

# History of Ocular Trauma in Tehran Population: Tehran Eye Study

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## Abstract

**Purpose:** To study the age and gender specific history of ocular trauma in the population of Tehran

**Methods:** Using a stratified cluster sampling approach, 6,497 residents of Tehran were selected. Participants were transferred to an eye clinic to have complete eye examinations. During the interview, participants were asked about any history of ocular trauma, and any treatment or hospitalization due to such trauma. Data are presented in detail according to age and gender, along with their 95% confidence intervals (CI).

**Results:** A total of 4,565 people participated in the study (response rate: 70.3%); their mean age was 30.05±18.78 years, and 58.2% were female. A history of ocular trauma was recorded in 13.3% (95% CI: 12.0-14.5%); the rate was significantly higher in men (17.1% vs. 9.2%, P<0.001). The trauma was blunt, sharp or chemical in 6.1% (95% CI: 5.2-7.1%), 4.1% (95% CI: 3.5-4.7%), and 1.5% (95% CI: 1.1-1.9%), respectively. A history of medical treatment and hospitalization due to eye trauma was stated by 2.2% and 2.4% of the participants.

**Conclusion:** Our results indicated that ocular trauma was more frequent among men and younger age groups. The rates of ocular trauma are neither too high nor very low compared to reports from other countries, yet it is important to consider educational programs to prevent ocular injury, specially occupational eye trauma.

**Keywords:** Ocular Trauma, Tehran, Cross-Sectional Study, Prevalence, Age, Gender

*Iranian Journal of Ophthalmology 2011;23(3):43-49 © 2011 by the Iranian Society of Ophthalmology*

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Received: December 22, 2010

Accepted: August 17, 2011

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Conflict of interest: None

## Introduction

Ocular trauma is known to be the leading cause of monocular blindness.<sup>1-2</sup> Reports indicate that 7 to 45 percent of cases of monocular blindness are due to ocular trauma.<sup>3-6</sup> In fact, ocular trauma may be responsible for half a million annual cases of monocular blindness globally.<sup>5</sup> In a comprehensive report on ocular trauma by Negrel and Thylefors, it was stated that 55 million cases of ocular injury occur annually; about 1.6 million leading to blindness and 2.3 million cause visual impairment, and another 19 million are cases of monocular blindness or visual impairment.<sup>2</sup> The annual rate of ocular injury in the United States alone is 2.4 million.<sup>7-8</sup> Reports suggest that up to 60.5% of cases of ocular injury lead to visual impairment, and rates are significantly higher among men under 30 years of age.<sup>9</sup> Research indicates that one out of every 5 adults have a history of ocular trauma.<sup>10</sup> In children, these rates are 12% to 38%, making ocular trauma the most avoidable cause of childhood blindness.<sup>11-15</sup> Apart from its effect on each individual, ocular trauma is a case of ophthalmic emergency. Hospitalization due to ocular trauma is a health issue, and admission rates have been reported between 8 and 33 per 100,000 per year.<sup>2,16-18</sup> Considering the importance of ocular traumas and their effect on eye and public health, we present this report as part of the Tehran Eye Study (TES), to provide the rates of ocular trauma history in the population of Tehran, as an Eastern Mediterranean population.

## Methods

The TES was designed and conducted in 2002 as a population-based cross-sectional study, and the details of its methodology have been published elsewhere.<sup>19</sup> The target population of the study was all residents of Tehran over one year of age. Sampling was done through a stratified cluster method. Households were approached in these clusters, the interviewers introduced the study to household members, and then invited all those over one year of age to have an eye examination. In each cluster, 10 households were approached systematically in a clockwise fashion, and participants were transferred to a clinic free of charge. At the clinic, they first had interviews followed by

complete ophthalmic examinations. The interview covered demographic information; history of ocular disease, trauma, hospitalization or eye care visit due to ocular trauma; diabetes mellitus, hypertension, and their history of eye care visits.

History of eye trauma has been questioned by 5 questions: "Have you ever had any injury to either eye, which required a doctor's care?" "Was this due to being hit by a blunt object? (like a fist, or a ball)" "Was this due to being hit by a sharp object? (glass, knife or something that penetrated the eye)" "Was this due to being hit by a chemical burn? (like acid or lye)" "Did you have to stay in a hospital overnight or longer because of it?"

## Statistical analysis

The overall prevalence of a history of ocular trauma was assessed in 3 categories of blunt, sharp, and chemical injuries. People who had a history of hospitalization or eye visit but had forgotten the type of trauma were included in the overall prevalence. The prevalence rates were also studied by age and gender. The design effect of a cluster sampling approach was considered in calculating the standard error and the 95% confidence intervals (CI), and adjustments were made. All rates were directly standardized according to the age and gender distribution in the 1996 national census. The correlations of ocular trauma with age and gender were studied using the logistic regression model, according to which, the odds ratios (OR) and 95% CI were determined.

The Research and Ethics Committee of Noor Ophthalmology Research Center and the Ethics Committee of the National Research Center for Medical Sciences approved the study. All participants in this study were informed about the project and the procedures in their native language before being enrolled. The participant's agreement for examination was obtained verbally.

## Results

During August to December 2002, 6,497 Tehran residents were selected to participate in the study, and 4,565 responded (response rate, 70.3%). The mean age of the participants was 30.05±18.78 (range, 1-96) years, and 58.2% (N=2656) were female.

A history of ocular trauma was recorded for 13.3% (95% CI, 12.0-14.5%); of these, 46.6% were blunt, 31.2% were sharp, 11.7% were chemical burns, and 10.5% could not remember the nature of the injury. Table 1 summarizes the details of ocular trauma history in the population of Tehran by age and gender. Overall, there was a positive history in 17.1% of women and 9.2% of men, and the inter-gender difference was statistically significant ( $P<0.001$ ). When studied by age, all age groups demonstrated significantly higher rate in men than in women except the over 60 age group.

### **Type of trauma**

A blunt object was involved in 6.1% (95% CI, 5.2-7.1%) of cases of trauma, and the OR of a blunt trauma was 1.91 for men compared to women ( $P<0.001$ ). As demonstrated in table 1, the lowest rate of blunt trauma was in the under 10 years of age group (3.8%), and the highest was in the 11-20 years of age group (9.5%). In all age groups, except the 51-60 years old age group, the rate of a history of blunt trauma was higher in men. The prevalence of trauma with a sharp object in this population was 4.1% (95% CI, 3.5-4.7%); 6.0% in men and 2.1% in women ( $P<0.001$ ). The highest rate of sharp trauma (6.5%) was detected among the 31-40 years old age group. In all age groups, the history of sharp ocular trauma was higher in men than in women, and the highest inter-gender difference was seen in the 31-40 years old age groups (10.8% vs. 2.1% in men and women, respectively).

Chemical burns of the eye were stated by 1.5% of the studied population, and this was significantly higher in men compared to women. The highest rate was seen in the 31-40 years old age group (Table 1). In all age groups, except over 60 years old, the rates were higher in men than in women.

According to the interviews, 4.0% of the participants had received medical treatment due to ocular trauma, and with prevalence rates of 4.6% in men and 3.28% in women, the inter-gender difference was statistically significant ( $P=0.019$ ). In over 60 years old group, the rate was as high as 14.7%. In relation to the type of trauma, the rate of receiving treatment was 24.9% in case of

sharp ocular trauma, 22.1% with blunt trauma, and 6.1% with chemical burns; differences among these groups were statistically significant ( $P=0.012$ ).

Hospitalization due to ocular trauma was recorded for 2.4% of the participants; 3.0% in men and 1.9% in women ( $P<0.001$ ). Hospitalization time was longest in over 60 years old and shortest in under 10 years old. Only females in the 41-50 and over 60 year old age groups had more hospitalization due to ocular trauma, and in other age groups, men were more hospitalized than women. In terms of the type of trauma, the history of hospitalization was recorded in 10.7% of people with sharp trauma, while the rates were 8.2% and 8.1% in cases of blunt trauma and chemical burns, respectively.

About 30.4% of cases of trauma had cataract or a history of cataract surgery; this indicates a OR of 3.1 for cataract in people with a history of ocular trauma ( $P<0.001$ ). Highest rates of cataract or a history of cataract surgery was 10.2%, as seen among cases of blunt trauma, and the rates among cases of sharp trauma and chemical burns was 5.1% and 1.2%, respectively. According to the OR derived from the simple logistic regression for cataract and different types of trauma, cataract was found to be significantly correlated with blunt trauma only ( $P<0.001$ ). The OR for cataract in cases of blunt trauma was 1.8 compared to other types of trauma ( $P=0.003$ ). In the presence of age in the multiple model, the correlation between cataract and blunt trauma was even stronger (OR=2.9 for blunt trauma, and OR=1.13 for age).

Studying the visual status in cases with a history of ocular trauma showed that 4.1% (95% CI, 2.5-5.8%) were blind in one eye; this rate is significantly higher compared to the 0.7% rate of monocular blindness without a history of trauma ( $P<0.001$ ). Bilateral blindness was seen in 1.2% of cases of ocular trauma; this indicated that a history of trauma increased the likelihood of bilateral blindness by 10 times ( $P<0.001$ ). Monocular low vision was significantly higher in cases with a history of ocular trauma; the odds of monocular trauma was 2.4 times higher in these people compared to those without a history of trauma ( $P<0.001$ ).

**Table 1.** Prevalence (95% confidence interval) of different types of ocular trauma, medical care and hospitalization due to it by age and gender

	n	Blunt Trauma	Sharp Trauma	Chemical Burn	All Trauma types	Hospitalization	Medical Care
<b>Age groups</b>							
≤10	657	3.8 (2.4-5.3)	1.4 (0.5-2.2)	5.7 (4.1-7.4)	0.4 (0.1-1.2)*	0.1 (0.02-1.2)*	0.2 (0.1-1.4)*
11-20	1155	9.5 (7.3-11.6)	3.6 (2.4-4.7)	15.0 (12.3-17.6)	1.3 (0.6-2.1)	1.0 (0.4-1.5)	2.2 (1.4-3.1)
21-30	730	5.9 (3.6-8.1)	4.7 (3.0-6.4)	12.8 (9.9-15.7)	1.5 (0.5-2.6)	2.0 (0.6-3.4)	2.6 (1.1-4.0)
31-40	673	5.2 (3.2-7.1)	6.5 (4.2-8.8)	15.5 (12.3-18.7)	3.1 (1.6-4.5)	2.5 (1.1-3.8)	2.7 (1.3-4.0)
41-50	634	4.5 (2.7-6.2)	5.5 (3.4-7.6.0)	12.7 (9.66-18.3)	1.9 (0.6-3.2)	1.2 (0.3-2.0)	2.6 (1.2-3.9)
51-60	379	5.3 (3.1-7.5)	4.9 (2.6-7.2)	17.0 (13.1-21.0)	2.1 (0.6-3.5)	6.9 (4.1-9.8)	3.1 (1.2-4.9)
60+	337	6.6 (3.6-9.5)	3.7 (1.7-5.7)	21.8 (17.3-26.4)	0.6 (0.1-2.6) *	12.6 (8.9-16.3)	4.3 (2.1-6.4)
<b>Gender</b>							
Male	1909	7.9 (6.5-9.3)	6.0 (4.8-7.1)	17.1 (15.1-19.1)	2.1 (1.4-2.8)	3.0 (2.1-3.8)	2.5 (1.7-3.3)
Female	2656	4.3 (3.4-5.2)	2.1 (1.6-2.73)	9.2 (7.9-10.6)	0.9 (0.5-1.3)	1.7 (1.2-2.3)	1.9 (1.3-2.5)
<b>Total</b>	<b>4565</b>	<b>6.1 (5.2-7.1)</b>	<b>4.1 (3.5-4.7)</b>	<b>1.5 (1.1-1.9)</b>	<b>13.3 (12.0-14.5)</b>	<b>2.4 (1.8-2.9)</b>	<b>2.2 (1.7-2.7)</b>

\*: The 95% confidence interval was calculated using binominal distribution.

## Discussion

The present report was prepared as part of the TES to review the history of ocular trauma in the population of Tehran. As mentioned in the methods section, the information was collected through interviews and thus, recall bias should be mentioned as one of the limitations of the study which may have caused underestimations; however, the importance of such trauma for people could minimize the probability of such bias. Since the exact ages and dates of the incidents were not known, it would be difficult to make comparisons with other studies or determine the correlation between age and ocular trauma. Nonetheless, as this is the first population based eye study in Iran, we believe this report provides valuable information concerning ocular trauma in the population of Tehran as an Eastern Mediterranean population.

The importance of ocular trauma lies in its long-term effect on an individual's vision. However, some traumas have immediate effects on vision due to corneal perforations or retinal ruptures, and the effects on mental well-being of people should not be underestimated as well.<sup>20-23</sup> Traumas cause great financial burden in all nations; the cost of ocular traumas and their resulting hospitalization costs have been shown by many reports.<sup>24</sup>

A history of ocular trauma was recorded for 13.3% of the studied population, and although we believe this may be an underestimation of the true rate, there are studies in the literature that have found even lower rates. For instance, a study in southern India by Nirmalan et al<sup>6</sup> reported a rate of 4.5%, while there have been rates as high as 21.1% in a study in Australia.<sup>8</sup> Overall, the rates reported in the literature vary greatly; 2.4% in the study in Delhi,<sup>25</sup> 3.9% in south India by Dandona et al,<sup>26</sup> 14.4% in the Baltimore study,<sup>7</sup> and 19.8% in the Beaver Dam study.<sup>10</sup> The most important cause of these differences could be attributed to the different age compositions of the studied populations. Other factors could be the level of education, health service coverage, rate of employment, population growth rate and density, and level of development. A possible explanation for a higher rate in our study is that our data concerned the history of trauma, and the commutation should be considered. Other important factors that can create different rates of trauma are the degree of industrialization, the use of safety gear in the workplace, and the economic status as a determinant of occupation type.<sup>2,5,27-33</sup>

Studies on the role of age and gender as two important factors on the incidence of ocular trauma have demonstrated higher incidences in people under 30 years of age

and in the male gender.<sup>9,34</sup> Our findings also indicated that men were 2.2 times more likely to have a history of ocular trauma; this figure is quite similar to those reported in other studies. For instance, Nirmalan et al<sup>6</sup> found a 2.2 higher odds of trauma in men, and Dandona et al<sup>26</sup> stated the odds in men were 2.5 times higher. In a study in Australia,<sup>8</sup> they found ocular trauma in men was 3.5 times more likely than in women; this figure is slightly different from our finding and those reported by studies in India. In a systematic review of global eye injuries by Negral and Thylefors,<sup>2</sup> the male to female ratio for ocular trauma was stated as low as 2 in Senegal, and as high as 8.5 in Iceland. In any event, all reports indicate that men are at higher risk of ocular injuries, and this can be mainly attributed to occupational differences and men's involvement with more risky tasks than women.

In this study, the exact ages at which ocular trauma occurred were not known, and thus we were not able to find the correlation between these two variables. Our data concerned a history of ocular trauma and thus, older people would naturally have higher rates than younger people. Although we cannot draw an eligible conclusion, it must be noted that most studies have found young age a risk factor for ocular trauma. Negral and Thylefors<sup>2</sup> state that the incidence of ocular trauma is significantly higher in under 20 years old compared to older age groups, and different studies have reported it to be between 6.0% and 47.0%. The overall trauma history in our under 20 years old population showed lower rates compared to some other studies. In the Beaver Dam study on the elderly, the researchers found that the incidence among men was 1.42 times higher than in women; this may imply a reduced probability for men compared to women at older age, and it could be explained by men's less exposure to hazardous environments and risky tasks in older age.

Studies have demonstrated the outcomes of trauma such as retinal perforation<sup>35-36</sup> and retinal nerve layer damage leading to low vision. Based on our study on the history of ocular trauma, we found that monocular low vision is more prevalent in people with the history ocular trauma. Other studies also agree that ocular trauma is the leading cause

of monocular blindness in today's world.<sup>1-2</sup> In this study, the prevalence of bilateral blindness with a history of ocular trauma was found to be 1.2%, which is 9 times higher than in those without a history of trauma. Different studies reviewed by Negral and Thylefors<sup>2</sup> have presented rates between 0.3% and 8.0%. In a study by Kuhn et al<sup>37</sup> in the United States, a history of eye injury was associated with monocular or bilateral blindness in 24.5% and 16.5%, respectively. In another report from Egypt,<sup>38</sup> ocular trauma was found to be the leading cause of monocular blindness. Comparing our results indicates similar findings, nonetheless, it must be noted that our study was a cross-sectional one, and since the history of ocular trauma was studied, the temporal precedence of ocular trauma to blindness cannot be verified. The correlation can be explained either way: trauma causes blindness, or people with impaired vision are at higher risk of trauma due to decreased reaction.

We found that the majority of cases of trauma (46.6%) were blunt, compared to 31.2% and 11.7% for trauma with sharp objects and chemical injury, respectively. There are studies in the literature that found sharp trauma had a higher incidence,<sup>10,38</sup> nonetheless, blunt traumas was more frequent in most studies,<sup>6,25,34</sup> in addition to ours. Blunt trauma has been reported to cause complications such as retinal light sensitivity,<sup>39</sup> retinal hemorrhage, fundus changes,<sup>40</sup> choroidoretinal vascular anastomoses,<sup>41</sup> hyphaema,<sup>42-43</sup> peripheral retinal changes,<sup>44</sup> and posterior capsule rupture.<sup>20-21</sup> Although blunt traumas are more prevalent than sharp injuries, the management of sharp trauma is more challenging and their complications include endophthalmitis, in addition to immediate consequences such as severe corneal perforation and retinal tears.<sup>45</sup>

In terms of hospitalization, we found that in 2.4% of cases of ocular trauma, the participant had been admitted for care. Although our methodology lacks the accuracy to determine hospitalization and results can be biased, nonetheless, it provides a rough estimate of how severe these traumas can be and what burden they can impose on hospital health services. Other studies in this field have used different methodologies and thus, have achieved different results. For instance,

studies from the United States, Australia, and the Beaver Dam study reported rates of 2.5%, 4.9%, and 8.9%, respectively.<sup>8,10,46</sup> In all three studies, the rates are higher than our finding, yet differences in studied population age must be noted; 39.7% of our population was under 20 years of age, and studies have demonstrated that hospitalization rates increase with age. This was seen in our study and also in the Beaver dam study where they found a rate of 8.9% for their over 40 years old population.<sup>10</sup>

### Conclusion

The overall rate of a history of ocular trauma

in the population of Tehran was 13.3%, and the rate was higher in men than in women. Compared to other populations, the rate falls in the mid range, nonetheless, it is important to include educational programs on safety instructions to decrease the risk of eye injury, specially in workplaces.

### Acknowledgements

This project was partly supported by a grant from the Iranian National Research Center for Medical Sciences, and the random sampling for the study was performed by the Iranian Statistics Center according to the 1996 national census.

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