

Original Article

Pediatric Ocular Trauma in Iranshahr, Iran

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Abstract

Purpose: The aim of this article was to evaluate the characteristics, causes, and severity of pediatric ocular trauma in Iranshahr, Iran.

Patients and Methods: This retrospective observational study analyzed pediatric ocular trauma (age < 12 years) cases presenting to pediatric and ophthalmology emergency units in Iranshahr, Sistan and Baluchestan Province, Iran, between April 2019 and September 2022. Data were collected on age, sex, circumstances of trauma, injury type, location and mechanism of trauma, associated injuries, hospitalization rate and length of stay, treatment, and trauma sequelae (visual impairment). Ocular traumas were classified according to the Birmingham Eye Trauma Terminology (BETT) system and the Ocular Trauma Score (OTS).

Results: A total of 79 children (56 males, 23 females) were included. The mean age was 6.4 ± 2.1 years (range: 6 months to 11.5 years). Blunt objects (25 %) and direct trauma (8 %) were the primary mechanisms of injury. According to BETT classification, 24 % of ocular traumas were open-globe traumas (OGT). By the end of ophthalmic follow-up, 19 patients (9.4 %) had persistent sequelae. Compared with female patients, male patients were older ($P < 0.001$) and more frequently injured by projectiles ($P = 0.026$). The majority of injuries occurred at home (49 %), followed by public areas (18 %).

Conclusion: Our findings indicate that male gender and home setting are risk factors for childhood eye trauma. Increasing public awareness, strengthening safety awareness at home, and improving ophthalmic emergency care are crucial steps in reducing the burden of pediatric ocular injuries in our setting and beyond.

Keywords: Pediatric; Ocular; Trauma; Iranshahr; Risk Factor; Iran.

Article Notes:

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Introduction

Ocular trauma is the leading cause of monocular blindness worldwide, with more than 55 million cases reported annually, 1.6 million of which result in vision loss ¹. The global annual incidence of pediatric ocular trauma is estimated to be between 9 and 15 cases per 100,000 inhabitants, with 25 % of injuries classified as open-globe traumas (OGT) ¹⁻⁹.

During blunt trauma, the weaker parts of the eyeball—such as the attachment sites of the extraocular muscles, the corneoscleral limbus, and the equatorial region—can rupture due to a rapid increase in intraocular pressure ¹⁰. Penetrating injuries to the eyeball are typically caused by sharp foreign bodies piercing or puncturing the ocular wall, with the wound located at the point of contact between the foreign body and the eye ¹¹. These wounds can be classified as penetrating injuries of the cornea, corneosclera, or sclera, often causing significant damage to the anterior segment ¹². In addition to the structural susceptibility of the eyeball, the risk and location of OGT are also influenced by certain biomechanical factors ¹¹.

These injuries are a major cause of acquired monocular blindness ^{12,13}. Post-traumatic visual impairment can result in significant disability, with profound psychological and social consequences for the affected child. The aim of this study was to evaluate the characteristics, causes, and severity of pediatric ocular trauma in Iranshahr, Iran. The study protocol was approved by the institutional ethics committee, and written informed consent was obtained from the parents of all participants before enrollment.

Patients and Methods

This retrospective observational study was conducted in the pediatric and ophthalmology emergency units of Iranshahr, Sistan and Baluchestan province, Iran, between April 2019 and September 2022. The study included all children younger than 12 years who presented to these units with ocular trauma during the study period. Patients with incomplete medical records or a history of pre-existing ocular conditions affecting vision were excluded.

Medical records of eligible patients were reviewed, and data were extracted using a standardized data collection form. The collected variables included demographic characteristics such as age and sex, as well as details regarding the trauma, including the time and circumstances of injury, the type of trauma (open-globe vs. closed-globe), the mechanism of injury (blunt force, projectile, penetrating injury, etc.), and the location where the trauma occurred (home, school, public areas, etc.). Additional information included the presence of associated injuries such as systemic or facial trauma, hospitalization details including admission rate and length of stay, treatment approaches such as medical management and surgical interventions, and trauma sequelae, specifically visual impairment at follow-up.

Ocular traumas were classified according to the Birmingham Eye Trauma Terminology (BETT) system. The severity of ocular trauma was assessed using the Ocular Trauma Score (OTS).

Statistical analysis was performed using SPSS version 24 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as mean $\pm$ standard deviation (SD) for continuous variables and as percentages for categorical variables. The chi-square test or Fisher's exact test was used for categorical data comparisons,

while the Student's t-test or Mann-Whitney U test was applied for continuous variables, as appropriate. A P-value of less than 0.05 was considered statistically significant.

The study protocol was approved by the institutional ethics committee, and written informed consent was obtained from the parents or legal guardians of all participants before enrollment.

Results

A total of 79 children with ocular trauma were included in the study, comprising 56 males and 23 females. The mean age was 6.4 ± 2.1 years (range: 6 months to 11.5 years). The majority of injuries occurred at home (49 %), followed by public areas (18 %) (Figure 1). The leading mechanisms of injury were blunt trauma (25 %) and direct trauma (8 %) (Figure 2). Based on the Birmingham Eye Trauma Terminology (BETT) classification, 24 % of ocular traumas were OGT and the rest were closed-globe traumas (CGT) (Figure 3).

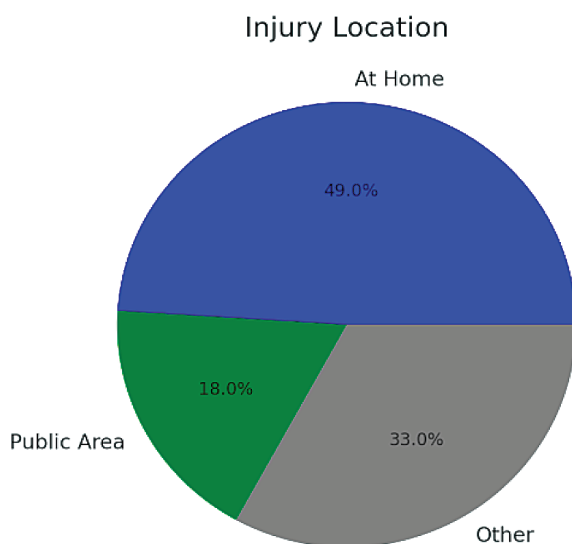


Figure 1: The percentage of injuries occurring at home, in public areas, or other locations among patients entering the study

OGT included penetrating injuries (42.9 %), perforating injuries (21 %), and injuries involving an intraocular foreign body (32.1 %) (Figure 4). Among CGT, hyphema was the most common lesion (19 %). Associated injuries were documented in eight patients. Regarding injury severity, 59 % of patients had an Ocular Trauma Score (OTS) of ≥ 3 , indicating a favorable visual prognosis,

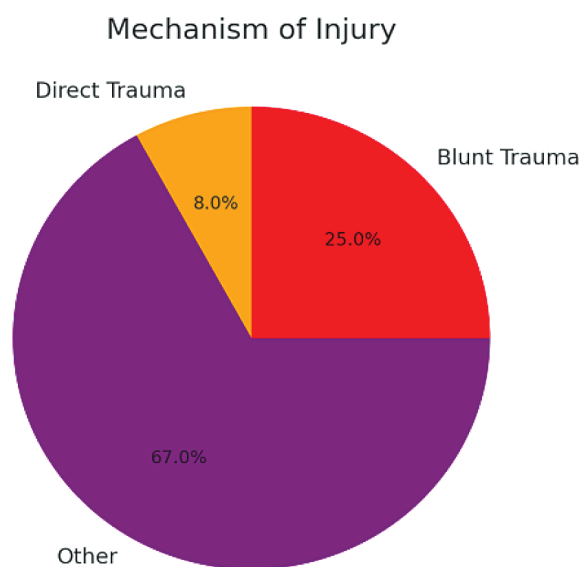


Figure 2: The proportion of trauma cases caused by blunt trauma, direct trauma, or other mechanisms among patients entering the study

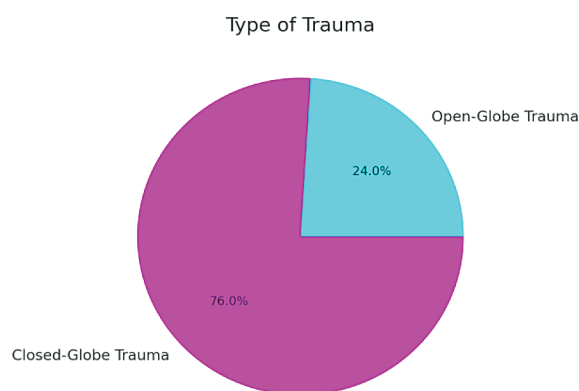


Figure 3: The percentage of open-globe and closed-globe trauma among patients entering the study

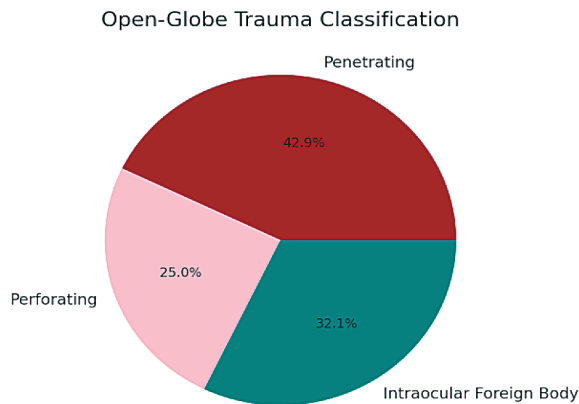


Figure 4: Distribution of open-globe trauma (penetrating, perforating, and intraocular foreign body injuries) among patients entering the study

whereas 11% had an OTS of ≤ 3 , suggesting a poor visual prognosis. Initial surgical intervention was required in 47 patients (59 %), and hospitalization was necessary in the same proportion of cases.

By the end of follow-up period, 19 patients (9.4 %) exhibited persistent sequelae, with the highest proportion observed in children aged 2 to 5 years (15 %). Male patients were significantly older than female patients ($P < 0.001$) and were more frequently injured by projectiles ($P = 0.026$). Ocular injuries resulting from projectiles ($P < 0.001$) and those occurring during spring and summer ($P < 0.01$) were more frequently associated with a poor visual prognosis.

Discussion

This study provides some insights into the epidemiology, causes, and outcomes of pediatric ocular trauma in Iranshahr, Iran. Ocular trauma remains a significant cause of avoidable blindness in children, with long-term visual impairment and substantial psychological and social consequences¹⁴.

Our findings align with previous studies highlighting the vulnerability of young children to ocular injuries, particularly those sustained at home or in public areas¹⁵⁻¹⁷.

Injury Patterns and Risk Factors

Our results show that home (49 %) and public areas (18 %) were the most common locations for pediatric ocular injuries, consistent with previous reports where domestic settings posed the highest risk for young children¹⁸⁻²¹. In a study by Ahmadi et al.,¹⁹ in northern Iran 67.4 % of injuries occurred in domestic setting, while this percentage was 71.7 % in a study by Abraham et al.,²¹ and 60.4 % in a study by Puodžiuvienė et al.,²⁰. The mechanism of injury varied, with blunt trauma (25 %) and direct trauma (8 %) being the predominant causes. Notably, our study found a significant association between male sex and higher injury risk ($P < 0.001$), consistent with literature indicating that boys are more prone to engaging in high-risk activities that predispose them to ocular trauma^{19,22,23}.

Trauma Classification and Severity

According to the Birmingham Eye Trauma Terminology (BETT) classification, 24 % of our cases were OGT, with penetrating injuries (42.9 %), perforating injuries (25 %), and intraocular foreign body injuries (32.1 %) being the most common types. In contrast, hyphema (19 %) was the most frequently observed lesion among CGT. In comparison to our results Puodžiuvienė et al.,²⁰ reported that the highest percentage of eye injuries in children were caused by blunt (40.3 %) and sharp objects (29.9 %), followed by burns (9.3 %), falls (6.7 %), explosions (4.5 %), fireworks (4.1 %), gunshots (1.9 %) and traffic

accidents (0.7 %). In their study similar to our study CGT was the most common type of eye injury (53.4 %).

Considering the severity of the ocular trauma 59 % of our patients had an OTS of ≥ 3 , suggesting a good visual prognosis, while 11% had an OTS of ≤ 3 , indicating a poor prognosis. Similar to our results in a study by Boret et al.,²⁴, 63% of patients had an OTS of 5 (good visual prognosis) while (12 %) had an OTS of ≤ 3 .

Surgical and Hospitalization Outcomes

In our cohort, 47 patients (59 %) required surgical intervention, and hospitalization was necessary in the same proportion of cases. The high surgical rate reflects the severity of injuries requiring immediate ophthalmic intervention. By the end of follow-up, 9.4 % of patients exhibited persistent visual sequelae, with the highest proportion observed in children aged 2 to 5 years (15 %). Younger children may be more vulnerable to severe injuries due to their delicate ocular structures and limited ability to protect themselves from harm, reinforcing the need for caregiver education and supervision^{16,25}.

Clinical and Preventive Implications

The high prevalence of home-related injuries and blunt trauma suggests that preventive interventions should focus on household safety modifications and parental education. Strategies such as securing sharp objects, discouraging the use of projectiles in play, and promoting the use of protective eyewear in high-risk activities could reduce the incidence of severe ocular trauma²⁶. Moreover, early medical intervention and appropriate trauma classification using systems like BETT and

OTS can guide treatment strategies and improve long-term visual outcomes²⁷.

Limitations and Future Research

Despite its strengths, this study has some limitations. The retrospective design may introduce selection bias, and reliance on medical records may have resulted in incomplete data collection. Additionally, the follow-up period was limited, which may not fully capture long-term visual outcomes. Future prospective studies with longer follow-up periods and larger sample sizes could provide more comprehensive insights into the epidemiology and management of pediatric ocular trauma in Iran and similar settings.

Conclusion

Our findings indicate that male gender and home setting are risk factors for childhood eye trauma. Increasing public awareness, strengthening safety awareness at home, and improving ophthalmic emergency care are crucial steps in reducing the burden of pediatric ocular injuries in our setting and beyond.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.