Original Article

# Pattern and Clinical Profile of Ocular Trauma at a Tertiary Eye Hospital in Bangladesh: A Prospective Observational Study

Tohura Sharmin[1], Abir Bin Sajj[2], Evan Akhter Adrita[3], Ridwana Rahman[4], Richmond Ronald Gomes[5], Masudul Hasan[6], Muhammad Moniruzzaman[7]

**Abstract**

**Background:** Ocular trauma is a leading cause of monocular vision loss and preventable blindness, particularly in developing nations. Globally, approximately 1.6 million people are blind due to ocular injuries, with younger, economically active populations bearing a disproportionate burden.

**Objectives:** This study aims to analyze the epidemiological patterns, clinical characteristics, and visual outcomes of ocular trauma at a specialized tertiary eye hospital in Dhaka, Bangladesh.

**Methods:** This prospective observational study was conducted at the Vision Eye Institute and Hospital in Dhaka, from January 2024 to December 2026. A cohort of 207 participants (215 eyes) was analyzed. Clinical severity was classified according to the Birmingham Eye Trauma Terminology System (BETTS). Visual outcomes were assessed using Snellen charts at presentation and three months post-intervention.

**Results:** The study population was predominantly male 168 (81.16%), with the 21–30 age group most affected 68 (32.85%). Occupational accidents were the leading mode of injury 73 (35.27%), and the workplace was the most common site of trauma 61 (29.47%). Notably, 98.55% of patients reported not using protective eyewear at the time of injury. Open-globe injuries predominated 131 (63.29%), with corneal lacerations 51 (24.64%) and subconjunctival hemorrhages 47 (22.71%) as the primary findings. At presentation, 21 (9.77%) of eyes had "Good Vision" (6/12 or better), which improved to 57 (26.51%) at follow-up. Blindness rates decreased from 41 (19.07%) to 29 (13.49%) over the study period.

**Conclusion:** Ocular trauma in this setting involves severe mechanical injuries in young, productive males. The critical lack of acompliance with protective eyewear usage underscores an urgent need for the enforcement of occupational safety regulations and public health education. Specialized management significantly improves vision, but the persistence of blindness highlights the necessity for early presentation and aggressive prevention strategies.

**Keywords:** Ocular Trauma; Open-Globe Injury; Visual Outcome; Occupational Safety; BETTS; Bangladesh.

1. Assistant Professor, Department of Community Medicine and Public Health. Ad-din Women's Medical College, Dhaka, Bangladesh
2. Consultant, Department of Cornea and Refractive Surgery, Vision Eye Institute and Hospital, 229, Green Road, Dhaka-1205, Bangladesh
3. Lecturer, Department of Community Medicine and Public Health, Ad-din Women's Medical College, Dhaka, Bangladesh
4. Assistant Professor, Department of Physiology, Ad-din Women's Medical College, Dhaka, Bangladesh
5. Professor and Head, Department of Internal Medicine, Ad-din Women's Medical College, Dhaka, Bangladesh
6. Consultant, Department of Cornea and Refractive Surgery, Vision Eye Institute and Hospital, 229, Green Road, Dhaka-1205, Bangladesh
7. Consultant, Department of Vitreo-Retina, Vision Eye Institute and Hospital, 229, Green Road, Dhaka-1205, Bangladesh

**Correspondence:** Abir Bin Sajj, Consultant, Department of Cornea and Refractive Surgery, Vision Eye Institute and Hospital, 229, Green Road, Dhaka-1205, Bangladesh. Mobile: 01715223100, E-mail: abirshagata @gmail.com

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## Introduction

Ocular trauma represents a significant global public health concern, frequently leading to monocular vision loss and severe socioeconomic burdens.[1] In developing countries, this issue is particularly pronounced, contributing substantially to preventable blindness and disability, especially in regions with limited access to specialized ophthalmic care.[2,3] Worldwide, approximately 1.6 million individuals are blinded annually by such injuries, with an additional 2.3 million experiencing bilateral low vision, disproportionately affecting younger, economically active populations.[3,4,5] These patterns underscore the urgent need for comprehensive epidemiological studies to characterize region-specific injury profiles and inform targeted prevention and treatment strategies.

In Bangladesh, a detailed investigation into the prevalence and patterns of ocular trauma is essential to formulate effective public health interventions. Although studies from various regions demonstrate that ocular injuries are a significant cause of visual impairment- often necessitating specialized medical attention.[6] A comprehensive understanding of specific clinical profiles, etiological factors, and visual outcomes at tertiary care facilities remains underexplored.[6,7,8,9] This study addresses this gap by prospectively analyzing patterns and clinical profiles, offering detailed insights into injury mechanisms, demographics, and visual outcomes of ocular trauma patients presenting to a tertiary eye hospital in Dhaka, Bangladesh, thereby contributing crucial data to the literature.

## Materials and Methods

The objective of this study is to analyze the epidemiological patterns, clinical characteristics, and visual outcomes of ocular trauma at a specialized tertiary eye hospital in Dhaka, Bangladesh.

### Study Design and Setting

This prospective observational study was conducted at the Vision Eye Institute and Hospital, a tertiary eye hospital in Dhaka, Bangladesh, from January 2024 to December 2025.

### Sample Size Calculation and Sampling Technique

The sample size was determined using the Kish and Leslie formula [(10)] for estimating a single population proportion: $n = Z^2pq / d^2$

where n is the required sample size, $Z$ is the standard normal deviate at a 95% confidence level, p is the estimated prevalence of ocular trauma (0.02, based on a 2% prevalence reported in rural Bangladesh, q = 1 - p, and d is the margin of error.[11] A 2% prevalence of ocular trauma in rural Bangladesh was used for sample size calculation because this study included patients from both rural and urban areas of Bangladesh, and because specific urban data were unavailable.

Substituting these values yielded a minimum sample size of 188. To account for potential data loss or follow-up attrition, an additional 10% was added, resulting in a final target of 207 participants recruited via purposive and consecutive sampling techniques.

### Study Population

The study population comprised patients presenting to the Vision Eye Institute and Hospital with ocular trauma during the specified study period.

### Inclusion and Exclusion Criteria

Patients of all ages and both sexes presenting with acute ocular injury to one or both eyes were included, provided they gave informed consent and completed 3-month follow-up after initial management. This also encompassed individuals referred from other medical facilities without prior primary care for their ocular trauma.[12] Patients with pre-existing ocular conditions that could confound the assessment of trauma-induced visual impairment, or those unwilling to participate, were excluded.

### Data Collection and Management

Data collection for this study used a standardized, pre-tested pro forma to capture demographic, clinical, and injury-related variables systematically. Following recruitment, detailed histories were obtained from all 207 participants. Informed written consent was obtained from adult participants, and assent was obtained from the legal guardians of pediatric patients.

Detailed histories documented each patient's socio-demographic profile, including age, gender, residence, religion, and occupation. Socioeconomic status was categorized into three groups based on monthly household income in Bangladeshi Taka (BDT), following the classification proposed for Bangladesh.[13]

- **Low Income**: <12,500 BDT
- **Middle Income**: 12,500–21,500 BDT
- **High Income**: >21,500 BDT

The mode of injury, mechanism of trauma, type of injuring object, and duration from trauma to hospital presentation were also recorded.

A comprehensive ophthalmic and systemic examination was conducted to assess ocular tissue involvement and any associated bodily injuries.

- **Anterior Segment**: Evaluated using slit-lamp biomicroscopy to check corneal and scleral integrity.

- **Pupillary Evaluation**: Performed via torchlight examination to assess pupillary reflex and detect relative afferent pupillary defect.
- **Posterior Segment**: Assessed using direct and indirect fundoscopy where clinically feasible.
- **Ancillary Investigations**: Included B-scan ultrasonography as needed to aid diagnosis and surgical planning.

Ocular trauma cases were classified according to the Birmingham Eye Trauma Terminology System.[4] Mechanical injuries were subdivided into:

- **Closed Globe Injury (CGI)**: Injury to the eye wall without a full-thickness wound.
- **Open Globe Injury (OGI)**: Full-thickness wound of the eye wall, further categorized as rupture, penetrating injury, intraocular foreign body, or perforating injury.

The initial management for each eye—whether surgical, medical, or observation-only—was recorded. Patients underwent a minimum three-month follow-up to evaluate final visual outcomes. Visual acuity (VA) was measured using Snellen charts at presentation and follow-up, and graded as.[14]

- **Good Vision**: VA 6/12 or better
- **Visual Impairment**: VA from 6/18 to 6/60
- **Blindness**: VA worse than 6/60

### Statistical Analysis

All collected data were entered into a Microsoft Excel spreadsheet, and statistical analyses were performed using SPSS software (IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp.). Descriptive statistics, including frequencies and percentages, were employed to characterize the demographic and clinical profiles of the study population.[15]

### Ethical Approval

The study was approved by the Institutional Review Board of Vision Eye Institute and Hospital (Reference: VEIH/IRB/ 2023/12-003) before its initiation. All participants provided written informed consent before data collection, aligning with ethical research practices.

## Results

### Demographic and Socioeconomic Profile

A total of 207 participants (215 eyes) were analyzed. The cohort was predominantly male 168 (81.16%), and the most frequently affected age group was 21–30 years 68 (32.85%). Residents of urban areas comprised 124 (59.90%) of the sample. In terms of occupation, industrial workers 54 (27.54%) and farmers 34 (16.43%) were the most affected groups. Regarding socioeconomic status, 109 (52.66%) of patients belonged to the middle-income group.

**Table 1**: Demographic and Socioeconomic Profile

| Variables | Number (%) |
|---|---|
| **Age groups (in years)** | |
| 0 -10 | 26 (12.56) |
| 11 - 20 | 29 (14.01) |
| 21 - 30 | 68 (32.85) |
| 31 - 40 | 35 (16.91) |
| 41 - 50 | 19 (9.18) |
| 51 - 60 | 23 (11.11) |
| 61 - 70 | 5 (2.42) |
| 71 - 80 | 1 (0.48) |
| >80 | 1 (0.48) |
| **Gender** | |
| Male | 168 (81.16) |
| Female | 39 (18.84) |
| **Residence** | |
| Urban | 124 (59.90) |
| Rural | 83 (40.10) |
| **Religion** | |
| Islam | 189 (91.30) |
| Hindu | 14 (6.76) |
| Christian | 1 (0.48) |
| Buddhism | 2 (0.97) |
| Others | 1 (0.48) |
| **Occupation** | |
| Student | 29 (14.01) |
| Farmer | 34 (16.43) |
| Laborer | 31 (14.98) |
| Industrial worker | 57 (27.54) |
| Doctor | 3 (1.45) |
| Homemaker | 17 (8.21) |
| Driver | 14 (6.76) |
| Shopkeeper | 9 (4.35) |
| Teacher | 2 (0.97) |
| Police and armed forces personal | 3 (1.45) |
| Businessman | 2 (0.42) |
| Others | 3 (1.45) |
| **Socio-economic condition** | |
| Low | 52 (25.12) |
| Middle | 109 (52.66) |
| High | 46 (22.22) |

The majority of patients belonged to the 21–30 years age group 68 (32.85%), followed by 31–40 years 31 (16.91%), and 11–20 years 29 (14.01%). Very few cases were observed in older age groups above 70 years 1 (0.48% each).

Most patients were male 168 (81.16%), while females accounted for 39 (18.84%) of participants.

The residential distribution of the patients. A higher proportion of patients were from urban areas 124 (59.90%) compared to rural areas 83 (40.10%).

The majority of participants were Muslim 189 (91.30%), followed by Hindu 14 (6.76%), while very small proportions belonged to Christianity, Buddhism, and other religions.

The occupational distribution of the patients. Industrial workers constituted the largest group 57 (27.54%), followed by farmers 34 (16.43%), laborers 31 (14.98%), and students 29 (14.01%).

More than half of the participants belonged to the middle-income group 109 (52.66%), followed by the low-income group 52 (25.12%) and high-income group 46 (22.22%).

### Clinical Characteristics of Ocular Trauma

The right eye was involved in 117 (56.52%) of cases, while bilateral involvement was rare 8 (3.86%). The workplace was the most common site of injury 61 (29.47%), with occupational accidents 73 (35.27%) and homicidal assaults 36 (17.39%) being the primary modes of trauma. Sharp objects 86 (41.55%) and blunt objects 84 (40.58%) were responsible for nearly equal proportions of injuries. Notably, 204 (98.55%) of patients were not using eye protection at the time of trauma.

According to the BETTS classification, open-globe injuries predominated 131 (63.29%). Common clinical findings included corneal lacerations 51 (24.64%), subconjunctival hemorrhages 47 (22.71%), and corneal foreign bodies 36 (18.36%).

**Table 2:** Clinical Characteristics of Ocular Trauma

| Variables | | Number (%) |
|---|---|---|
| **Eye involved** | | |
| Right | | 117 (56.52) |
| Left | | 82 (39.61) |
| Both | | 8 (3.86) |
| **Mode of injury** | | |
| Accidental | Road Traffic Accident (RTA) | 28 (13.53) |
| | Chemical Exposure | 18 (8.70) |
| | Sport | 33 (15.94) |
| | Occupational | 73 (35.27) |
| | Electrical | 2 (0.97) |
| | Domestic | 17 (8.21) |
| Homicidal (assault) | | 36 (17.39) |
| **Type of object causing injury** | | |
| **Objects** | | |
| Sharp | | 86 (41.55) |
| Blunt | | 84 (40.58) |
| Projectile | | 19 (9.18) |
| Chemical | | 18 (8.70) |
| **Type of injury** | | |
| Open globe | | 131 (63.29) |
| Close globe | | 85 (41.06) |
| **Place of sustaining trauma** | | |
| Home | | 34 (16.43) |
| Work place | | 61 (29.47) |
| School | | 16 (7.73) |
| Road | | 32 (15.46) |
| Playground | | 21 (10.14) |
| Industry | | 34 (16.43) |
| Outdoor | | 4 (1.93) |
| Hospital | | 2 (0.97) |
| Not documented | | 3 (1.45) |
| **Time of injury** | | |
| 12 am – 4 am | | 2 (0.97) |
| 4 am – 8 am | | 2 (0.97) |
| 8 am – 12 pm | | 70 (33.82) |
| 12 pm – 4 pm | | 53 (25.60) |
| 4 pm – 8 pm | | 42 (20.29) |
| 8 pm – 12 pm | | 38 (18.36) |
| **Time taken to reach the hospital** | | |
| **Duration** | | |
| 0 – 6 hours | | 54 (26.09) |
| >6 hours – 12 hours | | 67 (32.37) |
| >12 hours – 24 hours | | 43 (20.77) |
| >1 day – 3 days | | 23 (11.11) |
| >3 days – 7 days | | 12 (5.80) |
| >1 week – 1 month | | 7 (3.38) |
| >1 month 1 (0.48) | | |
| **Eye protective wear** | | |
| Yes | | 3 (1.45) |
| No | | 204 (98.55) |

The right eye was more frequently affected 117 (56.52%) than the left 82 (39.61%), and bilateral involvement was observed in 8 (3.86%) of cases. Occupational injuries were the most common cause 73 (35.27%), followed by homicidal assault 36 (17.39%), sports-related injuries 33 (15.94%), and road traffic accidents 28 (13.53%).Sharp objects were responsible for the largest proportion of injuries 86 (41.55%), closely followed by blunt objects 84 (40.58%). Open globe injuries accounted for the majority of cases 131 (63.29%), whereas closed globe injuries constituted 85 (41.06%).The workplace was the most common site of injury 61 (29.47%), followed by home 34 (16.43%), industry 34 (16.43%), and road 32 (15.46%). Most injuries occurred during the daytime, particularly between 8 am and 12 pm 70 (33.82%) and 12 pm and 4 pm 53 (25.60%). The largest proportion of patients presented within 6–12 hours 67 (32.37%), followed by within 0–6 hours 54 (26.09%). The largest proportion of patients presented within 6–12 hours 67 (32.37%), followed by within 0–6 hours 54 (26.09%). Only 3 (1.45%) of patients reported using eye protective devices at the time of injury, whereas 204 (98.55%) did not use any protective eyewear.

**Table 3:** Tissue Involved

| Tissue involved | Complications or findings | Number (%) |
|---|---|---|
| **Anterior Segments** | | |
| Lids and adnexa | Lid laceration | 31 (14.98) |
| | Eyebrow laceration | 7 (3.38) |
| | Canalicular injury | 8 (3.86) |
| Conjunctiva | Laceration | 27 (13.04) |
| | Sub-conjunctival haemorrhage | 47 (22.71) |
| Sclera | Foreign body | 11 (5.31) |
| | laceration | 38 (18.36) |
| | Perforation | 13 (6.28) |
| Cornea | Abrasion | 30 (14.49) |
| | Laceration | 51 (24.64) |
| | Perforation | 19 (9.18) |
| | Foreign body | 38 (18.36) |
| | Oedema | 10 (4.83) |
| Anterior chamber | Hyphema | 33 (15.94) |
| | Traumatic uveitis | 6 (2.90) |
| | Foreign body | 4 (1.93) |
| | Secondary glaucoma | 2 (0.97) |
| Iris | Prolapse | 28 (13.53) |
| | Iridodialysis | 5 (2.42) |
| | Traumatic Mydriasis | 9 (4.35) |
| Lens | Traumatic cataract | 25 (12.08) |
| | Capsule rupture | 7 (3.38) |
| | Subluxation | 7 (3.38) |
| | Aphakia (dropped lens) | 5 (2.42) |
| | Decentered IOL | 3 (1.45) |
| **Posterior segment** | | |
| Vitreous | Hemorrhage | 21 (10.14) |
| | Prolapse | 10 (4.83) |
| Retina | Detachment | 11 (5.31) |
| | tear | 2 (0.97) |
| | Dialysis | 1 (0.48) |
| | Fibrosis | 1 (0.48) |
| | Intraretinal haemorrhage | 8 (3.86) |
| | Macular hole | 2 (0.97) |
| | Commotion retinae | 6 (2.90) |
| Choroid | Rupture | 5 (2.42) |
| | Prolapse | 13 (6.28) |
| | Detachment | 1 (0.48) |
| Optic nerve | Traumatic optic neuropathy | 3 (1.45) |
| Others | Intraocular foreign body | 6 (2.90) |
| | Endophthalmitis | 2 (0.97) |

Table 3 presents the distribution of ocular tissue involvement and complications. Corneal laceration 51 (24.64%), subconjunctival hemorrhage 47 (22.71%), scleral laceration 38 (18.36%), and corneal foreign body 38 (18.36%) were among the most commonly observed findings.

**Table 4:** Associated Injury

| Associated with other Injuries | Number (%) |
|---|---|
| Yes | 24 (11.59) |
| No | 183 (88.41) |

Table 4 shows the presence of associated systemic or bodily injuries. Most patients 183 (88.41%) had no associated injuries, while 24 (11.59%) had additional injuries.

### Management and Visual Outcomes

Surgical intervention was required for 158 (73.49%) of the eyes. At presentation, only 21 (9.77%) of eyes had good vision (6/12 or better), while 41 (19.07%) were classified as blind. Following management, at the three-month follow-up, the proportion of eyes with good vision improved to 57 (26.51%), and the rate of blindness decreased to 29 (13.49%).

**Table 5:** Visual Acuity at Presentation

| Grade of Visual Acuity | Number (%) |
|---|---|
| Good Vision (≥6/12) | 21 (9.77) |
| Visual Impairment (6/18 – 6/60) | 149 (69.30) |
| Blindness (<6/60 – No PL) | 41 (19.07) |
| Could not be assessed | 4 (1.86) |

Table 5 illustrates the visual acuity at presentation. The majority of eyes had visual impairment 149 (69.30%), while blindness was present in 41 (19.07%) and good vision in only 21 (9.77%) of eyes.

**Table 6:** Initial Management

| Initial Management | Number (%) |
|---|---|
| Surgical | 158 (73.49) |
| Medical | 55 (25.58) |
| Observation | 2 (0.93) |

Table 6 presents the initial management of ocular trauma. Surgical management was required in the majority of eyes 158 (73.49%), while medical treatment was provided in 55 (25.58%) of cases.

**Table 7:** Final Visual Outcome After 3 Months

| Grade of Visual Acuity | Number (%) |
|---|---|
| Good Vision (≥6/12) | 57 (26.51) |
| Visual Impairment (6/18 – 6/60) | 125 (58.14) |
| Blindness (<6/60 – No PL) | 29 (13.49) |
| Could not be assessed | 4 (1.86) |

Table 7 shows the final visual outcome after 3 months. Visual impairment remained the most common outcome 125 (58.14%), while good vision improved to 57 (26.51%) and blindness was observed in 29 (13.49%) of eyes.

## Discussion

The findings of this study provide critical insights into the epidemiological characteristics, clinical profiles, and visual outcomes of ocular trauma in a tertiary care setting in Bangladesh. By analyzing 207 participants (215 eyes), this research elucidates prevailing injury patterns and risk factors, offering a robust foundation for targeted preventive strategies and public health interventions.[3]

The overwhelming male predominance observed in our cohort (81.16%) aligns with global and regional trends, where men are disproportionately exposed to occupational hazards and high-risk outdoor activities.[4,7] Our results closely mirror findings from a rural hospital in Central India (81.5% male) and a tertiary center in India (80.5% ) male.[4,8] Furthermore, the high concentration of injuries in the 21–30 age group 68 (32.85%) underscores the vulnerability of the most economically productive segment of society. This demographic trend is a recurring theme in South Asian ocular trauma literature, emphasizing the significant socioeconomic burden resulting from productivity loss in young adults.[3,4,16]

The workplace emerged as the primary site of injury in 61 (29.47%) of cases, a figure comparable to the 26.3% reported in Indian clinical profiles.[4] While this is slightly lower than the 34.5% reported in Singapore, the disparity likely reflects differences in industrial safety enforcement and urban-industrial density.[17] A critical and alarming finding in this study was that 98.55% of patients were not using protective eyewear at the time of injury. This pervasive non-compliance is consistent with existing literature, where rates of non-use in high-risk occupations often exceed 95% and directly contributes to the high burden of severe preventable injuries observed in our cohort.[17,18] Such data highlight a significant failure in occupational health education and necessitate urgent intervention in both industrial and agricultural sectors.[11]

In this study, open-globe injuries accounted for 131 (63.29%) of cases—a rate significantly higher than the

41.5% reported in Pakistan and 45.3% in rural India.[7,8] This higher prevalence likely reflects the nature of our tertiary center as a referral hub for the most complex mechanical traumas that exceed the management capabilities of primary facilities. The data also reveal a high frequency of anterior segment involvement, particularly corneal lacerations 51 (24.64%) and subconjunctival hemorrhages 47 (22.71%). These findings align with regional research in Nepal and India, which identifies the anterior segment as the primary site of trauma and emphasizes the critical necessity of timely surgical intervention to mitigate adverse outcomes.[16,19]

The visual prognosis following ocular trauma is heavily influenced by the mechanism of injury and the initial visual acuity.[1,20] Our study observed a significant post-intervention improvement, with "Good Vision" (6/12 or better) increasing from 21 (9.77%) at presentation to 57 (26.51%) at the three-month follow-up. This trend supports the efficacy of current surgical and medical protocols in achieving meaningful visual recovery in a subset of patients.[2,4,14] However, the persistence of blindness in 29 (13.49%) of eyes—despite a reduction from the initial 41 (19.07%) underscores the devastating potential of severe mechanical trauma, especially in cases involving the posterior segment or globe rupture.[20,21]

The high prevalence of visual impairment and poor initial vision at presentation highlights the urgency of public health initiatives. Delayed presentation remains a significant hurdle; while early presentation is consistently linked to better outcomes.[22] Delays are often driven by geographical distance, economic constraints, and a lack of awareness regarding the severity of ocular symptoms.[23,24] In resource-limited settings, these barriers are compounded by limited access to comprehensive follow-up care.[23]

Future research should investigate the socioeconomic and cultural determinants influencing injury incidence and treatment adherence. Furthermore, the disparities in outcomes across different age groups warrant exploration to tailor age-specific interventions.[7] To address these challenges, we advocate for community-based educational campaigns that emphasize the importance of protective eyewear and the need for prompt consultation, even for seemingly minor injuries, to prevent permanent disability.[1,16,25] Such measures are vital for enhancing the overall effectiveness of ophthalmic care and reducing the burden of preventable blindness in traditionally "safe" environments, such as the home or small-scale workplaces.[9,26]

**Limitations**

While providing valuable clinical insights, this study has several limitations:

- **Referral bias**: As a single-center study at a tertiary hospital, our findings are skewed toward severe mechanical trauma—such as the high rate of open-globe injuries—and may not reflect patterns in primary or secondary care settings.
- **Follow-up duration**: The three-month follow-up is adequate for primary surgical recovery but insufficient to capture late-onset complications, such as traumatic glaucoma or secondary retinal detachment.
- **Recall bias**: Relying on patient or guardian recall for injury mechanisms and timing risks inaccuracies in the reported interval between trauma and presentation.
- **Geographic constraints**: With a primarily urban population, the findings may not capture rural Bangladesh's distinct agricultural trauma patterns or systemic care barriers.
- **Limited scope of behavioral data**: Although socioeconomic status was assessed via income, other factors-such as health literacy or pre-presentation use of traditional medicine-were not comprehensively analyzed.

**Conclusion**

This observational study examined the epidemiology and clinical outcomes of ocular trauma at a tertiary eye hospital in Bangladesh and found that injuries predominantly affected young, economically active males, with workplace-related accidents being the most common. The high frequency of open-globe injuries and the low use of protective eyewear highlight the largely preventable nature of these events. Although most patients required surgical intervention, specialized care resulted in significant visual improvement. Given the substantial socioeconomic burden, stronger occupational safety measures, greater promotion of protective eyewear, public awareness regarding timely eye care, and the establishment of a national ocular trauma registry are essential to reduce ocular morbidity and its broader impact.

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