

An Observational Study of Ocular Trauma in Aswan University Hospital

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Short title: An Observational Study of Ocular Trauma.

Abstract

Purpose: to review the epidemiology of ocular trauma among ophthalmic patients attending to Aswan University Hospital

Patients & methods: A cross-sectional hospital based study estimating patients sustained ocular trauma within one year period (Jan 2020 - Dec 2020), the association between variables was checked by Chi-square test

Results: 701 eyes of 607 patients had sustained ocular trauma in one year period (2020). The mean age of the patients was (23.02 ± 11.52) years, (79.7%) were males and (20.3%) were females, with a male to female ratio of (3.9:1). The majority of injuries were adnexal injuries (38.5%) followed by globe injuries (26.4%), extra global foreign body (18.1%), chemical injuries (2.7%) and intra mural foreign body (0.9%). In globe injuries; (10%) (70) were open globe; ((60) eyes with rupture globe, (6) eyes with penetrating injury, (3) eyes with intraocular foreign body) and (16.4%) (115) were closed globe; ((4.4%) (25) were contusion whereas (12%) (52) were lamellar laceration). The most common eye injury was periocular ecchymosis and oedema (19.1%).

Conclusion: Ocular trauma is a major problem for monocular morbidity and blindness. Workers and students as involved in street activities and workplaces were the most affected.

Keywords: Ocular trauma, epidemiology, Aswan University Hospital.

INTRODUCTION

Ocular injuries remain a significant global health problem. The epidemiological data for ocular injuries are scarce or totally lacking, unlike other major blinding conditions such as Cataract, Trachoma, and Xerophthalmia, where epidemiological studies have contributed much¹.

It has been recognized that ocular trauma is one of the leading causes of monocular blindness². The annual incidence of ocular trauma is estimated at 55 million, of which around 750,000 (1.4%) cases require hospitalization each year, including around 200,000 (26.7%) open globe injuries³.

The impact of trauma on the human eye may range from minute corneal abrasions to badly lacerated globe. Most of the eye injuries are minor and unlikely to result in permanent visual impairment. For severe eye injuries, a substantial proportion of patients may experience poor visual outcomes⁴.

Since data collection is the initial step in any epidemiological study, once a sufficient amount of information is available on how injuries occur (to whom, where, and why, etc.), prophylactic measures can be planned for and implemented⁵.

Most of the ocular traumas could be prevented through applying proper use of safety eyewear. Implementing standard strategies for eye injury prevention would substantially reduce its incidence. The associated prevention measures include requiring certified eye protectors at the workplace and sports activities whenever possible, rather than making their use as voluntary⁶.

To our knowledge, the epidemiology of ocular trauma has never been previously investigated in Aswan. This study investigates the demographics, etiology, and prognostic

factors management of eye trauma at Aswan University Hospital for one year.

PATIENTS AND METHODS

This is a cross-sectional hospital-based study involving all cases of ocular trauma at the outpatient ophthalmology clinic and the emergency rooms presented to the Ophthalmology department, Aswan University Hospitals within one year period (Jan 1st, 2020 - Dec 31st, 2020).

This study approval from the Institutional Research Board of faculty of medicine, Aswan University, No. (424/12/19) was taken; the study was carried out following the tents of the Declaration of Helsinki.

Patients with injuries in the blind or atrophic eye, comatosed patients, and Patients with old ocular trauma (> one month), surgically treated elsewhere were excluded from the study. Personal history of the patients, demographic data, details of the injury and the condition of the other eye were obtained with a full ophthalmological examination.

In this study, according to WHO definitions of the term 'blindness' was used for those who had VA (< 3/60) in the better eye, whereas 'moderate to low vision' was for those who had VA (less than 6/18 to 3/60) in the better eye. Epidemiological and examination data were collected and analyzed. Follow-up was carried out according to the severity

of the eye injury. Globe injuries were followed up for 3 months.

Data were statistically described in terms of; mean, standard deviation (\pm SD), frequency, and percentage (%). Comparison between the study groups was done using the "Chi-square (χ^2) test"; a probability value (*p*-value) less than (0.05) was considered statistically significant.

RESULTS

This study was carried out in the Ophthalmology department at Aswan University Hospital over one year period (Jan 1st, 2020 - Dec 31st, 2020). There were (607) patients who had sustained ocular trauma with (701) eye injuries (94 cases had bilateral eye injuries).

Demographics:

(A) Age and Sex

In this study, the mean (SD) age of patients was (23.02 \pm 11.52) years (range: 3 months - 66 years). The pediatric age group (15 years and younger) was (146) (24.1%), while the adult age group >15 years was (461) (75.9%). Males were (484) cases (79.7%) and females (123) cases (20.3%) with male to female ratio (3.9:1).

Significantly more males were injured than females in our study (*p*-value is 0.037 chi-square test), (chart 1).

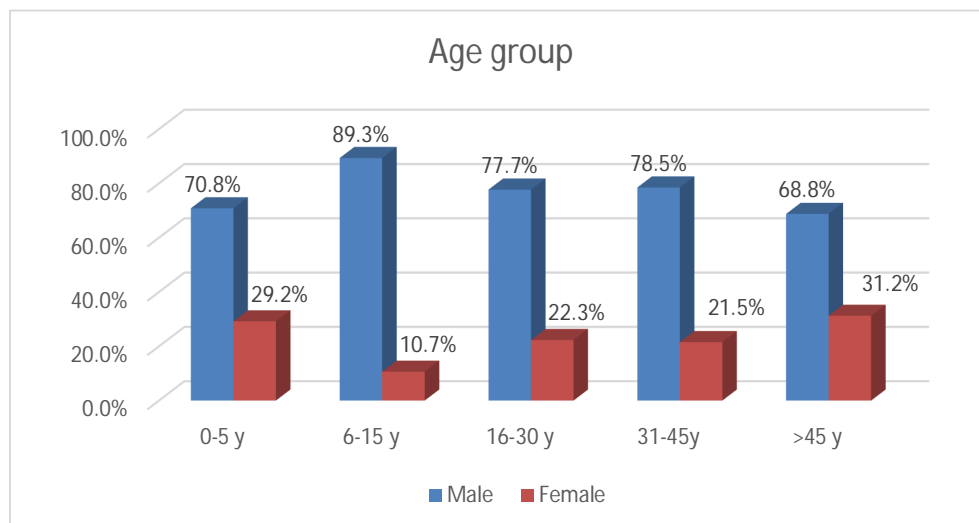


Chart (1) Age and Sex distribution of ocular trauma patients.

(B) Occupation

Most of the patients were workers 207 (34.1%) and students 171 (28.2%), followed by housewives 84 (13.8%) and farmers 83 (13.7%).

Trauma;**(A) Time of presentation**

Most of the patients 213 (35.1%) attended the hospital in the first 2 hours from injury. A total of 504 (83%) of the patients presented in the first 24 hours from injury and showed no delay of presentation whereas 103 (17%) patients presented after 24 hours from injury and show delayed presentation.

(B) Position of trauma

The street-related injuries accounted for 280 (46.1%) of cases, workplace-related injuries accounted for 147 (24.2%), home-related injuries accounted for 91 (15%), injuries in the farms accounted for 75 (12.4%), and injuries within the schools accounted for 14 (2.3%).

There was an association between the place of trauma and gender and the difference was statistically significant (p-value is < 0.001 Chi-square test).

In males; street-related injuries (53.1%) and workplace-related injuries (29.3%) were more common than in females ((18.7%) and (4.1%) respectively), while in females; home-related injuries (68.3%) were more common than in males (1.4%), (table 1).

Table 1: Number and percentage of patients distributed by categories

Characteristic	Categories	No. (%)
Occupation	Workers	207 (34.1)
	Students	171 (28.2)
	Housewives	84 (13.8)
	Farmers	83 (13.7)
	Drivers	25 (4.1)
	Preschoolers	24 (4)
	Others	13 (2.1)
Place of Trauma	Street	280 (46.1%)
	Workplace	147 (24.2%)
	Home	91 (15%)
	Farm	75 (12.4%)
	School	14 (2.3%)

(C) Causative agent

Both mechanical and non-mechanical agents were encountered. There was a difference in the causative agents of ocular trauma between males and females which was statistically significant (p-value is 0.021 Chi-square test). Mechanical agents caused injury in 588 cases (96.9%) and non-mechanical agents caused injury in (19) cases (3.1%).

Sharp objects caused injury in (20.3%) of all patients; fingernails were a more frequent cause (11.9%) of ocular trauma cases, followed by glass (2.3%) and scissors (2%). Chemical injuries were found in 19 (3.1%) cases.

Most of the mechanical eye injuries were caused by blunt objects (65.6% of all patients), in which stones were a more frequent cause (30.3% of ocular trauma cases), followed by metal particles (21.6%), wood (5.1%) and hand fist (4.4%). Animal kicking accounted for (0.8%) of cases (table 2).

Table 2: Association between gender and causative agent

Causative agent	Category	M	F	T (%)	P-Value
Mechanical agents		466	122	588	0.021*
	Blunt objects	317	81	398 (67.7)	
	Sharp objects	89	34	123 (20.9)	
	Motor vehicle/bicycle	59	7	66 (11.2)	
	Gunshot pellets	1	0	1(0.2)	
Non-mechanical agents		18	1	19	0.042*
	Chemical injury	18	1	19 (100)	
Sharp objects					<0.0001**
	Nail	44	28	72 (11.9)	
	Glass	13	2	15 (2.5)	
	Scissors	9	3	12 (2)	
	Pen / Pencil	8	1	9 (1.5)	
	Metal border	6	0	6 (1)	
	Knife	5	0	5 (0.8)	
	Plastic	4	0	4 (0.6)	
Blunt objects					<0.0001**
	Stones	136	48	184 (30.3)	
	Metal stick	130	1	131 (21.6)	
	Wood	22	9	31 (5.1)	
	Fist	9	18	27 (4.4)	
	Metal bar	11	5	16 (2.6)	
	Animal kick	5	0	5 (0.8)	
	Ball	4	0	4 (0.6)	
	Total	317	81	398	

(D) Classification of eye injuries:

There were (701) cases of ocular trauma with (607) eye injuries 94 (13.4%) Of cases had bilateral injuries).

In this study, eye injuries were classified into mechanical and non-mechanical. Mechanical eye injuries were classified

into globe injuries, extra global foreign body (EFB), intramural foreign body (IMFB), and adnexal injuries. The adnexal injuries were categorized as separate items as their presence alone could not be classified in “BETT”),

The majority of injuries were adnexal injuries (38.5%) followed by globe injuries (26.4%).

1. Globe injuries:

Globe injuries were reported in 185 (26.4%) cases. Seventy cases (37.8%) had open globe injuries while 115 cases (62.2%) had closed globe injuries. There was a significant difference in the distribution of globe injuries between males and females (**table 3**) (p -value is <0.001 Chi-square test) but there was no significant difference in the frequency of right vs. left eye injuries (98 (52.9%) right vs. 87 (47.1%) left) (p -value is 0.051 Chi-square test).

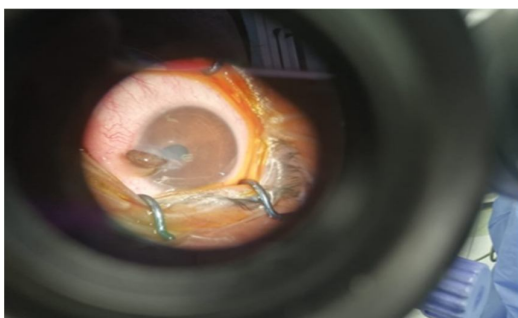
- **Open globe injuries (OGIs):**

Open globe injuries were reported in (70) eyes representing (37.8%) of globe injuries and (10%) of total eye injuries; rupture globe was found in 60 (85.7%) eyes, penetrating injury

was found in 6 (8.6%) eyes, IOFB was found in 3 (4.3%) eyes (two in AC (iron, wood) and one intravitreal (1.4%); due to shooting (lead)) and one perforating injury.

Males are more affected than females, however, the difference was statistically insignificant (p -value 0.514 Chi-square test), also the frequency of right vs. left eye injuries (39 (55.7%) right vs. 31 (44.3%) left) was not statistically significant. (**table 3**) (**Figure 1: a, b&c**).

The most common findings in OGIs were; corneal wounds (51.4%), iris prolapse (41.4%), limbal wounds (21.4%), traumatic hyphema (20%), traumatic cataract (18.6%) and corneoscleral wound (17.1%).



(a)



(b)



(c)

Figure 1: (a) Corneal wound and iris prolapse. (b) Lower eye lid wound with canalicular laceration. (c) CT orbit showing IOFB.

Table 3: Types and representation of globe injuries in the study

Type of injury	M	F	Total	Pediatric trauma (≤ 15 y)	% in OGIs (70 eyes)	% in globe injuries (185eyes)	% in total eye injuries (701)
Open globe injury	50 (71.4%)	20 (28.6%)	70	26 (37.1 %)	100 %	37.8%	10%
• Rupture globe	44 (73.3%)	16 (26.7%)	60	21 (29.5%)	83.6 %	32.4 %	8.6%
• Penetrating injury	3 (50%)	3 (50%)	6	4 (6.5%)	9.8 %	3.2 %	0.9%
• IOFB	2	1	3	1(1.6)	4.9 %	1.6 %	0.4 %
• Perforating injury	1	0	1	0	1.6 %	0.5 %	0.1 %
Closed globe injury (CGI)	77 (67%)	38 (33%)	115	35 (31.3%)	100%	62.2%	16.4%
• Contusion	25	6	31	9	27%	16.8%	4.4%
• Lamellar laceration	52	32	84	26	73%	45.4%	12%

- **Closed globe injury (CGIs):**

They were recorded in (115) eyes representing (62.2%) of total globe injuries and (16.4%) of total eye injuries. There was no significant difference in the distribution of CGIs between males and females, or right vs. left eye injuries (59 (51.3%) right vs. 56 (48.7%) left) (p -value is 0.514 Chi-square test), (table 3).

The most common findings in CGIs were; corneal abrasion (70.4%) and traumatic hyphema (20.9%).

- **Extra global foreign body (EFB):**

One hundred and twenty-seven patients (127) had (EFB) accounting for (18.1%) of eye injuries while 3 patients had bilateral injuries. All cases were superficial corneal FBs. There was a significant difference in the distribution of (EFB) between males and females (p -value is <0.001 Chi-square test). Meanwhile, there was no significant difference in the frequency of right vs. left eye injuries (65 (51.2%) right vs. 62 (48.8%) left), (table 3).

- **Intra mural foreign body (IMFB):**

The IMFB Consisted of (6) eyes of mid-stromal corneal FBs accounted for (0.9%) of total eye injuries where two patients had bilateral injury, (4 right vs. 2 left) (table 3).

- **Ocular adnexa injuries:**

The ocular adnexa injuries were found in (270) cases representing (38.5%) of total eye injuries where 84 (31.1%) patients had bilateral adnexal injuries, (51 (60.7%) cases had bilateral eyelid oedema and 33 (39.3%) cases had bilateral subconjunctival hemorrhage). The most common findings in adnexal injuries were periorcular ecchymosis and oedema (49.6%), subconjunctival hemorrhage (38.5%) lid laceration (8.9%), and canalicular laceration (2.6%). Injuries were more common in males than females and this was statistically insignificant (p -value is 0.337 Chi-square test). There was no significant difference in the frequency of right vs. left eye injuries (125 (46.3%) right vs. 145 (53.7%) left) (table 4) (figure 2: a,b,c,d).

Table 4: Different types of ocular adnexal injuries in males and females.

Type of injury	M	F	T	Pediatric trauma (≤ 15 y)	Percentage in adnexal injuries (270 eyes)	Percentage in total injuries (701 eyes)
Periocular ecchymosis and oedema	105	29	134	42	49.6%	19.1%
Lid laceration	22	2	24	7	8.9%	3.4%
Canalicular laceration	6	1	7	2	2.6%	1%
Subconjunctival hemorrhage	74	30	104	21	38.5%	15%
Conjunctival FB	1	0	1	0	0.4%	0.14%
Total	211	62	270	72	100%	38.5%



Figure 2: (a) A full-thickness lid laceration near the lateral canthus, (b) Periocular haematoma. (c) Full thickness scleral wound. (d) Intraocular F.B

(F) Presenting and final visual acuity:

Visual acuity couldn't be recorded in (89) (14.4%) eye injuries either because they were preverbal children or there was difficulty in recording follow-up progress data especially in elderly patients as a result of poor compliance. The majority of patients 349 (49.8%) had good vision at presentation ($\geq 6/12$).

Laterality:

The right eye was affected in 301 (49.6%) patients and the left eye in 306 (50.4%) patients, while both eyes were affected in 94 (155%) patients.

DISCUSSION

The eye represents only 0.27% of the total body surface area and 4% of the facial area, but it is the third most common organ affected by trauma after hands and feet⁷.

Ocular trauma is a significant public health problem while it is a preventable cause of visual morbidity. In developing countries, it is common to have ocular trauma which may lead to permanent visual impairment⁸.

According to the World Health Organization (WHO) estimates, the global annual incidence of ocular trauma is around 55 million, where worldwide, 1.6 million blind people are due to ocular trauma⁹.

This is a cross-sectional hospital-based study involving cases of ocular trauma at the outpatient ophthalmic clinic in addition to emergency cases presented to the Ophthalmology department, Aswan University Hospitals within one year period. History was taken and ophthalmological examination was done for all participants. Each patient sheet was reviewed and the ocular trauma epidemiological and examination data were collected and analyzed. Radiological evaluation was performed for injured patients using x ray, B-scan &/or CT scan. Intra operative data was collected and all participants were followed up after operation by visual acuity testing, slit lamp and B-scan (when needed).

The mean age of the participants was (23.02 ± 11.52) with age ranges from 3 months to 66 year. The majority of the participants were adults and older. Elhesy,¹⁰ reported mean age of 25.7 ± 17.1 years with wider age range (1-80 years). Other studies reported eye trauma with age about 35 years^{11,12}.

Our patients in majority lies in adult age group >15 years was (461) (75.9%). Highest number of ocular trauma was seen in age group 15–20 (11.5%) in Pandita and Merriman study¹¹.

Other studies reported increase prevalence of ocular trauma among older population aged 40 years and older,^{13,14}.

Incidence of eye trauma decreases with age older than 35 years. The same findings were shown by other investigator¹⁵. Elhesy¹⁰, also showed that the incidence of eye trauma decreased after 30 years.

Wang et al¹², reported decrease incidence after age of 50 years. This may be referred to the criteria of the included

patients. In the current study, we included patients of more variable age groups.

Ocular trauma in the current study had male predominance (79.7%) with male to female ratio: 4 to 1. El-Sobky et al,¹⁶ reported also increased incidence of ocular trauma among males (69.1%) with a male to female ratio of (2.2:1).

Male predominance regarding eye trauma was reported in other studies Wang et al, 2017, Wong et al, 2018^{12,14}.

The risk of ocular trauma increases among male patients and this may be referred to the higher exposure for trauma risks in males during their work (occupational trauma). Ocular trauma had male predominance among all age groups. This comes in hand with other study¹⁷.

In the current study, ocular trauma had the highest incidence among workers and this could explain the male adult predominance. This comes in hand with other investigator^{12,18}.

Pandita and Merriman¹¹, reported that work was the second most common cause of eye injury while outdoor activities was the first and this is similar to the current study. Elhesy¹⁰, stated home as the third place for injury after work and street. El-Sobky et al,¹⁶ reported comparable incidence of ocular trauma among workers and students and also between work place and streets. Home came third.

Geographical distribution of ocular trauma in Aswan government showed that the highest prevalence was in Aswan. Being more urban and larger sample size may be the causes of the different distribution.

In hand with this study, Zungu et al,¹⁵ reported more eye trauma among urban than rural populations.

On contrary to the current study, rural areas had higher incidence of ocular trauma than urban areas as reported by other studies^{19,12,20}

Madan et al,²¹ did not found significant difference in the occurrence of ocular trauma between urban and rural areas.

In an Egyptian study, there was no delay for referral in about (69.5%) of the patients¹⁰.

Delayed presentation of the patients to the hospital delays intervention thus leading to poor prognosis²².

In Zungu et al,¹⁵ most of males were referred after 24 hours while the majority among females were referred to the

hospitals within 24 hours and it was related to the more severe injuries among females in their study.

In the current study, Place of the trauma differs from males to females. In males, street related and work related had the highest rate while in females, home injuries had the highest rate. This is referred to the nature of populations in the study as most of males are hand workers while the majority of females are housewives in the studied community with increased indoor work than outdoor one.

Gordon et al,²³ reported increased ocular accidents in home then work in Canada with equal incidence between males and females. The same was reported by other investigators^{14,24}.

Fighting was the common cause of trauma in males followed by working. While, working home was the commonest activity among females. The same findings were shown by other researchers^{19,15}

Playing was the third action associated with ocular trauma in our study. Playing is the commonest cause among children. This was also stated in other studies^{21,24}.

Both mechanical and non-mechanical agents were encountered in this study. Non- mechanical agents caused by chemicals were rare and mainly had male predominance. Blunt injury was the predominant in both males and females followed by sharp objects. Motor/bicycle accidents occurred mainly among males. Zungu et al,¹⁵ reported the same findings.

Zakrzewski et al,²⁵ performed his study on work related injuries and chemical injuries were the top cause of ocular trauma. In Finland, other study reported chemical injuries to be the commonest among adults²⁶.

These variations could be referred to the difference in the inclusion criteria of these studies. It is considered one of the strength points in the current study that it included wide age range and different types.

Adnexal injuries had the higher incidence in the current study followed by closed globe injuries. IOFB had also high incidence.

Also, in indian pediatric survey, out of the 357 patients, 242 (67.8%) presented with closed globe injury and 115 (32.2%) with open globe injury. Among closed globe injury,

adnexal injury was commonest, followed by subconjunctival hemorrhage and then corneal abrasion¹⁸.

Another report in Malawi showed that the majority of the study population sustained a closed globe injury (n = 74, 72.6%) and penetrating injury was the most common type of open globe injury sustained. (n = 22, 21.6%)¹⁵. The two types of ocular trauma were reported in the Brazilian report with predominance of closed globe type²⁴. On the other hand, Madan et al,²¹ reported more open globe injuries among pediatric patients.

Different types of open globe injury were reported in the current study. Corneal wound had the highest prevalence (5.1%) followed by iris prolapsed (4.1%) then limbal wound and traumatic hyphema. Elhesy¹⁰, also reported corneal wound as the highest OGI type but followed by scleral and corneoscleral wounds then iris prolapse.

Corneal abrasions followed by traumatic hyphema were the commonest closed globe injury shown in the current study. This comes in hand with Elhesy, 2016¹⁰.

In the current study, there were 127 (21%) patients managed by surgical intervention, 349 (57.5%) patients managed medically and corneal FB removal was done for 131 (21.6%) patients.

Among 127 patients; a single emergency interference were needed in 108 patients (85%) after admission whereas 19 patients (15%) underwent secondary surgical procedures such as cataract removal and IOL implantation Only one case (rupture) received intravitreal antibiotics; (vancomycin 1 mg and ceftazidime 2.25 mg each in 0.1 ml) (post-traumatic endophthalmitis (0.2%)).

Also, Zungu et al,¹⁵ reported over a third of the population were treated surgically (n = 41, 40.2%) and corneal repair was the most frequent surgery (n = 18 of 40, 45%) followed by cataract surgery (n = 12 of 40).

The majority of patients (349) (49.8%) had good vision at presentation. The final BCVA was; (6/12) or better in (426) (60.8%) eyes, (6/18-6/60) in (106) (15.1%) eyes, (5/60 - 3/60) in (57) and less than (3/60) in (23) (3.3%) eyes. Incidence of blindness (< 3/60) from ocular trauma at last follow up in current study was (23) (3.3%) cases, low vision was (163) (23.2%) cases and good vision was (426) (60.8%) cases.

Also Qayum et al,¹⁸ showed improvement in a large portion of patients but 12.3% of patients ended up with mono ocular blindness.

Zungu et al,¹⁵ also reported blindness in third of patients with endophthalmitis and corneal scarring against our study. The same findings were reported in Madan et al,²¹ as he also showed increased rates of open globe injuries.

The current study had the advantage of being performed on large number of population. Also it included considerable number of patients in both sexes and included wide range of age groups.

Variability in causes and types of ocular trauma gives strength points to the study. Different treatment modalities were used and studied.

The study had the limitation of lack of randomization and absence of control group. Few patients had poor visual acuity at time of presentation which limited our ability to study risk factors associated with loss of vision.

CONCLUSION

Ocular trauma occurred among males more frequently and decrease with age progression after thirties. Fight and work related trauma occurred more in males while indoor traumas occurred more among females. Adnexal trauma and closed globe trauma are more frequently to happen with better outcome than open globe trauma. Proper treatment could be achieved either medically or surgically and associated with relatively good outcome regarding visual acuity.

Ocular trauma in Egypt is a major problem, accounting for the majority of cases of unilateral blindness. However, eye trauma and its subsequent visual disability are for the most part avoidable. This study aimed at identifying factors involved in ocular trauma in an attempt to help to reduce its prevalence in Egypt.

People at a higher risk of trauma had been identified as those involved in street and work activities. Workers and students were the most affected population. The risk factors can be concluded, in that, we have relatively violent behavior in our streets; throwing stones, fist fights, sticks, knives and guns, in addition to the workers using hammers or rough instruments without protection.

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Data Availability: The authors declare that all data supporting the findings of this study are available within the article and its supplementary information file.

Competing interests: The authors declare no competing interests.

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Ethics declarations: All procedures performed in the study followed the 1964 Helsinki declaration and its later amendments, University Ethics Committee approved the project.

Conflict of interest

Ahmed F. Gabr, Maya S. Kamel, Ahmed A. Albarawy, Tageldin M. Othman. All authors have no conflicts of interest that are directly relevant to the content of this review.

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