Original Article

Pattern and Severity of Pediatric Ocular Trauma at a Tertiary Eye Care Center in Pakistan

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Abstract

Objective: This study evaluated the occurrence, aetiology, severity, and visual outcomes of paediatric eye trauma cases referred to Al-Shifa Trust Eye Hospital in Rawalpindi.

Methods: This cross-sectional study enrolled 350 children aged 1–16 years over six months using non-probabilistic consecutive sampling. Demographic data, mechanism, site, and location of the injury were recorded. Visual acuity was assessed using age-appropriate charts, and a comprehensive ocular examination, including slit-lamp biomicroscopy and indirect ophthalmoscopy, was performed. The Ocular Trauma Score (OTS) was calculated. Data were analysed using SPSS v25. Categorical variables are presented as frequencies and percentages, and chi-square tests were used to determine associations ($p \leq 0.05$).

Results: The mean age of the children was 8.2 ± 4.1 years, with boys accounting for 62% of the cases. The right eye was more frequently affected (45%), and the majority of injuries were unilateral (78%). The most common places for injuries were at home (38%) and outdoors (32%). The most common mechanism of injury was blunt trauma (42%), followed by penetrating injuries (27%), lacerations (20%), and chemical injuries (11%). Fifteen percent of injured eyes had severe visual impairment (NPL/PL-HM). Chemical injuries were comparatively more common in girls (14%), whereas blunt trauma was more common in boys (45%). OTS categories 2 (28%) and 3 (36%) comprised the majority of cases in this study.

Conclusion: Paediatric ocular trauma predominantly affects boys and is most often blunt in nature, with children injured at home or outside the home. While a certain number of children have mild-to-moderate levels of visual impairment, many are affected by severe visual loss. Proactive monitoring of children during playtime, raising public awareness, and providing timely access to specialised eye care can significantly prevent visual impairment in children.

Keywords: Eye injuries, trauma, lacerations, visual acuity.

Introduction

Eye injuries during childhood remain a leading, yet largely avoidable, cause of vision loss in one eye. According to global estimates, millions of people live with impaired vision or blindness after eye injuries, which has a long-term social and educational effect on children and their families,[1] since such injuries may impact the education and development of the child, as well as their overall quality of life. The burden is especially high in resource-deprived areas, where delayed access to ophthalmic services and lack of awareness of the population are factors aggravating the outcomes.[2]

The International Globe and Adnexal Trauma Epidemiology Study (IGATES) shows that most paediatric eye injuries occur in the daily routines of individuals (playing at home or school) and are hence avoidable. Unsafe environments, lack of supervision, and accessibility to sharp and dangerous objects are often risk factors.[3] Education, safer playgrounds, and early referral to eye specialists are some of the strategies that have been linked to improved visual prognosis. [4,5]

Studies from Asia and the Middle East on the pattern of eye injuries in children have been enlightening. A national-level study in Taiwan identified a similar pattern, with most injuries being inflicted during daily routine activities, such as at home or during outdoor

play, highlighting the common dangers that children are exposed to in their daily settings.[6] Similar evidence from studies conducted in Nigeria and Iran reported accidents involving toys, sharp objects such as sticks, household items, stones, and simple falls as the most significant causes of trauma.[7,8] In Sri Lanka, experts have stressed the crucial role of parental education and the creation of safer home environments as key steps in reducing the risk of childhood injuries.[9]

In Pakistan, tertiary care centres continue to see a significant number of paediatric trauma cases, with the highest incidence of injuries being blunt trauma, followed by chemical and penetrating injuries, respectively, with serious complications such as corneal scarring, hyphema, traumatic cataract, and significant retinal damage due to delays in seeking care.[10] Contemporary local evidence is limited. Understanding the patterns and outcomes of these injuries is important for guiding prevention strategies and improving clinical care in the future. This study aimed to describe the mechanisms, severity, and visual outcomes of paediatric ocular trauma at a major tertiary eye hospital in India.

Materials And Methods

This cross-sectional study was conducted at the Emergency Department of Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan, over a period of six months, following approval from the Ethical Review Committee of the Pakistan Institute of Ophthalmology (ERC Approval No. ERC-54/AST-24). A sample size of 350 participants was calculated using the WHO sample size calculator, based on an anticipated prevalence of paediatric ocular trauma of 4.5%, 95% confidence interval, and an absolute precision. A non-probability consecutive sampling technique was used to enrol children aged 1–16 years who presented with ocular trauma during the study period. Written informed consent was obtained from the parents or guardians in their native language, and confidentiality was ensured throughout the study. Children and guardians were informed of their voluntary participation and right to withdraw at any stage without compromising medical care.

Children meeting the inclusion criteria were evaluated immediately upon arrival at the emergency department. The inclusion criteria consisted of: (1) children aged 1–16 years, and (2) presentation with ocular trauma as an emergency case. Exclusion criteria included: (1) incomplete or unavailable data, (2) unclear or unverified source of trauma, and (3) medico-legal cases. Data were collected through a structured proforma documenting demographics (age, gender, and residence), place and mechanism of injury, and clinical presentation. Visual acuity was assessed using a Snellen chart for cooperative children and age-appropriate methods for younger participants. A detailed ocular examination, including slit-lamp biomicroscopy and indirect ophthalmoscopy, was performed to determine the type and extent of trauma. Children with severe or sight-threatening injuries were admitted for urgent intervention. To ensure reliability, all entries were independently cross-checked by the primary investigator the following morning, and standardised assessment protocols were used to minimise inter-observer and information bias.

Data analysis was performed using IBM SPSS Statistics (version 25. Quantitative variables, such as age, are expressed as mean ± standard deviation (SD). Categorical variables, including sex, cause of injury, type of trauma, site of injury, setting of injury, and immediate clinical outcomes, were presented as frequencies and percentages. Stratification was conducted for key variables such as age group, sex, residence (urban/rural), site, and location of trauma to control for potential effect modifiers. Following stratification, the chi-square test was applied to determine statistically significant associations between the causes and types of trauma. Statistical significance was set at $p \leq 0.05$.

Results

The study included 350 children who experienced ocular trauma. The mean age was 8.2 ± 4.1 years, with 40% of the patients aged between 6 and 10 years. Boys accounted for 62% of the cases, and 55% of children presenting with ocular trauma came from urban areas (Table 1).

Table 1: Demographic Characteristics of Pediatric Ocular Trauma Cases (n = 350)

Variable	Category	n	%
Age (years)	1–5	80	22.9
	6–10	140	40.0
	11–16	130	37.1
Gender	Male	217	62.0
	Female	133	38.0
Residence	Urban	193	55.1
	Rural	157	44.9

Most injuries involved only one eye (78%), with the right eye being slightly more affected than the left (45% and 33%, respectively). Bilateral injuries accounted for 22% of the cases. Most injuries occurred at home (38%), followed by outdoor activities (32%) and school (25%). The remaining 5% of the participants were from other locations. The most common cause of injury was blunt trauma (42%), followed by penetrating trauma (27%), lacerating injuries (20%), and chemical injuries (11%) (Table 2).

Table 2: Patterns of Pediatric Ocular Trauma (n = 350)

Variable	Category	n	%	Common Causes
Eye Involvement	Right eye	158	45.1	—
	Left eye	116	33.1	—
	Both eyes	76	21.7	—
Location of Injury	Home	133	38.0	—
	School	88	25.1	—
	Outdoor	112	32.0	—
	Other	17	4.9	—
Nature of Injury	Blunt trauma	147	42.0	Sports, falls
	Penetrating trauma	95	27.0	Wooden sticks, glass
	Lacerating trauma	70	20.0	Sharp tools, knives
	Chemical trauma	38	11.0	Household chemicals

Visual acuity at presentation showed that severe vision loss (NPL or PL/HM) occurred in 15% of eyes, whereas the majority had mild to moderate impairment (Table 3).

Table 3: Visual Acuity at Presentation in Pediatric Ocular Trauma (n = 350)

Visual Acuity Category	n	%
NPL	20	5.7
PL/HM	32	9.1
1/200–19/200	72	20.6
20/200–20/50	98	28.0
≥20/40	128	36.6

Blunt trauma was more frequent in boys (45%) than in girls (37%), whereas chemical injuries were more common in girls (14%) than in boys (9%). The differences were statistically significant (p = 0.03) (Table 4).

Table 4: Type of Injury Stratified by Gender (n = 350)

Type of Injury	Male n (%)	Female n (%)	p-value
Blunt trauma	98 (45.2)	49 (36.8)	0.03
Penetrating trauma	60 (27.6)	35 (26.3)	0.71
Lacerating trauma	38 (17.5)	32 (24.1)	0.05
Chemical trauma	21 (9.7)	17 (12.8)	0.21

OTS was calculated for all patients based on the presenting visual acuity, type, and zone of injury. Most eyes fell into OTS categories 3 (36%) and 2 (28%) (Table 5).

Table 5: Ocular Trauma Score in Pediatric Ocular Trauma (n = 350)

OTS Category	Open Globe n	Closed Globe n	Total n (%)
1 (0–44)	25	12	37 (10.6)
2 (45–65)	60	38	98 (28.0)
3 (66–80)	80	46	126 (36.0)
4 (81–91)	20	20	40 (11.4)
5 (92–100)	10	39	49 (14.0)

Discussion

In our study of 350 paediatric ocular trauma cases at a tertiary centre, we found a predominance of young school-age children and a male preponderance, with a substantial proportion of both closed-globe (blunt) and open-globe (penetrating/lacerating) injuries. The predominance of blunt trauma mirrors the patterns reported internationally. Although many injuries are minor, a considerable subset results in significant and sometimes permanent loss of vision, particularly in cases of open-globe trauma.

A recent observational study at a tertiary hospital in Karachi, which included 232 children (237 eyes), reported that the average age at presentation was 8.28 ± 3.52 years, with boys being affected more than girls at a ratio of 2.6 to 1. The majority of injuries were closed-globe injuries, accounting for 58.4% of cases, whereas open-globe injuries comprised 32.1% of cases.[11] Wooden sticks and sharp objects were the most common causes, and outdoor activities were the leading cause of these injuries. Treatment resulted in significant improvement in visual outcomes, with results strongly correlating with the Ocular Trauma Score (OTS).

In paediatric open globe trauma, a 2023 study of 93 children demonstrated that the most prevalent cause was penetration by non-metallic sharp objects. Another study showed that the location, size, and timing of the wound influence recovery by highlighting that poor visual outcomes result from injuries to the central cornea.[12] A study conducted in Istanbul reported that a child's initial visual acuity at presentation and lens damage were major factors that impacted their final vision. However, a clinically significant difference was observed with surgical repair, with average vision improving from logMAR 1.48 to 0.83 ($p < 0.001$), further highlighting the importance of early intervention.[13]

Looking at a wider population, a 2024 survey in Iran among schoolchildren aged 6 to 12 found that about 5% had experienced some form of eye injury in their lifetime. Most of these cases (approximately two-thirds) were due to blunt trauma, and the study highlighted that boys, older children, and those living in rural areas were at higher risk. This highlights that many paediatric eye injuries are preventable and that community-level factors (supervision and environment) play significant roles.[14]

More recently, a 2024 study from Shandong Province evaluated patients with penetrating ocular trauma < 18 years and found that wound size and central location were strongly associated with poorer outcomes, whereas peripheral injuries and older age were linked with better prognosis; the authors cautioned that both OTS and Paediatric Penetrating Ocular Trauma Score (POTS) may underestimate good visual outcomes in selected cases.[15-17]

Our findings reinforce several key points: first, paediatric ocular trauma remains a common and preventable cause of vision loss; second, the type of injury (closed vs. open), mechanism (blunt vs. penetrating), wound characteristics (size, location), and promptness of care greatly influence prognosis; third, even with appropriate management, a substantial fraction of children are at risk of long-term visual impairment, especially in open-globe injuries involving the cornea, lens, or posterior segment, which is consistent with previous studies.[18-20]

Therefore, apart from clinical treatment, significant public health interventions are needed, which stresses the importance of community awareness, parental oversight, safer play and domestic surroundings, limiting access to sharp objects, and prompt referral to ophthalmic care.

Our research has several limitations, such as its single-centre design, which restricts the generalisability of the study to other areas of Pakistan where paediatric ocular trauma occurs. In addition, there was no systematic evaluation of long-term visual outcomes and socioeconomic risk factors, which may affect injury severity and subsequent recovery. However, this research presents important evidence at the local level that can be used in both clinical practice and prevention strategies. The evidence for the prevention of paediatric ocular trauma can be further explored in future multicentre studies with a longer follow-up period.

Conclusions

Paediatric eye injuries remain a preventable national health problem in Pakistan. In most cases, it is associated with blunt trauma in everyday life and most commonly occurs in young boys. These injuries can be mitigated by enhancing preventive measures, increasing the rate of early accessibility to ophthalmic care, and educating the general population.

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