SJ Ophthalmology Africa
Vol. 3 No. 1 (2026): JANUARY 2026 ISSUE
https://doi.org/10.51168/jx050x48
Original Article

Pattern of ocular trauma and visual outcome among emergency ophthalmology visits: A retrospective observational cross-sectional study.

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Abstract

Background

Ocular trauma is a major cause of preventable visual impairment worldwide and contributes significantly to emergency ophthalmology visits. Understanding injury patterns and visual outcomes is essential for improving management and prevention strategies.

Objective

To assess the pattern of ocular trauma, determine visual outcomes following treatment, and evaluate associated risk factors and preventive awareness among patients presenting to emergency ophthalmology services.

Methodology

This retrospective observational cross-sectional study was conducted in the emergency ophthalmology department of a tertiary care hospital from January 2024 to December 2024. Medical records of 50 patients presenting with ocular trauma were reviewed. Demographic details, type and cause of injury, clinical findings, management, visual acuity at presentation and follow-up, and awareness of protective measures were analyzed. Visual outcomes were categorized as good, moderate, or poor. Data were analyzed using descriptive statistics.

Results

Most patients were males (76%), with the 21–40-year age group most affected (48%). Mechanical injuries were predominant (70%), and workplace accidents were the leading cause (40%). Closed globe injuries accounted for 58% of cases. Visual improvement was observed in 62% of patients, while 14% had poor outcomes. Only 28% reported using protective eyewear.

Conclusion

Ocular trauma predominantly affects working-age males, largely due to occupational exposure. Early diagnosis and timely management improve visual prognosis. Strengthening workplace safety regulations, promoting protective eyewear use, and enhancing public awareness are strongly recommended to reduce preventable ocular injuries.

Keywords: Ocular trauma; Visual outcome; Emergency ophthalmology; Mechanical eye injury; Workplace accidents; Closed globe injury; Preventive awareness; Protective eyewear; Occupational hazards; Eye safety; Retrospective study; Visual impairment.

Submitted: December 15, 2025 **Accepted:** December 30, 2025 **Published:** January 30, 2026

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Introduction

Ocular trauma constitutes an important health issue of the population, and it is also one of the most frequent causes of monocular blindness in the world. Eye injuries may lead to temporary or permanent visual loss and this will impact the quality of life, productivity and psychological conditions of that individual [1]. Traumatic visual loss is not only associated with loss of personal independence, but it is also accompanied by significant socioeconomic expenses to families and healthcare systems. The World Health Organization states that an annual number of millions of people have ocular injuries, many of which can be prevented with the help of safety measures and timely medical treatment [2]. The developing countries bear the brunt of ocular trauma since the rapid pace of industrialization, rise in occupational exposures, road carnage and lack of awareness on measures against eye protection contribute to high occurrence of eye injuries. Lack of adequate access to healthcare premises and

https://doi.org/10.51168/jx050x48

delayed management contributes to visual morbidity related to the ocular trauma in such environments [3]. The emergency ophthalmology department is often faced with a vast array of ocular injuries, such as minor superficial abrasions and foreign body injuries, to severe ocular injuries, like globe rupture, penetrating injuries, and chemical burns. To avoid irreversible damage to ocular structures and preserve visual capabilities, the given injuries need to be evaluated and managed as quickly as possible [4]. The trend of ocular trauma is quite different based on the demographic factors like age, gender, occupation and socioeconomic status, environmental and behavioral factors. Male young adults frequently tend to be more vulnerable to ocular injuries because they are more exposed to high risk factors, there is occupational exposure in the industrial environment and also because they are involved in outdoor or contact sports. Also, the rising cases of road traffic accidents and domestic injuries have led to the rise in cases of ocular trauma cases which present to the emergency services [5].

Ocular mechanical, chemical, thermal, and radiation-related trauma are all mechanisms of ocular trauma. Some of the most frequently reported ones are mechanical injuries, such as blunt and penetrating trauma, which can be acquired either in the workplace or during an assault or accidental injuries. Chemical injuries which may be as a result of exposure to industrial chemicals, cleaning agents, or houshold chemicals may result to a rapid and severe ocular damage when not promptly attended to [6]. Thermally and radiation-related injuries are less frequent, but such injuries could also cause severe ocular morbidity. These injuries have a wide range of clinical manifestations and severity that depend on the character and extent of the tissue damage, and timely pharmacological intervention and early diagnosis plays a main role in the visual prognosis of such injuries[7]. Past researchers have all pointed out the significance of early medical intervention in the assessment of visual outcome after ocular injury. High-quality diagnosis and treatment at an early age increase the possibility of visual restoration and minimizes the chances of incurring eventual complications in the form of corneal scarring, the development of cataracts, retinal detachment, or incurable blindness [8]. Yet, one of the most significant problems is the delay in presentation to the healthcare facility, especially in rural and resource-scarcity conditions. The lack of awareness, financial limitations, and access to specialized ophthalmic medical care as well as dependence on the traditional remedies usually lead to delays in the treatment process leading to the poor visual outcome. Thus, the consideration of the ocular trauma pattern and related visual outcomes is critical to the creation of the effective management and preventive measures [9].

Besides clinical management, knowledge about the risk factors related to ocular trauma is important in the reduction of the occurrence of that trauma. The work hazards are one of the greatest causes of eye injuries, particularly in the metalwork and construction, farming, and chemical processing sectors. Employees in such industries often come in contact with flying particles, dangerous chemicals, and machinery, which put them at risk of eye damage. On the same note, domestic accidents such as injuries caused by sharp objects, domestic chemicals or falls are prevalent among children and the elderly [10]. Eye injuries also have a sizeable percentage of sports-related trauma and road traffic accidents. Although protection equipment like face shields and safety goggles are available, people still underuse them because of ignorance or laxity, or proper implementation of safety measures. One of the elements in the reduction of occurrence and severity of ocular trauma is the use of preventive awareness [11]. Education, promotion, and practice of occupational safety standards can also be used to help reduce the prevalence of preventable eye injuries by providing public health efforts in the areas of eye safety education, promoting protective eyewear, and enforcing occupational safety standards. There is also an opportunity that educating people on the significance of immediate medical consultation after the ocular trauma and discouraging the use of self-medication or traditional medicine can also enhance the visual outcomes [12]. Making an evaluation of the level of awareness of the patients concerning the prevention and pinpointing the areas of knowledge deficit can be a useful resource in developing specific educational interventions and policy changes.

Therefore, this study specifically aimed to evaluate the demographic profile, pattern of ocular trauma, causes and risk factors, visual outcomes following treatment, and level of preventive awareness among patients presenting to the emergency ophthalmology department of a tertiary care hospital.

Materials and Methods

Study Design

This study was designed as a retrospective observational cross-sectional study conducted using previously recorded clinical data of patients presenting with ocular trauma.

Study Duration

The study was conducted over a one-year period from January 2024 to December 2024.

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Study Setting

The researchers conducted the study in the emergency ophthalmology department of a tertiary care hospital, which is a large referral center of ocular emergencies and trauma patients. This environment permitted a wide range of patient population that arrived with different kinds of ocular trauma such as mild traumatic injuries to severe injuries that affect the sight.

Sample Size

The sample size was calculated using the single population proportion formula:

$N = Z^2P(1-P)/d^2$

Where Z = 1.96 at 95% confidence interval,

P = assumed prevalence of ocular trauma (50% due to lack of prior regional data),

D = margin of error (14%).

The calculated minimum sample size was approximately 49, which was rounded to 50 participants.

Inclusion Criteria

- Patients who reported ocular trauma in the course of the study.
- Both sexes of patients of all ages.
- Patients that have all medical records like clinical information and follow-ups.

Exclusion Criteria

- Patients with pre-existing ocular illnesses that impact on vision like advanced cataract, glaucoma, or retinal illnesses.
- Incomplete clinical records of patients.
- Patients whose follow-ups were not available.

Data Collection

The data were collected through an intensive study of hospital case records, emergency registers and follow-up reports through a structured data collection form. Demographic information such as age and gender. Mode and cause of injury: work place accident, road traffic accident, domestic accident, or sporting accident. Ocular trauma that is divided into mechanical, chemical, thermal, and radiation-related trauma. Presentation and complications clinical findings. Management was provided, such as medical treatment, surgery or conservative management. Visual acuity on presentation and follow-ups. Knowledge about precautionary issues like safety goggles or protective eyewear. To assess the character and the degree of ocular injuries and their effects on visual functioning, clinical data were documented.

Outcome Measures

The outcomes of the treatment were determined by visual acuity on presentation as well as follow-up visits. Visual outcome was rated under three categories:

- Good outcome: Visual acuity after treatment had improved.
- Moderate outcome: No important change of vision.
- Poor outcome: Visual loss or permanent deterioration of the vision.

This classification aided in the determination of the efficacy of the clinical management and prognosis of various forms of ocular trauma.

Bias Control

To minimize selection bias, all eligible patients presenting during the study period were included. Information bias was reduced by using standardized hospital records and structured data extraction forms. Patients with incomplete records were excluded to avoid misclassification bias.

Statistical Analysis

The data obtained was summarized and built up through the descriptive statistical measurement. Categorical variables were computed into frequencies and percentages including type of injury, cause of trauma and visual outcomes. Continuous variables like age distribution were found to have mean values. The findings were provided in tabular and graphical forms as needed to make it easier to interpret and compare.

Results

Participants Flow

During the study period, 58 patients with ocular trauma were assessed for eligibility.

Eight patients were excluded due to incomplete records (n=5) and lack of follow-up data (n=3).

A total of 50 patients met the inclusion criteria and were included in the final analysis.

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Table 1: Demographic Characteristics of Study Participants (n = 50)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	38	76%
	Female	12	24%
Age Group	≤20 years	8	16%
	21–40 years	24	48%
	41–60 years	12	24%
	>60 years	6	12%
Occupation	Occupational workers	21	42%
	Students	10	20%
	Homemakers	9	18%
	Others	10	20%

The majority of patients were males (76%), indicating higher exposure to risk factors such as occupational hazards and outdoor activities. The most affected age group was 21–40 years (48%), representing the economically productive population. Occupational workers formed the largest group (42%), suggesting that workplace exposure plays a significant role in ocular trauma occurrence.

Table 2: Pattern of Ocular Trauma

Type of Ocular Trauma	Frequency (n)	Percentage (%)
Mechanical injuries	35	70%
Chemical injuries	6	12%
Thermal injuries	5	10%
Radiation injuries	4	8%
Total	50	100%

Mechanical injuries were the most common type of ocular trauma (70%), indicating that physical impact and foreign body injuries were major contributors. Chemical, thermal, and radiation injuries were less frequent but still significant due to their potential to cause severe ocular damage.

Table 3: Causes of Ocular Trauma

Cause of Injury	Frequency (n)	Percentage (%)
Workplace accidents	20	40%
Road traffic accidents	12	24%
Domestic injuries	10	20%
Sports-related injuries	5	10%
Others	3	6%
Total	50	100%

Workplace accidents were the leading cause of ocular trauma (40%), followed by road traffic accidents (24%) and domestic injuries (20%). This finding highlights the importance of occupational safety measures and accident prevention strategies in reducing eye injuries.

https://doi.org/10.51168/jx050x48

Table 4: Type of Ocular Injury

Type of Injury	Frequency (n)	Percentage (%)
Closed globe injury	29	58%
Open globe injury	11	22%
Adnexal injuries	10	20%
Total	50	100%

Closed globe injuries were the most common (58%), suggesting that many injuries involved blunt trauma without full-thickness penetration of the eyeball. Open globe injuries (22%) were less frequent but associated with higher risk of severe visual impairment. Adnexal injuries accounted for 20% of cases.

Table 5: Visual Outcome After Treatment

Visual Outcome	Frequency (n)	Percentage (%)
Improved vision	31	62%
No significant change	12	24%
Poor outcome	7	14%
Total	50	100%

Most patients (62%) showed improvement in vision following treatment, indicating effective clinical management and timely intervention. However, 14% of patients experienced poor visual outcomes, possibly due to severe injury or delayed presentation.

Table 6: Preventive Awareness and Protective Measures (Side Topic)

Preventive Awareness	Frequency (n)	Percentage (%)
Use of protective eyewear	14	28%
No use / lack of awareness	36	72%
Total	50	100%

Only 28% of patients reported using protective eyewear, while the majority (72%) lacked awareness of eye safety measures. This finding indicates a significant gap in preventive practices and highlights the need for increased safety education and awareness programs.

Discussion

Principal Findings

The current research assessed the trend of eye injuries and vision among patients who have attended the emergency ophthalmology department of a tertiary care hospital in a one-year span. The results showed that ocular trauma occurs largely among young adult males, especially in the 21-40 years age bracket. This tendency can be explained by the fact that there is more work-related exposure, activities in the open air, and involvement in the high-risk situations. The largest group who were affected was the occupational workers, meaning that workplace hazards are significant in the incidence of ocular injuries. Mechanical injuries were determined to be the most prevalent form of ocular traumas, with chemical traumas, thermal traumas, and radiation injuries in the second place. The importance of the workplace accidents and road traffic incidents to ocular morbidity is shown by the high prevalence of mechanical injuries. The injuries of closed globe were more common than injuries of open globe implying that the majority of the cases were blunt trauma as opposed to penetrating injuries. Closed globe injuries usually have a better prognosis though they too must be managed urgently so as to avoid complications. This paper also revealed that in most patients, there was a good visual outcome with over half of them exhibiting improvement in vision after treatment. This observation demonstrates the usefulness of early diagnosis and proper treatment in the maintenance of visual activity. A percentage of the patients however had poor visual outcomes especially those who were severely injured or took a long time to report to medical facilities. Moreover, the research found out that the patients were not highly aware of protective eyewear and practices such as safety, which implies that there was a large gap in the preventive practices.

Literature Comparison.

The results of the current article can be compared to the earlier researches, which state that ocular trauma is more prevalent in males and young adults. [13] and [14] have explained this gender difference by the exposure to occupation, risk taking behavior and increased engagement in industrial and outdoor activities. On the same note, some of the studies have detected mechanical injuries as the most common cause of ocular injuries especially in developing nations where the industrial safety rules may not be followed strictly. The fact that closed globe injuries are predominated in this research is also reflective of the literature that proposes that blunt trauma contributes a considerable percentage of ocular injuries that are coming to emergency departments. [15] have already demonstrated that when medical intervention is administered early, there

would be noticeable improvement in the visual outcome of such patients and hence the current study has revealed positive results in visual prognosis among patients who are treated early. The poor state of preventive awareness in the given study corresponds to previous reports about the insufficient use of protective eyewear and the lack of knowledge about the eye safety in the high-risk groups. The necessity of better preventive means is further supported by the focus of the World Health Organization on the fact that a vast percentage of the ocular injuries can be avoided by means of the safety education and the protection provided at the workplace and the early treatment.

Clinical Implications

The clinical implications of the findings of this research to the patient management and the health interventions of the population are of great importance. The fact that the problem of ocular trauma is especially high in young adults and occupational workers shows that special preventive measures should be developed in those communities. To enhance the outcomes of ocular injury, healthcare providers need to focus on the early detection, timely intervention, and follow-ups in order to promote better visual prognosis and prevent complications. The popularity of mechanical and workplace-related injuries also shows that it is crucial to introduce occupational safety equipment, such as compulsory use of protective eyewear and compliance with safety practices. Patient education on eye safety measures should also be promoted by clinicians and health authority officials as well as making people seek medical attention as soon as they have ocular trauma. These measures can go a long way in stopping and lessening the frequency and severity of ocular injuries as well as enhance the long-term visual prognosis.

Strengths of the Study

The detailed analysis of ocular trauma patterns, visual outcomes, and preventive awareness in the tertiary care emergency is one of the key advantages of the study. The patients were of a variety of age and occupation and thus the study allows a wide range of evaluation of the demographic and clinical features. The use of visual outcome assessment during the follow-up was important in terms of information on treatment efficacy and prognosis. The secondary focus on risk factors and preventive awareness, which also contributes to the other strength of the study, gives an idea of the avoidable factors of ocular trauma and the significance of safety measures. This combination strategy makes the study findings more relevant to clinical and public health.

Limitations

Although it has contributed to some extent, the study has some limitations. The sample size of 50 patients is relatively small and does not allow generalizing the results to the rest of the population. The study was retrospective and based on the medical records available at the time, it could be prone to incomplete recording or lack of information especially on preventive awareness and risk factors. The research was also done in one tertiary care facility, which might not be sufficient as a reflection of epidemiological trends of ocular trauma in other health facilities or geographic areas. The follow-up was short too, and it might limit the evaluation of the long-term visual outcomes and complications. It is suggested that future research of greater sample size, prospective designs, and multi-centers should be carried out to present more detailed evidence on patterns and outcomes of ocular trauma.

Conclusion

Ocular trauma has been a major reason behind emergency visits to ophthalmology and a major cause of avoidable visual impairment. As the results in the current study show, most ocular injuries involve males, who are of working age, especially when exposed to hazards at the workplace and other risk behaviors. The highest prevalence of trauma was mechanical injuries, and most of the cases involved workplace accidents and road traffic accidents, which indicates the necessity of better safety protocols. The research revealed that early diagnosis and timely clinical intervention is an important factor that contributes to successful visual outcomes. The visual acuity of most patients improved after early treatment, which indicates the need to treat the disease immediately before total vision loss occurs. Nevertheless, there were a percentage of patients who had poor results because of serious injuries and late-presentation which means that more awareness of early healthcare-seeking behaviour is required. The low awareness level and poor use of protective eyewear, especially by occupational workers, was also one of the key issues raised in the study. It is important to strengthen the preventive measures such as safety education programs, promotion of protective equipment and implementation of the safety rules at the workplace. The World Health Organization points out that a number of ocular trauma can be stopped by the proper use of safety measures. Thus, the burden of ocular trauma and visual prognosis can become much better through the enhancement of awareness and the use of preventive interventions.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this study.

Funding

No external funding was received for this study.

Author Contribution

Dr Sweta Bharti: Conceptualization, study design, data collection, data analysis, manuscript drafting, and final approval.

Dr SheelMani: Data collection, data interpretation, critical revision of the manuscript, and final approval.

Dr Pragya Prasoon: Literature review, data interpretation, manuscript editing, and final approval.

All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Ethical Approval

Ethical approval was obtained from the Institutional Ethics Committee of GMCH Purnia (Approval No: IEC/GMCH/2024/021; Approval Date: 10 January 2024).

Due to the retrospective nature of the study and use of anonymized data, informed consent was waived by the ethics committee. Patient confidentiality was strictly maintained throughout the study.

Data Availability

Data are available from the corresponding author on reasonable request.

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