

Epidemiology of ocular trauma in a population-based study



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HIGHLIGHTS

The prevalence of history of ocular trauma is high. The prevalence of ocular trauma and its subsequent impact, including hospitalisation, is higher in men than in women. The literature suggests that increasing age and low education are important risk factors for the history of ocular trauma.

ABSTRACT

Purpose: The aim of this study was to determine the prevalence of ocular trauma in Iran through a population-based study.

Method: The target population of this population-based study was all the residents of Mashhad that were above 1 year of age. The randomized stratified cluster sampling method was used to select the participants. The study samples were selected proportional to each district of the city according to the 2006 census. The participants were interviewed to determine ocular trauma. The design effect was considered to calculate 95% confidence intervals.

Results: The prevalence of ocular trauma was 6.9%, 9.5%, and 5.5% in the whole population, men, and women, respectively. The prevalence of ocular trauma was lower in individuals with higher education. In addition, 2.3% of all the participants, 1.1% of women, and 4.6% of men had a history of hospitalization due to ocular trauma. The results of logistic regression showed a direct relationship between the history of ocular trauma and hospitalization with older age and female sex.

Conclusion: The prevalence of ocular trauma and the rate of hospitalization due to it are higher in men than women. The reason seems to be more exposure of men to environmental risk factors, especially at work environments.

Key words: prevalence, ocular trauma, hospitalization, Iran, blunt trauma

INTRODUCTION

Ocular trauma is an important preventable public health problem and a major cause of visual loss, especially in developing countries [1]. On average, more than 500,000 injuries resulting in post-traumatic visual loss occur worldwide, 1.6 million people experience visual loss following ocular trauma, 2.3 million people experience loss of vision in both eyes, and 19 million people lose the vision of one eye [2]. The prevalence of ocular trauma and the pattern of ocular injuries and diseases vary in different parts of the world as a result of different ethnic, geographic, socio-economic, and cultural conditions [3].

Ocular trauma is the second case of visual injury in the US and more than 2.5 million new cases of ocular injury are detected in this country annually [4]. The prevalence of these injuries is 2% in Bangladesh villages [5], 2.1% in northern villages of China [6], 5.1% in Singapore [7], and 13.8% in Iran [8]. The importance of this issue is because 35% of all ocular traumas occur in children and adolescents below 17 years of age [9] and 6.5% of them occur in children below the age of 10, but about 21–35% of hospital admissions due to ocular injuries are related to children [10].

Ocular injuries have a great impact on the person and the society. Ocular trauma is one of these common preventable injuries as 90% of ocular traumas can be prevented through simple measures [11]. Therefore, efforts to decrease these injuries may play an important role in the promotion of the socioeconomic status of the societies [12]. Despite its importance, there are little data on the distribution of risk factors, especially in developing countries [13, 14]. Most studies on the ocular trauma have been performed based on hospital records and admitted cases but these data cannot define the at-risk population precisely [5]. Some studies have been conducted to evaluate the prevalence of ocular traumas in different Iranian cities with relatively different results [8], so there is a need for more studies in other cities to determine the overall prevalence of ocular traumas. Since Mashhad, a north-east city in Iran is one of the most populous cities, determining the prevalence of ocular traumas in this city can have an important role in the estimation of the prevalence of ocular traumas in Iran. Therefore, the aim of this study was to estimate the prevalence of these injuries in Mashhad in a population-based study.

METHODS

This study was a cross-sectional population-based study. The target population of this study was all residents of Mashhad that were above 1 year of age. The randomized stratified cluster sampling method was used to select the participants. The study samples were selected proportional to each district of the city according to the 2016 census. 120 clusters of the blocks determined by Statistical Center of

Khorasan Razavi were randomly selected and the first house number in each cluster was considered the head cluster. In each cluster, sampling was continued systematically for 10 households. After introducing themselves and explaining the importance of this project, the interviewers completed a demographic questionnaire and invited the households to the Optometry Clinic of Mashhad University of Medical Sciences to undergo complete refractive examinations. If a household was not willing to participate in the study, the next house number was invited. The neighboring households were invited in a clockwise manner systematically. The participants were reimbursed for transportation to the clinic. After selecting the households and their presence at the clinic, they were interviewed to collect their demographic information as well as the data on the history of ophthalmic examinations, ocular diseases, ocular trauma, cataract or glaucoma surgery, laser surgery, and the use of contact lens. The examinations in this study included direct and indirect ophthalmoscopy, slit lamp biomicroscopy, measurement of uncorrected visual acuity using an E Snellen chart and mirror system, measurement of visual acuity with current glasses, cycloplegic and non-cycloplegic refraction, and measurement of best corrected visual acuity, as well as examinations to evaluate ocular deviations and binocular vision. We only analyzed the refraction data in this study considering the objective of this research. After direct or indirect ophthalmoscopy and slit lamp biomicroscopy, the participants with pathologies affecting refraction or pseudophakia were excluded from visual acuity and refraction examinations.

Data analysis

The prevalence of different types of trauma is reported as percentage with 95% confidence interval (CI). The design effect was considered for calculating the 95% CI. Chi-2 and Fisher's exact test were used to evaluate the relationship between the variables. P values less than 0.05 were considered significant.

Ethical issues

The Ethics Committee of Mashhad University of Medical Sciences approved the study protocol, which was conducted in accord with the tenets of the Helsinki Declaration. The study was funded by Mashhad University of Medical Sciences. All participants signed a written informed consent. The consent included commitments to keep household information confidential and take responsibility for any complications that might occur as a result of the study.

RESULTS

In this study, the history of ocular trauma was investigated in 3029 individuals in, of whom 207 had a positive histo-

ry. The prevalence of ocular trauma was 6.9%, 9.5%, and 5.5% in the whole population, men, and women, respectively. According to table 1, a history of ocular trauma had an inverse relationship with the educational level; in other words, the prevalence of a positive history of trauma was lower in individuals with academic education. Moreover, as table 1 shows, the history of ocular trauma was negative in children below 5 years of age. The prevalence of a positive history of ocular trauma increased with age and the highest prevalence (15.9%) was observed in individuals over the age of 65 years. In addition, 2.3% of all the participants, 1.1% of women, and 4.6% of men had a history of hospitalization due to ocular trauma.

Accordingly, based on the results of logistic regression, increase age (OR = 1.03 and OR = 1.04; $p < 0.001$) and male gender (OR = 1.85, OR = 4.2; $p < 0.001$) were related to the history of trauma and hospitalization.

DISCUSSION

Ocular trauma is one of the most important causes of ocular injury and visual loss and imposes a considerable burden on the societies. Therefore, it is important to determine the burden of this injury to estimate the required facilities and design preventive programs. Since the majority of affected and at-risk people are young individuals of productive age, they spend their valuable time on the treatment of this disease [15]. Severe injuries require costly admissions, special treatments, long follow-ups, and visual rehabilitation. In addition to these direct costs, the indirect costs resulting from work or school absenteeism, which are very hard to estimate, should not be overlooked [16].

The prevalence of ocular trauma was found to be 6.9% in this population-based study. Comparison of the results of

this study with the findings of other studies indicates the difference in its prevalence in different parts of the world. Available sources in this regards show that 5.2% of 6 to 12 years children [17], 8.5% of the 40 to 64 years adults [18] and 7.46% of elderly population with ages more than 60 years [19] of Iranian population had a positive history of ocular trauma. According to a rough estimate, we can expect that about 7% of Iran's population has a history of ocular trauma. However, Mir et al. [8] in their systematic review state that the prevalence of ocular trauma is 13.8% of Iran's population. The type of studies used in the above systematic review, which was a combination of studies related to hospital based patients along with population-based studies, has caused the prevalence of ocular trauma to be reported higher than the actual amount. The prevalence of ocular trauma has been reported 1.6% in China [20], 4.1% in Singapore [21], 5% in the villages of Southeast Asian countries [22], and 9.40% in India [23]. The results of other studies in this field are presented in table 2. The observed results may be due to differences in the culture, age, level of industrialization, use of safety equipment in the work environment, type of occupation, and socio-economic factors [14].

The results of the present study showed that the prevalence of ocular traumas is higher in men versus women; The results of studies including Khan in Bangladesh [5], Hashemi et al. in Iran [17], and Mowatt et al. in Jamaica [1], also showed the higher prevalence of ocular trauma in men. Since most ocular traumas occur in the workplace [35], it is observed that almost all studies have shown a higher prevalence of ocular trauma in men, which is obviously due to the higher exposure of men to risk factors, especially occupational exposures [36]. However, Alik et al. showed in their study that 62.3% of the people who were subjected to intimate partner violence and suffered ocular injuries were

TABLE 1

The prevalence of ocular trauma hospitalization due to ocular trauma and in Mashhad by age and gender.

		Ocular trauma (%) (95% CI)	Hospitalization due to ocular trauma (%) (95% CI)
Age	<5	0	0
	5–15	1.12 (0.17–2.08)	0
	16–25	6.25 (3.93–8.57)	1.01 (0.10–1.91)
	26–35	8.39 (5.55–11.22)	2.15 (0.64–3.66)
	36–45	9.01 (6.5–11.53)	5.87 (3.23–8.51)
	46–55	9.14 (5.52–12.76)	2.29 (0.07–4.51)
	55–65	14.75 (6.76–22.75)	2.46 (0.40–6.11)
	>65	16.36 (6.18–26.55)	10.91 (0.84–20.98)
Gender	female	5.51 (4.44–6.57)	1.15 (0.45–1.84)
	male	9.54 (7.16–11.92)	4.60 (2.74–6.46)
Education	illiterate	9.78 (5.59–13.98)	4.89 (1.2–8.58)
	without higher education (1–14 years)	6.66 (5.35–7.97)	2.11 (1.11–3.11)
	higher education (>14 years)	7.73 (5.18–10.28)	2.58 (0.83–4.32)
Total		6.85 (5.69–8.01)	2.30 (1.27–3.32)

TABLE 2

A summary of the studies on the prevalence of ocular trauma conducted in different parts of the world.

Country	Place	Study year	Sample size	Age (years)	Prevalence (%)
China [24]	Hunan	2017	2009	1–87	8.6 per 100,000
France [25]	French tertiary university	2020	337	<15	9–15 per 100,000
China [26]	Chaoshan	2012	3559	<60	27.7 per 100,000
China (north) [26]	Beijing	2012	4438	>40	1.62
China [6]	Handan	2015	6830	>30	2.1
India [27]	Delhi	2008	6704	24.2 (mean)	2.4
India [28]	Uttar Pradesh	2019	436	2–70	3.93
Singapore [29]		2018	3353	≥40	4.12
India [30]	Aravind Eye Hospital	2004	5150	>40	4.50
Singapore [22]	Yong Loo	2009	3280	40–80	5.0
Singapore [7]		2011	3400	40–80	5.1
Iran [17]	Shahroud	2022	5267	6–12	5.2
Iran [19]	Tehran	2023	3310	>60	7.46
Iran [18]	Shahroud	2015	5190	40–64	8.57
India [23]	Belagavi	2014	2308	34.47 (±19.49)	9.40
India [31]	Andhra Pradesh	2006	7771	all age	10.6
USA [32]	Wisconsin (Beaver Dam)	2000	4926	43–84	19.8
Australia [33]	Victoria	1999	3271	>40	21.1
Iran [34]	Sari	2013	178	25–34	35.4

women [37]. Therefore, the type of factor causing ocular trauma in different situations can have a different prevalence in women compared to men.

In our study, the highest prevalence of ocular injuries was observed in individuals above the age of 65 while the prevalence in young people was almost zero. On the other hand, the literature indicates that the majority of the affected people in other studies are younger, mainly below 50 years of age [26, 35, 38]. The results of other studies in this field are very different regarding age [4, 5, 10]. For example, Hashemi et al. found the highest prevalence in the age group 40–64 years old [18]. The prevalence of ocular trauma in children aged 6–12 in Shahroud (Iran) [17] is almost equal to its prevalence in people older than 60 years in Tehran (Iran) [19] and both of them are about 7%. This observations means that if a large number of people of different ages are randomly selected, we will probably see an equal prevalence of ocular trauma in different ages and the possible reason for the difference in the observations of the present study is probably related to the limited sample size in different age groups. However, the important point is that the prevalence and incidence of these injuries are different considering the differences in demographic conditions and exposure levels [39].

As for the educational level, the highest prevalence of ocular trauma was observed in low educated people. This

finding is similar to the results of the studies conducted by Omolase et al. [40] and Khan [5]. In general, an increase in the educational level is associated with a decrease in the occurrence of ocular injuries; considering low educated people who are mostly from low socio-economic classes of the society and are exposed to more risk factors in their workplace [5], we can expect that ocular traumas and injuries mostly occur in this group [36]. High educated people mostly belong to higher socio-economic classes and are less exposed to environmental and occupational risk factors [41]. Therefore, the prevalence of ocular trauma would be lower as compared to low educated people.

In the present study, 2.3% of the participants had a positive history of hospital admission, which is similar to other studies conducted by Hashemi et al. in Shahroud [18]. However, the rate of hospitalization due to ocular trauma is higher in other countries than Iran [42], which could be mainly due to differences in the epidemiologic patterns of these injuries in other countries. The results of different studies have shown that hospitalization due to ocular trauma and its complications is higher in men than women [42, 43]. Our study also showed a higher rate of hospitalization in men (4.6% in men versus 1.1% in women), which is similar to the results of studies by Wong et al. [42], Movahedinejad et al. [35] and Balaghafari et al. [34]. The higher hospitalization rate in men may indicate the severity of these injuries in

this group as compared to women; most ocular traumas are superficial in women and they are discharged from treatment centers without any need for hospitalization while men require hospitalization due to more severe injuries.

CONCLUSION

The prevalence of ocular trauma is different in different studies. As mentioned earlier, these controversial results may be due to conducting studies on different populations with different age compositions. All studies have shown higher prevalence of injuries in men versus women, maybe

due to more exposure to environmental and occupational risk factors. Considering the higher prevalence of these injuries in men, the hospitalization rate is naturally higher in this group, as well. Another reason for the higher hospitalization rate in men is that ocular traumas in this group are mostly related to occupational exposures, and since these exposures are usually more severe than other exposures, ocular traumas in men take longer to heal, contributing to the higher hospitalization rate in men. On the other hand, low educated people are more prone to these injuries due to more exposure to risk factors, especially in work environments.

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Collection, management of the data: Abbasali Yekta, Hadi Ostadimoghaddam, Alireza Jamali.

Analysis, and interpretation of the data: Alireza Jamali, Mehdi Khabazkhoob, Navidreza Zamani.

Preparation, review, and approval of the manuscript: Hadi Ostadimoghaddam, Hassan Hashemi, Alireza Jamali, Abbasali Yekta, Navidreza Zamani, Mehdi Khabazkhoob.

Conflict of interest:

None.

Financial support:

The study was founded by Mashhad University of Medical Sciences.

Ethics:

The Ethics Committee of Mashhad University of Medical Sciences approved the study protocol, which was conducted in accord with the tenets of the Helsinki Declaration. All participants signed a written informed consent. The consent included commitments to keep household information confidential and take responsibility for any complications that might occur as a result of the study. (Ethics code: IR.MUMS. 86170).