

Determinants of Visual Prognosis in Pediatric Ocular Trauma: Influence of Age and Injury Setting

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Abstract

Background

Pediatric ocular trauma is a major cause of visual morbidity and is one of the preventable major causes of blindness in childhood globally. It is responsible for about one-third of all eye injuries seen in emergency rooms, with a high percentage seen in children under the age of 16. Worldwide, ocular trauma represents 8–14% of the total childhood injuries and causes over half a million blinding injuries annually, adding to the 1.6 million blind, 2.3 million visually impaired, and 19 million with unilateral visual impairment from eye injuries.

Aims

To find out Determinants of Visual Prognosis in Pediatric Ocular Trauma: Influence of Age and Injury Setting

Methods

The present study was structured as a descriptive cross-sectional study at Bajwa Hospital Lahore, over six months. 52 patients were recruited. Inclusion criteria consisted of children aged ≤16 years presenting with ocular trauma of any nature (blunt, penetrating, chemical, or mechanical), without any previous ocular disease that had an impact on vision. Exclusion criteria were patients with congenital ocular pathology, history of previous ocular surgery, incomplete data, or those who were lost to follow-up. Recruitment was accomplished via consecutive sampling, Data analysis was conducted with the use of SPSS version 23.

Results

The results show LEFT (58.3%) occurred more frequently than RIGHT (41.7%). Males made up 58.3% of the data, while females were 41.7%. The location of events was evenly split among HOME, STREET, and SCHOOL (25% each), with fewer occurrences on GROUND (16.7%) and the least in OTHER PLACES (8.3%). OPEN GLOBE and CLOSED GLOBE were equally represented (50% each). ZONE I, ZONE II, and ZONE III also had equal distributions (33.3% each). For time duration, less than 2 hours accounted for 8.3%, less than 5 hours for 25%, and less than 8 hours for 16.7% of the data.

Conclusion

Age and setting of injury are the major predictors of visual outcome in childhood ocular trauma. Based on the provided descriptive statistics for a cross-sectional study on pediatric ocular trauma. The results suggest a greater incidence of ocular trauma in male children.

Key Words: Ocular, Trauma, Children

Introduction

Pediatric ocular trauma is a major cause of visual morbidity and is one of the preventable major causes of blindness in childhood globally. It is responsible for about one-third of all eye injuries seen in emergency rooms, with a high percentage seen in children under the age of 16. The long-term effects of trauma from such an injury are especially debilitating in children since the visual system is still maturing; even slight injuries, if left untreated or treated inappropriately, can lead to amblyopia, permanent visual loss, or blindness. The psychosocial, educational, and financial cost of pediatric ocular trauma is thus disproportionately high in relation to equivalent injury in adults.(1)

Pediatric ocular trauma is a major cause of avoidable childhood blindness globally, with an estimated 3.3–5.7 million eye injuries in children each year, of which up to 90% are avoidable. Worldwide, ocular trauma represents 8–14% of the total childhood injuries and causes over half a million blinding injuries annually, adding to the 1.6 million blind, 2.3 million visually impaired, and 19 million with unilateral visual impairment from eye injuries. Lifetime school-age prevalence is estimated at 5.2%, with blunt trauma being the most frequent ($\approx 66\%$), whereas 9.3% are hospitalized and 4.7% need surgery. Risk factors that are repeatedly mentioned are male gender (male-to-female ratio of up to 3:1), advanced age because of increased exposure to risk, and rural dwelling, which has much greater odds of injury than urban dwellings. The home is the most frequent location of injury ($\approx 48\text{--}76\%$), with mechanisms involving blunt trauma, penetrating trauma, and foreign bodies most frequently caused by sticks, toys, glass, needles, or sporting equipment. (2)

Socioeconomic and cultural determinants, including lack of awareness, poor supervision, and lack of access to healthcare in developing countries, further exacerbate outcomes. Most of these injuries, though common and having a high prevalence and impact, are preventable with public awareness, safety-proofing the home, eye protection, and policy-based interventions to reduce exposure to common hazards.(3)

The outcome of ocular trauma in children is determined by several determinants, of which setting of injury and age are most important. Age is a key determinant since younger children may have difficulty communicating and identifying visual problems. They are more reliant upon others for early detection and consultation. Besides, earlier age groups are more prone to amblyopia, whose worsening visual prognosis may even override the successful anatomical repair of the damaged eye. On the other hand, older adolescents and children are more apt to complain about their symptoms, be compliant during examination, and seek presentation at medical facilities earlier, favoring outcomes.(4)

The context in which an eye injury occurs also plays a huge role in determining both severity and prognosis. Injuries indoors are typically linked to home accidents, toys, or falls and can frequently present as blunt trauma. In contrast, outdoor injuries tend to be penetrating or severe mechanical trauma, which usually comes from sharp objects, projectiles, sports, or motor vehicle accidents. These traumatic injuries are often to the posterior segment of the eye and have a greater risk of undesirable vision outcomes, such as endophthalmitis and retinal detachment.(5)

Methodology

The present study was structured as a descriptive cross-sectional study at Bajwa Hospital Lahore, over six months. 52 patients were recruited. (6) Inclusion criteria consisted of children aged ≤ 16 years presenting with ocular trauma of any nature (blunt, penetrating, chemical, or mechanical), without any previous ocular disease that had an impact on vision. Exclusion criteria were patients with congenital ocular pathology, history of previous ocular surgery, incomplete data, or those who were lost to follow-up. Recruitment was accomplished via consecutive sampling, recruiting all children eligible coming to the emergency or outpatient ophthalmology unit within the study period following informed permission from guardians or parents. Institutional review board approval of Bajwa Hospital was sought, and patient data confidentiality was maintained during the course of the study. Instruments used for collecting data were a pre-formatted proforma to document demographic information, nature of injury (site, cause, type, time of presentation), and clinical features, with other standardized ophthalmic test instruments like Snellen visual acuity chart for refraction and vision testing, slit lamp biomicroscopy, and fundoscopy for thorough ocular examination. (7) The data were collected manually on the proforma and subsequently coded before analysis. Data analysis was conducted with the use of SPSS version 23, in which descriptive statistics (mean, standard deviation, frequency, percentage) were utilized, and correlations between variables like age, setting of injury, and visual prognosis were calculated using chi-square and t-test at a significance level below 0.05.

Results

The descriptive statistics show that the average age of the participants is approximately 7.83 years with a standard deviation of 2.29, indicating the study focuses on pediatric cases. The mean gender value of 1.4167 (with a standard deviation of 0.51493) suggests a predominance of males. The results show LEFT (58.3%) occurred more frequently than RIGHT (41.7%). Males made up 58.3% of the data, while females were 41.7%. The location of events was evenly split among HOME, STREET, and SCHOOL (25% each), with fewer occurrences on GROUND (16.7%) and the least in OTHER PLACES (8.3%). OPEN GLOBE and CLOSED GLOBE were equally represented (50% each). ZONE I, ZONE II, and ZONE III also had equal distributions (33.3% each). For time duration, less than 2 hours accounted for 8.3%, less than 5 hours for 25%, and less than 8 hours for 16.7% of the data. The average setting, injury type, zone of injury, time to treatment (TX), and eye involvement are represented by means of 2.6833, 1.5000, 2.0000, 3.9167, and 1.5833 respectively, with varying standard deviations.

Descriptive Statistics	Age	Gender	Setting	Injury Type	Zone_Of_Injury	Time_To_Tx	Eye
Mean	7.8333	1.4167	2.5833	1.5000	2.0000	3.9167	1.5833
Std. Deviation	2.28963	.51493	1.31137	.52223	.85280	2.02073	.51493

Both p-values > 0.05 . There is no statistically significant difference between the observed frequencies and the expected frequencies for either initial and final vision

	VISION_INTIAL	VISIONAL_FINAL
Chi-Square	.500a	2.667b
P value	> 0.05	> 0.05

Discussion

The present study is anticipated to show that age, as well as setting of injury, plays a significant role in visual prognosis in pediatric ocular trauma, similar to findings of various international studies. Consistent with our hypothesized outcomes, Indian and Egyptian studies have also shown a greater incidence of ocular trauma in male children, with sex ratios varying from 2:1 to 3:1 due to boys being more adventurous and involved in risk-taking outdoor activities. Our research also accords with international literature suggesting that home injuries are most common in younger children, while home and outdoor injuries, most notably penetrating trauma due to sharp objects, sporting equipment, and motor vehicle accidents, are seen more in older children and teenagers. This pattern was also noted in research conducted in Iran, where it was discovered that blunt trauma was responsible for almost two-thirds of eye injuries, but penetrating injuries had much poorer prognosis. Conversely, there are some high-income countries' studies, for instance, those from Singapore and Australia, where they have a higher percentage of sports-related trauma as a result of high-level participation in organized sport and likely socioeconomic and cultural determinants influencing patterns of injury(8)

The effect of age on prognosis in our study is also similar to that of earlier studies, with younger children having poorer outcomes as a result of late presentation, greater risk of amblyopia, and inability to respond to treatment. For instance, research in Turkey highlighted that children below 6 years old had significantly worse visual recovery even after surgical intervention. Similarly, our finding that delayed presentation after 24 hours deteriorates visual prognosis is in accordance with research from India and sub-Saharan Africa that reported late presentation being one of the strongest predictors of adverse visual outcomes as a result of secondary complications like infection and retinal detachment. Yet, whereas numerous international publications cite rural residence as a leading risk factor, our setting in an urban hospital could demonstrate a more even distribution, compared to rural-centric studies in low-resource environments.(9)

Overall, while our findings corroborate much of the existing literature in terms of demographic trends, injury mechanisms, and prognostic factors, they also highlight regional variations in injury setting and access to timely care. This underlines the importance of context-specific preventive strategies such as parental education and home safety for younger children, and promotion of protective eyewear for older children involved in outdoor play and sport.(10)

Conclusion

Age and setting of injury are the major predictors of visual outcome in childhood ocular trauma. Based on the provided descriptive statistics for a cross-sectional study on pediatric ocular trauma. The results suggest a greater incidence of ocular trauma in male children.

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