



Original Research Article

An observational study on medicolegal profile of ocular injuries at SMS medical college and attached Hospitals, Jaipur during 2023-2024

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Abstract

Introduction: Ocular trauma, involving injuries to the eye and surrounding structures, remains one of the leading causes of visual impairment and blindness worldwide, disproportionately affecting individuals in low- and middle-income countries.

Aim: is to conduct a comprehensive assessment of the medicolegal profile of ocular trauma cases presented at SMS Hospital, Jaipur, within the study period of 2023-2024, focusing on injury patterns, severity, and demographic attributes.

Objectives: are to analyse the morphological characteristics, to evaluate the severity of ocular trauma and to profile the demographic variables and medicolegal attributes of ocular trauma cases.

Materials and Methods: After obtained approval from the Review Research Board and the Institutional Ethics Committee, data collection was initiated. A structured pro forma was used to collect demographic information, injury characteristics, and medicolegal details from each participant.

Results: A total of 100 patient's data were included for the study. The majority were males (n= 85 [85.0 %] with male-female ratio of 5.67: 1). Vehicle accidents were most common cause of injury 45 [45%], followed by fist injury were 42[42%] and other cause were such as injuries from metals 4 [4%], sticks 3[3%], blunt objects 1[1%], branches 1[1%], falls1[1%], glass1[1%], stones1[1%], and 1[1%]. Simple injuries accounted for 66% (66 individuals), while 33% (33 individuals) had grievous injuries, and 1% had an unspecified nature of injury, indicating that most injuries were less severe. Unilateral eye involvement was most common with varied depths. Most participants with accidental-fist injuries and vehicle accidents achieved a full recovery, but vehicle accidents also had the highest proportion of cases resulting in permanent disability (17.8%).

Keywords: Ocular Trauma (OT), Ocular Injury, Visual impairment.

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1. Introduction

Ocular trauma is an injury to the eye, eyelid or surrounding bone around the eye. Eye is protected anatomically from direct injuries by underlying the defence structures such as lids, eyelashes, projecting margins of orbit, however ocular injuries occurs in several ways. The original BETT classification system defined ocular injuries as a closed or open globe without reference to accompanying periocular injuries.¹¹ The modified BETT classification overcomes this globe bias by incorporating extraocular injuries with or without retained foreign bodies .

The WHO estimates that globally 55 million eye injuries occur each year restricting activities for more than a day with 750,000 cases requiring hospitalization which includes 200,000 open globe injuries. There are approximately 1.6 million blind people from injuries, additionally around 2.3 million people with bilateral low vision resulting from ocular trauma and almost 19 million people with unilateral blindness or low vision.² Ocular trauma is one of the most common causes of ophthalmic morbidity and monocular blindness throughout the world,³ hence ophthalmic injuries are grave and major public health issue globally. Varying mechanical forces in different cases owing to variations of circumstances; the injury of eye shows

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different patterns. Forensic professionals are required to determine the ocular injuries as medicolegal point of view.

2. Medicolegal Significance of Ocular Injuries

Medicolegal cases (MLCs) refer typically arise in situations involving injuries, assaults, accidents, occupational hazards, or any events where medical evidence is essential for judicial or legal proceedings. In the context of ocular trauma, medicolegal cases hold particular significance due to the unique nature of eye injuries and their potential role in vision which is a sensory organ too can leading cause to blindness. The relationship between ocular trauma and medicolegal cases can be outlined as follows:

1. **Criminal Cases:** Ocular trauma is often encountered in cases of physical assault, where injuries to the eye may result from blunt force, sharp objects, or chemical agents. The forensic analysis of such injuries can provide insights into the type of weapon used, the force applied, and the intent behind the act.
2. **Accidental Cases:** Road traffic accidents and workplace mishaps frequently result in ocular trauma. In such cases, forensic investigations help ascertain the cause of injury, determine liability, whether the injury was due to negligence or non-compliance with safety regulations.
3. **Self-Harm or Fabricated Injuries:** In certain instances, ocular trauma may be self-inflicted or fabricated to gain sympathy, financial benefits, or legal advantage. Forensic medicine plays a critical role in determining the plausibility of such claims by analysing the injury patterns.
4. **Occupational and Environmental Hazards:** Eye injuries sustained in industrial settings or hazardous environments often become medicolegal cases, particularly when questions of employer negligence or unsafe working conditions arise.
5. **Insurance and Compensation Claims:** The extent of ocular trauma, particularly in cases leading to visual impairment or blindness, often becomes central in claims for compensation or insurance settlements.

Ocular trauma is frequently encountered in medicolegal cases involving physical assaults, accidents, and, occasionally, cases of suspected self-harm.⁴ In assault cases, blunt or penetrating injuries to the eye can serve as critical evidence in identifying the type of weapon used, the force of impact, and the circumstances of the injury.⁵

Furthermore, the medicolegal assessment of ocular trauma is crucial for distinguishing between accidental injuries and those resulting from intentional harm. For

instance, in road traffic accidents, the pattern and severity of eye injuries can provide clues about the mechanics of the incident, aiding in the reconstruction of events for legal purposes. Similarly, in cases of workplace accidents, establishing whether an injury was due to negligence or non-compliance with safety protocols can have legal implications, particularly in jurisdictions where employers are held accountable for workplace safety. This study focuses on creating a medicolegal profile of ocular trauma cases documented in the Forensic Medicine and Ophthalmology departments at SMS Hospital, Jaipur. Through a detailed examination of these cases, the study seeks to identify common causes, types, and outcomes of ocular injuries and to explore demographic trends associated with these cases.

3. Materials and Methods

After approval from the Institutional Research Review Board and the Institutional Ethics Committee, a cross-sectional, hospital based descriptive observational study focusing on medicolegal profile on ocular trauma cases in Department of Forensic Medicine in collaboration with the Department of Ophthalmology at SMS Hospital, during March, 2023, to April, 2024. With completing all due formalities, After selection of cases as per inclusion and exclusion criteria's total of 100 cases were included for the study. Detailed history will be obtained from the patient / attendants in cases of minor. Then patient will be examined. All findings to eye injury and medicolegal details will be recorded as per pre-proposed proforma. After data collection, all relevant details will be entered in Microsoft excel data sheet. The data will be compiled and statistically analyzed. Results and conclusion will be derived.

4. Results

A total of 100 patients data were included for the study. Majority of male predominance, (with n=85 [85%] were male and only n=15 [15%] were female), with male-female ratio of 5.67 : 1) (**Figure 1**).

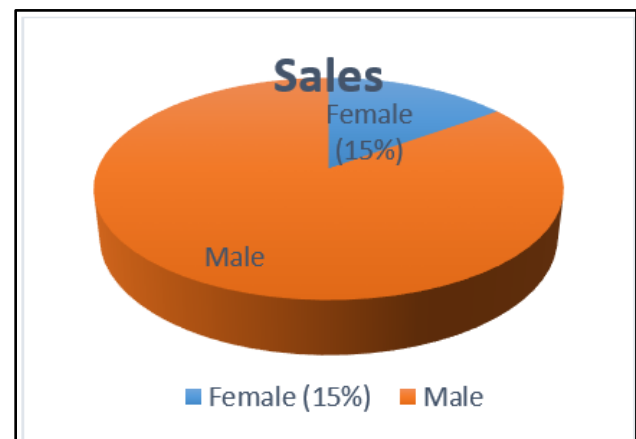


Figure 1: Gender wise distribution of ocular injuries cases.

Most of the subjects were graduates (n=51 [51%]), followed by high school (n=19[19%]), intermediate (n=16 [16%]), middle school (n=5 [5%]), primary school (n=7 [7%]), and illiterate (n=2 [2%]), reflecting a diverse educational background. Most participants earned (as per Modified Kuppuswamy Socio Economic Scale updated for the year 2021) between 15, 536-20, 714 (55%), followed by 10,357-15,535 (28%), 20,715-41,429 (16%), and 6,214-10,356 (1%), indicating that the majority had moderate family income levels. The majority were belonged to the upper-middle class (n=70 [70%]), followed by the lower-middle class (29%), and a small number from the upper-lower class (1%).

In our study, Vehicle accidents (n=45 [45%]) and accidental-fist injuries (n=42 [42%]) were the leading causes of injury related to various place of incidences such as open filed, ground, roads, on tree during fall or climb, machinery etc. Other causes, such as injuries from blunt objects, branches, falls, glass, metal, sticks, stones, and pointed objects, each accounted for a small fraction of cases, highlighting vehicle accidents and physical altercations as primary sources of ocular trauma (As Shown in **Table 1**). In this study, 73% (73 individuals) were found absent in Right eye vision loss, while 27% (27 individuals) experienced it followed by Vision loss in the left eye was present in 36% (36 individuals) and absent in 64% (64 individuals), suggesting a slightly higher incidence of left-eye vision loss compared to the right eye (as Shown in **Table 3**). Simple injuries were more frequent across all types of causes, however the study shows grievous injuries (n=40 [40%]) were due to vehicle accidents.

This study had majority of Abrasion injuries were (n=99 [99%]) 99 of cases in ocular trauma, followed by Contusion injuries were (n=96) 96% of cases, followed by Lacerations were present in 57% (n=57) of cases, followed by Eyelid injuries were noted 53% (n=53 individuals), followed by Corneo-scleral tears were found in 27% (n=27 individuals), followed by Anterior chamber injuries were in 18% (n=18 individuals), followed by Iris were observed damage in 10% (n=10 individuals), followed by Lens injuries were 3% (n=3 individuals) and Retina injuries were extremely rare, with only 1% (n=1 individual) (as shown in **Table 2**). In our study mostly abrasions were corneal and upto superficial layers. Out of all lacerations, majority of laceration in eye lid was quite common was 38(68%) cases of 56 cases of total. The depth of injuries varied between the right and left eyes, with common areas affected including the cornea (13 right, 16 left) and corneo-scleral tear (9 right, 16 left). Majority of participants with accidental-fist injuries and vehicle accidents achieved a full recovery, but vehicle accidents also had the highest proportion of cases resulting in permanent disability (17.8%).

Table 1: Cause of Injury (n=100) distribution in O

Cause of Injury	Frequency (%)
Vehicle Accident	45 (45%)
Fist Injury	42 (42%)
Injury with Metal	04 (04%)
Injury with Stick	03 (03%)
Blunt Object	01 (01%)
Branch of Tree	01 (01%)
Fall from Height	01 (01%)
Glass Injury	01 (01%)
Injury with Stone	01 (01%)
Pointed Object	01 (01%)
Total	100 (100%)

Table 2: Type of injuries in ocular trauma (OT)

Type of Injury (Each n=100)	Frequency (%)
Abrasion	99 (99%)
Contusion	96 (96%)
Laceration	57 (57%)
Eyelid Injuries	53 (53%)
Corneo-Scleral Tear	27 (27%)
Anterior Chamber injuries	18 (18%)
Iris injuries	10 (10%)
Lense injuries	03 (03%)
Retinal Tears	01 (01%)

Table 3: Vision loss distribution

(Each eye n=100)	Right Eye (%)	Left Eye (%)
Present	27 (27%)	36 (36%)
Absent	73 (73%)	64 (64%)
Total (%)	100 (100%)	100 (100%)

5. Discussion

In our study, 85% of participants were male, highlighting the gender disparity commonly observed in ocular trauma cases. This male predominance is consistent with findings from *Bauza et al. (2012)*,⁶ who reported that 96.7% of their work-related open-globe injury (OGI) series involved males. The higher male representation is often attributed to greater exposure to hazardous work environments and occupations involving manual labor or risky activities. Similarly, *Kushwaha et al. (2013)*⁷ observed that 84.4% of ocular trauma cases were male, primarily young adults engaged in physically demanding jobs. The trend reflects men's higher mobility and participation in outdoor activities, which increases their risk of injuries such as road traffic accidents (RTAs) and industrial incidents.

In our study, vision loss affected the left eye more frequently (36%) than the right eye (27%), a trend that has been observed in other ocular trauma studies. This pattern is potentially explained by handedness during daily activities,

where right-handed individuals might instinctively protect the left side of their body, leaving the left eye more exposed to injury. Similar findings were observed by *Kushwaha et al. (2013)*⁷

Specific types of ocular injuries in our study revealed critical insights into trauma mechanisms and their effects on the eye. *Tripathi et al. (2016)*⁸ observed Mechanical trauma was present in 169 (90%) patients with injury to globe in 129 (69%) patients and injury to lid or orbit without damage to the globe in 40 (21%) patients. Chemical injury was observed in 6 (3%) patients. Closed globe injury (CGI) was seen in 116 eyes and open globe injury (OGI) was noted in 29 eyes. Abrasions injury, affecting 99% of participants, highlighting the cornea's vulnerability as the eye's outermost protective layer. This finding aligns with *Panda et al. (2019)*⁹ who observed a similarly high frequency of abrasions, particularly in pediatric trauma cases involving blunt force impacts. Although less severe than other injuries, abrasions require prompt treatment to prevent complications such as infection or scarring. The high prevalence of abrasions emphasizes the need for protective measures, such as safety goggles in work and recreational environments.

Contusions were observed in 96% of participants, indicating that blunt trauma was a significant cause of ocular injuries. *Das and Sharma (2017)*¹⁰ similarly reported a high prevalence of contusions, often resulting from interpersonal violence, accidental impacts, or falls. These injuries frequently involve internal bleeding or swelling, necessitating vigilant monitoring to prevent secondary complications like glaucoma or angle recession. Lacerations were present in 57% of cases, often caused by sharp objects or physical altercations. *Gupta et al. (2021)*¹¹ also noted lacerations as a common form of trauma in assault-related injuries, emphasizing the risks associated with direct contact and sharp implements. Eyelid and conjunctival injuries were equally common, affecting 53% and 54% of participants, respectively. These injuries reflect the vulnerability of the eye's external structures in blunt trauma cases. *Sahu et al. (2024)*¹² observed that conjunctival injuries often result from the initial impact force, leading to minor tears or subconjunctival hemorrhages. Scleral injuries (51%) represented deeper trauma, often linked to severe blunt force impacts, consistent with findings by *Soni et al. (2022)*¹³. Corneal injuries (40%) and corneo-scleral tears (27%) further highlight the susceptibility of external and peripheral eye structures to both blunt and penetrating trauma. Anterior chamber involvement (18%) and less frequent injuries to the iris (10%), pupils (8%), and lens (3%) reflected varying trauma severities, with posterior chamber injuries (2%) being rare but significant when present. The absence of retinal and optic nerve injuries suggests that most cases in our study involved moderate trauma rather than high-impact or penetrating forces.

Most injuries in our study were classified as simple (66%), while 33% were categorized as grievous. Simple injuries, such as abrasions, contusions, and minor lacerations, often required conservative management, which was effective in 70% of cases. These findings are consistent with *Das and Sharma (2017)*¹⁰, who noted a similar trend of successful conservative management for moderate trauma cases. The simple injuries, which constituted 66% of cases in our study, align with the medicolegal definition of *simple hurt* under BNS 114. Conversely, grievous injuries, representing 33% of the cases, required surgical intervention and carried a higher risk of permanent damage. Injuries such as deep lacerations, lens involvement, or scleral tears fit the criteria outlined in BNS 116, with a subset involving permanent privation of vision classified under BNS 116(b).

The educational background of participants revealed that 51% were graduates, followed by 19% with high school education. Graduates were more likely to experience accidental fist injuries and RTAs, likely due to increased mobility and occupational exposure associated with higher educational levels. These findings align with *Mahalingappa et al. (2021)*¹⁴, who observed that individuals with higher education often engage in activities requiring frequent travel or interaction in urban environments, increasing their injury risk. *Discussion* 95

Conversely, lower-educated individuals were more prone to workplace injuries, often involving manual labor and industrial hazards. Occupationally, skilled workers (46%) were the most affected, reflecting the inherent risks associated with jobs requiring interaction with machinery, tools, or hazardous environments. *Rasool et al. (2023)*¹⁵ emphasized that occupations like construction, carpentry, and factory work expose individuals to unique risks of ocular trauma. The middle-income bracket accounted for 55% of participants, highlighting the limited access to safety gear and healthcare resources in this group. Upper middle-class individuals (70%) were more likely to recover fully due to better access to timely medical care, reflecting socio-economic disparities in trauma outcomes.

Study should be elaborately discussed with the significance of the results with the help of earlier work and reports.

6. Conclusion & Suggestions

The findings of OT revealed a significant male predominance, likely due to higher exposure to risk-prone activities such as driving and physical altercations. Vehicle accidents (Road Traffic Accidents) emerged as the leading cause of OT. The nature of OT injuries was predominantly superficial, with a majority involving abrasions, contusions, and lacerations that primarily affected the anterior segment of the eye, including the cornea and conjunctiva. Despite the prevalence of such ocular injuries, vision impairment was noted more frequently in the left eye, suggesting potential anatomical or situational factors that may predispose it to

greater vulnerability. Encouragingly, most cases were managed successfully with conservative treatment, with 90% of patients achieving full recovery. Promoting protective measures, such as mandatory use of laminated windshields in motor vehicles, use of goggles during driving could significantly reduce ocular injuries in road traffic accidents. Early police intervention in recurrent street fights is essential for preventing repeat incidents. Establishing monitoring and de-escalation protocols, coupled with police-community collaboration, can help mitigate violence-related injuries. Including public members in police meetings to address community concerns and improve transparency can foster trust and better management. Governments, policy makers should prepare preventive guidelines in this regards to minimize the OT cases.

7. Conflict of Interest

None.

8. Ethical Approval

Approval was obtained from the Institutional Ethical Committee of S.M.S. Medical College & Attached Group of Hospitals, Jaipur.

9. Source of Funding

None.

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