	-	-	-
Shotgun/Airgun	1	1 (100)	1 (100)	1 (100)
Total	83	15 (18.0)	14 (16.8)	9 (10.8)

were male. This finding is consistent with literature indicating that eye injuries occur more frequently in men than in women, both in childhood and adulthood.[20,28,29] In both industrial and rural areas, high-risk occupations that require physical labor, as well as work accidents involving cutting tools such as hammers and knives, disproportionately affect men. Additionally, incidents of assault and battery are more common among men. In the pediatric age group, the use of toy guns and male dominance in physically demanding sports increase the risk of eye injuries. Men's predisposition to eye injuries can be explained by these factors. Studies have also shown that hospitalization rates due to eye trauma and vision loss from trauma are higher in boys.[5,30] Thylefors et al.[31] demonstrated that after the age of 70, this gender disparity disappears due to similar lifestyles among elderly men and women.

The age group with the highest incidence of injuries was 18-35 years (35.0%), followed by the 36-59 age group (29.0%). Our study population consisted of patients aged 2 to 93 years, with the majority being young adults. In our study, the proportion of patients aged 0-17 years was 18.0%. Kyei et al.[32] reported that 38.4% (331) of the cases in their study were in the 18-35 age range, followed by the 0-17 age range at 27.9% (241). Soylu et al.[33] reported that 45.6% (114) of cases in their study conducted in Türkiye were between the ages of 0-15. Similarly, Soliman et al.[34] reported a similar pediatric age group rate in their study. Dandona et al.[35] demonstrated a significant positive relationship between age and ocular trauma. While it is generally expected that the incidence of ocular trauma increases with age and longer life expectancy, some studies have shown the opposite trend.[36] This variation may be influenced by different socioeconomic conditions, cultural habits, and exposure to risk factors. Additionally, underreporting among the elderly may also contribute to this trend.

D'Antone et al.,[1] in their study evaluating 61 eyes with pediatric trauma, reported that 57.37% (35) of cases involved closed globe trauma. Mallika et al.,[37] in their study in Malaysia, found that 61.1% of cases were closed globe injuries, while 34.8% were open globe injuries. Pandita et al.,[38] in their study conducted in New Zealand, reported a significantly higher number of closed globe injury cases (568) compared to open globe injuries (253). Contrary to these findings, Soylu et al.[33] reported in their study in Türkiye that the most common injury type was open globe injuries, with a prevalence of 72%.Similarly, Kyei et al.,[32] in their study in Zimbabwe, reported the prevalence of open globe injuries as 71.2%.Other studies in the literature have also indicated that open globe injuries are more common.[39-41] In our study, closed globe trauma was predominant in both the group under 18 years of age (53.3%) and the overall patient population (73.5%). Open globe injuries were observed in 8.4% of cases, while ocular adnexal and orbital injuries accounted for 18.1%. Gise et al.,[42] in their study analyzing data from 58,765 children with traumatic brain and ocular injuries in the United States, reported ocular adnexal injuries in 39.1% of cases and orbital injuries in 35.8%. Sahraravand et al.,[43] in their study evaluating 118 eyes of patients aged 61 and older in Southern Finland, reported ocular adnexal and orbital injuries in 12.7% of cases. There are several reasons for the differences observed in studies in the literature. These include the geographical location of the study, socioeconomic factors, awareness levels, and the age group analyzed. Additionally, while closed globe injuries are often treated in primary and secondary healthcare institutions, open globe injuries are frequently referred to tertiary hospitals. This referral pattern significantly impacts the rates reported in hospital-based studies.

The most common causes of eye injuries in children are toys and sports-related incidents, although these vary by age group.[2,44,45] In adults, workplace accidents, traffic accidents, physical assaults, and falls are the most frequent causes.[46,47] The literature indicates that blunt objects, such as sticks and stones, are among the most common causes of eye injuries.[23,48,49] Shrestha et al.[50] reported that the most common injuries were caused by plant materials such as sticks and branches (23%), followed by metal objects (21%).Singh et al.[51] found that in India, tree branches and sticks were responsible for 29.54% of injuries, while in the United Kingdom, compressed air guns accounted for 53% of pediatric eye injuries.[4] In our study, while falls were the primary cause of eye injuries in both pediatric and elderly populations, metallic objects, wood, and physical assaults were the leading causes of injuries in young adults. When all injuries were analyzed collectively, falls were the most frequent cause, followed by physical assaults, wood, metallic objects, and traffic accidents. A significant proportion of injuries resulted from metallic objects or wood. Metal objects such as needles, scissors, and knives are widely used in daily life at home, school, and the workplace. One of our patients with a penetrating eye injury was injured by a quilt needle. Most wood-related injuries were associated with agricultural work in rural areas. A substantial number of patients sustained eye injuries from contact with wood and branches, particularly during harvest periods.

Injuries caused by falls were frequently observed in the older age group. Approximately 30% of individuals over the age of 65 experience a fall each year, and this rate increases to 50% in those aged 80 and above.[52] Falls result in serious injuries in 32% of patients aged 65 and older.[53] Sahraravand et al.[43] evaluated 118 eyes of patients aged 61 and over in southern Finland and reported that falls were the most common cause of injury (22%) and the leading cause of permanent injuries (47%). Uzel et al.[21] analyzed ocular trauma due to falls in 50 eyes of patients over the age of 90, finding that 41 patients (82%) were women. Orbital fractures were observed in 36% of cases, followed by open globe injuries in 34% and periocular injuries in 28%. The most common risk factors identified in their study were female gender (82%) and antihypertensive drug use (46%).Similarly, in our study, female gender and antihypertensive medication use emerged as the

most significant risk factors. In our study, closed globe injuries due to falls were commonly observed, often accompanied by orbital fractures and eyelid injuries. However, no open globe injuries were recorded. One patient required surgical intervention for an orbital wall fracture, but no cases resulted in permanent vision or functional loss. Overall, the prognosis due for fall-related injuries in our study was favorable. In this elderly patient population, careful consideration should be given to comorbid conditions and increased anesthesia risks. It is crucial to educate both patients and caregivers, particularly those in the older age group with visual impairment, about fall risks and to design living environments that support daily activities.

Haavisto et al.[54] evaluated eye injuries caused by toy guns in Southern Finland and reported that 1% (15) of all eye injuries were due to toy guns. The majority of affected individuals were male (14) and children under the age of 16 (13). They also found that the use of protective eyewear was very low, and even those who wore it did not use it properly. A study conducted in Hong Kong reported that toy gun-related eye injuries in children accounted for 12% of all eye injuries.[55] The sale and safety regulations of toy guns and protective equipment must be strictly controlled by authorities. In Denmark, the law prohibits the use of pellet toy guns by individuals under 18 years of age.[56] Cohen et al.[57] evaluated 11 children with eye injuries caused by Nerf guns and reported the following complications: hyphema (82%), corneal abrasion (27%), vitreous hemorrhage (27%), and traumatic mydriasis (18%). Additional findings included glaucoma-related complications (36%), commotio retinae (27%), and severe photoreceptor damage (9%).Nerf guns are often considered less dangerous than pellet guns. However, in our study, a 15-year-old patient sustained hyphema, corneal edema, and peripheral commotio retinae due to a Nerf gun injury. It is evident that when posterior segment findings accompany traumatic hyphema, the visual prognosis worsens.[58] Extramacular commotio retinae is generally associated with good visual acuity. However, approximately one-quarter of patients with macular commotio retinae have been shown to have a visual acuity of 6/9 or worse.[59] The incidence of angle recession in post-traumatic hyphema has been reported to be approximately 71-76%,[60] with a six-month incidence of glaucoma development at 3.39%.[61] Healthcare professionals should be prepared for both short-term and long-term complications following traumatic hyphema. It should also be emphasized that Nerf gun bullets are not as harmless as commonly perceived and can cause severe eye injuries. Additionally, both sellers and parents ensure compliance with age restrictions for the sale and use of Nerf guns.

In our study, eye injuries resulting from traffic accidents accounted for 14.4% (12) of all injuries. Adhering to traffic rules and using seat belts can reduce the incidence of these injuries. Although necessary legal measures have been implemented in our country, traffic accidents remain a major public health concern. Motorcycle use is particularly common in the region where our study was conducted, and 50% traffic accident-related eye injuries were caused by motorcycle accidents. The age group using these vehicles is generally younger, and unfortunately, compliance with traffic regulations is lower.

In a study evaluating 1,132 patients who experienced eye trauma in a metropolitan city, it was reported that assault was the most common cause (41%) and also led to the most severe injuries.[62] In our study, assault-related injuries accounted for 19.2% of cases. The majority of these injuries occurred in males (93.7%), and 87.5% of the affected individuals were between the ages of 18 and 59. Preventing eye injuries caused by assault does not seem feasible through the standard precautions used to prevent injuries at home or in the workplace.

In our study, injuries most frequently occurred on the street (38.6%), followed by injuries at home (31.3%) and in the workplace (22.8%). In both children and older adults, home was the most common location for injuries, whereas in young adults, the street was the primary site of injury. Serrano et al.[63] reported that in the pediatric age group, injuries most commonly occurred at home (44.4%), followed by injuries on the street (28.6%). Soylu et al.[33] found that for individuals aged 16-30 years, the most common location for injuries was the workplace, whereas for all other age groups, the street was the most frequent site of injury. In the literature, the rate of occupational eye trauma is reported to range between 38.9% and 73.7%, with higher rates observed in developing countries.[64,65]

In our study, work-related eye injuries accounted for 22.8% of cases, including those associated with rural farming activities, making them a significant cause of eye trauma, particularly in the working population. Among these cases, 84.2% involved male patients, with the most common age group being 18-35 years. Agricultural activities and farming are extensively carried out in the rural areas of the Middle Black Sea region, where this study was conducted. They are a significant cause of eye injuries in the middle-aged population. Basic protective measures, such as the use of protective eyewear, can prevent eye injuries in workplaces with a high risk of accidents. In a study by Cai and Zang,[66] most individuals who sustained work-related injuries were temporary workers (65.8%). Their use of protective eyewear was severely inadequate (92.9%), and the majority had not received any safety training before starting their jobs (77.5%). Proper maintenance and repair of machinery and equipment should be prioritized to mitigate workplace hazards. Employers must fulfill their obligations to provide safe and secure working conditions. Thompson et al.[67] demonstrated that only 13% of workers were wearing protective eyewear at the time of their injury. Chen et al.[68] reported that the use of protective eyewear reduced the risk of work-related eye injuries by up to 60%, yet the compliance rate was only 18.4%. Although protective equipment is available and its

necessity is well known, it is evident that most employees do not use it properly. Both employees and employers have important responsibilities in this regard. We believe that work-related eye injuries can be prevented through the implementation of mandatory regulations. In some developed countries, reporting eye injuries to authorized agencies and organizations is required. These countries have systems in place for collecting and analyzing statistics on this subject.[69] However, in many countries, including Türkiye, reporting such injuries is still not mandatory. As a result, authorities and public health researchers may face challenges in implementing effective preventive measures. In our study, the location of injury was recorded as a school setting for 6 out of 15 children (40%). There may be cultural differences in children's play behaviors and toy usage. Organizing training programs to raise awareness among educators on this issue can help prevent injuries in schools.

Visual acuity at the time of admission is an important predictor of final visual acuity. Among patients who presented with finger-counting vision at baseline, 36.3% retained the same level of vision at the end of follow-up. Overall, 77 patients (92.7%) had good final vision, while three patients (3.6%) had moderate final vision. All three eyes that initially had no light perception remained at the same level at the final assessment. These findings align with previous reports in the literature.[15,70,71]

Most closed globe injuries and periocular injuries have a favorable prognosis with good final visual acuity. However, the prognosis may be poor in cases involving the optic nerve head and macula, such as traumatic optic neuropathy and traumatic macular hole in closed globe injuries. The visual prognosis is poor in cases of open globe injuries and intraocular foreign body (IOFB). Kyei et al.[32] reported that, after adjusting for age and gender, patients with open globe injuries were approximately ten times more likely to develop blindness than those with closed globe injuries. Additionally, they found the prevalence of visual impairment due to eye injury to be 60.1%. Cases involving penetration, perforation, rupture, and IOFB were treated surgically, while closed globe injuries were managed with medical treatment. As expected, better visual outcomes were achieved in the group that received medical intervention. In our study, a patient with a perforating eye injury caused by a gunshot wound developed phthisis bulbi during follow-up. Although our study did not include enough cases to confirm this, scleral injuries are more strongly associated with hypotonia and phthisis bulbi due to ciliary body damage. The literature also supports a close relationship between gunshot wounds and blindness, as well as enucleation.[72,73]

Obtaining more accurate epidemiological data on ocular trauma and establishing a multicenter, and even international, database could help optimize the clinical management of these patients. The heterogeneity of ocular trauma cases makes prospective studies challenging, and most research in this field consists of single-center, retrospective studies. The Birmingham Eye Trauma Terminology System and Ocular Trauma Score are now widely accepted for creating a common language and a standardized classification system for eye injuries.[10,15] Ocular trauma databases, such as the United States Eye Injury Registry (USEIR), which was established in the United States in 1988 and became obsolete in 2013, have been created in many countries but have often become outdated over time. Recently, the International Globe and Adnexal Trauma Epidemiology Study (IGATES) was launched as a collaborative initiative among several countries.[28] These international registry systems play a crucial role in establishing a standardized approach to ocular trauma and collecting more comprehensive data for improved analysis and management. In our country, the Ocular Traumatology and Medicolegal Ophthalmology community within the Turkish Ophthalmology Association is actively working on this issue.

The fact that patients with missing or incorrect diagnosis codes were not included in the study, along with the referral of some patients to other healthcare institutions in the region, may limit the generalizability of the study's epidemiological data. As this is a hospital-based study with a cross-sectional design, the findings may not be fully applicable to the general population.

The retrospective nature of our study and the limited number of patients, particularly those with open globe injuries, are among its limitations. This is primarily because open globe injuries are often referred to tertiary hospitals.

CONCLUSION

In conclusion, while the morbidity associated with eye injuries remains significant, it is promising that these injuries are preventable. It appears feasible to reduce the frequency of eye injuries through simple and practical measures that can be integrated into daily life. Providing regular training to students and teachers in schools on this topic is essential. Additionally, increasing the use of protective eyewear by educating employers and employees, particularly in high-risk industrial and agricultural sectors, is crucial. The sale of toy guns to children should be regulated, and the use of firearms by adults should be restricted to licensed individuals. Strict compliance with traffic rules is among the essential precautions that must be taken, as emphasized in our study.

Ethics Committee Approval: This study was approved by the Merzifon State Hospital Ethics Committee (date: 23.10.2023, decision no: E-44269710-929-227406639.

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ORİJİNAL ÇALIŞMA - ÖZ

Türkiye'de bir devlet hastanesinde oküler travmaların epidemiyolojik ve klinik bulguları

AMAÇ: Çalışmamızın amacı, Türkiye'de ikinci basamak bir devlet hastanesinde oküler travmaların sosyodemografik, epidemiyolojik ve klinik özelliklerini karakterize etmek; o coğrafyadaki risk faktörlerini ortaya koymak; bu konuda farkındalık yaratmak ve yaralanmaların önlenmesine yönelik çözüm önerileri sunmaktır.

GEREÇ VE YÖNTEM: Bu hastane bazlı retrospektif kesitsel çalışma, Türkiye'nin Orta Karadeniz Bölgesi'nde yer alan ikinci basamak bir devlet hastanesinde, Ocak 2021 - Ocak 2023 tarihleri arasında oküler travma nedeniyle takip ve tedavi edilen hastaların verilerine dayanılarak yapılmıştır. Göz, göz kapağı ve orbita travması bulunan tüm hastalar çalışmaya dahil edilmiştir. Hastaların yaşı, cinsiyeti, yaralanmaya neden olan durum/nesne, yaralanmanın meydana geldiği yer, Birmingham Göz Travması Terminoloji Sistemine (BETTS) göre yaralanmanın türü, başlangıç ve son görme keskinlikleri ve tedavi sonuçları analiz edilmiştir.

BULGULAR: Yaşları iki ile doksan üç arasında değişen 83 hastanın tıbbi kayıtları değerlendirilmiştir. Oküler travma ağırlıklı olarak 18 ila 35 yaş arasındaki kişilerde (%35) meydana gelmiş ve çoğunluğu erkeklerden (%74.6) oluşmuştur. Kapalı glob yaralanmaları en sık görülen yaralanma tipiydi (%73.5), glob tutulumu olmayan yaralanmalar %18.1, açık glob yaralanmaları ise %8,4 oranında görülmüştür. Oküler travmaların en sık nedeni düşme (%22.9) olup, bu gruptaki hastaların %47.3'ü 60 yaş ve üzerindedir. Açık glob yaralanmalarına en sık neden olan cismin %42.8 oranıyla tahta olduğu görülmüştür. Yaralanmaların en sık sokakta (%38.6) meydana geldiği tespit edilmiştir. Bunu %31.3 ile evde, %22.8 ile işyerinde meydana gelen yaralanmalar takip etmiştir. Perforasyon ve rüptür, nihai sonuç açısından en kötü prognoza sahip yaralanmalardı.

SONUÇ: İleri yaşta düşmeler en sık neden olarak karşımıza çıkmıştır. Yaşlılarda düşmeye bağlı oküler travmaların nedenleri ve risk faktörlerine karşı önleyici tedbirler alınmalıdır. Oküler travmaların nedenleri ve sonuçları konusunda toplumda ve yetkililerde farkındalık oluşturulmalıdır. Bu sayede alınacak önlemler, bu yaralanmaların önlenebilir olmasını sağlayacaktır.

Anahtar sözcükler: Oküler travma; göz yaralanmaları; epidemiyoloji; kapalı glob yaralanması; açık glob yaralanması; görme keskinliği; önleme.

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