



To Analyze the Morphological Characteristics of Ocular Trauma in Medicolegal Cases and Its Effect on Vision, At SMS Medical College and Attached Hospitals, Jaipur During 2023-2024.

Dr. Manish Kumar Dewat¹, Dr. R. K. Punia², Dr. Surya Bhan Kushwaha³

- 1- Senior Resident, Department of Forensic Medicine & Toxicology, ESIC Medical College and Model Hospital, Jaipur.
- 2- Senior Professor, Department of Forensic Medicine & Toxicology, S.M.S Medical College & Attached group of Hospitals, Jaipur.
- 3- Postgraduate student, Department of Forensic Medicine & Toxicology, S.M.S Medical College & Hospital, Jaipur.

CORRESPONDING AUTHOR – Dr. Manish Kumar Dewat (Senior Resident, Department of Forensic Medicine & Toxicology, ESIC Medical College and Model Hospital, Jaipur)

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KEYWORDS

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ABSTRACT:

Background: Injuries to the eye are a significant public health concern and one of the leading causes of vision loss in one eye across the globe. Such trauma frequently arises in medicolegal situations, including road accidents, violent assaults, and workplace incidents. Analyzing the morphological features of these injuries can provide crucial information about the trauma's nature and prognosis, supporting both clinical care and legal processes.

Aim: To analyze the morphological patterns of ocular trauma and assess their effect on vision in patients presenting with medicolegal injuries at SMS Medical College and its associated hospitals in Jaipur during the period 2023–2024.

Materials and Methods: A descriptive cross-sectional study was carried out on 100 patients with documented medicolegal ocular trauma at SMS Hospital from March 2023 to April 2024. Patients with direct eye injuries who gave informed consent were included. Data were compiled and evaluated using Microsoft Excel to identify common injury patterns, visual outcomes, and their medicolegal relevance.

Results: Out of 100 cases, 85% were males, with an almost equal distribution between rural and urban backgrounds. The most common causes of trauma were road traffic accidents (45%) and physical altercations, particularly fist injuries (42%). Abrasions (99%) and contusions (96%) were the most prevalent forms of injury. Visual impairment was more commonly observed in the left eye (36%) than the right (27%).

Conclusion: Ocular trauma affected individuals from both rural and urban areas, with a marked predominance in males, often due to occupational and road-related hazards. Blunt trauma was the most common mechanism, with the left eye being more frequently involved. Strengthening preventive measures through the use of safety gear and increasing public awareness about eye protection can help reduce the occurrence and severity of such injuries.



INTRODUCTION

Ocular trauma is a critical public health issue and a major cause of monocular blindness worldwide. Morphological analysis of ocular injuries can provide valuable insight into injury mechanisms and help predict visual prognosis, thereby assisting both medical and legal evaluations.^(1,2) Globally, it is estimated that 55 million eye injuries occur each year, with about 750,000 cases severe enough to require hospital admission.³ Open-globe injuries where there is a full-thickness wound of the eye wall account for a significant portion of these severe cases, often resulting in irreparable vision loss.⁴ In fact, approximately 1.6 million individuals are permanently blind due to ocular trauma, while an estimated 2.3 million suffer from bilateral low vision. An additional 19 million people are affected by unilateral blindness or low vision resulting from eye injuries.⁵ The types of ocular injuries are diverse, ranging from blunt trauma, which can cause contusions and internal damage, to penetrating injuries involving sharp objects or foreign bodies that can severely damage the internal structures of the eye.⁶

Ocular trauma plays a pivotal role in forensic medicine, as the assessment of eye injuries often provides critical evidence in a variety of medicolegal cases. Forensic evaluation focuses on analyzing the type, mechanism, and intent of the injury to aid in legal investigations. This includes determining whether the injury was accidental, intentional, or self-inflicted, and correlating findings with the reported circumstances. Forensic experts rely on meticulous documentation, including photographic evidence and detailed descriptions of the injury pattern, to assist in crime scene reconstruction and legal proceedings. Injuries to the eye and surrounding structures are frequently encountered in cases of physical assaults, road traffic accidents, and workplace incidents, making forensic expertise essential in identifying causative factors, the potential use of weapons, and the dynamics of the event. Moreover, the medicolegal implications extend to assessing the extent of visual impairment for determining compensation, legal responsibility, or criminal intent—highlighting the integral role of forensic analysis in the management of ocular trauma cases.^(7,8)

Ocular injuries hold significant medicolegal importance, often arising in cases of assault, accidents, occupational hazards, or suspected self-infliction. In criminal cases, forensic analysis of eye trauma helps identify the weapon used, force applied, and intent. Accidental injuries, such as road traffic or workplace incidents, require investigation to determine liability or negligence. Self-inflicted or fabricated injuries may be assessed for authenticity. Occupational injuries involve evaluating employer compliance with safety norms. In compensation or insurance claims, accurate documentation of ocular damage and expert forensic opinion are essential. Thus, ocular trauma plays a vital role in linking medical findings to legal proceedings.

AIM OF THE STUDY

To assess the morphological characteristics of ocular trauma in medicolegal cases and evaluate its impact on visual acuity in patients presenting to SMS Medical College and its attached hospitals, Jaipur, during 2023–2024.

MATERIALS AND METHODS

After getting approval from the Institutional Ethics Committee and Research Review Board, a cross-sectional, hospital-based observational study was conducted at the Departments of Forensic Medicine and Ophthalmology, SMS Hospital, from March 2023 to April 2024. The sample size was calculated using a 46% prevalence rate at 95% confidence with 10% precision, requiring at least 95 cases. For convenience, the sample size was rounded to 100.¹¹ Medico-legal cases of direct ocular trauma of any age and sex with informed consent included in study. Cases of indirect trauma, vision issues due to metabolic or endocrine disorders, and cases without consent excluded from study. Detailed history was taken from patients or attendants (in case of minors), followed by a thorough eye and medicolegal examination. All findings were recorded in a pre-designed form. The collected data was entered into Microsoft Excel and analyzed statistically to draw meaningful results and conclusions.

OBSERVATIONS & RESULTS

The present study was conducted by the Department of Forensic Medicine in collaboration with the Department



of Ophthalmology at SMS Hospital, Jaipur, from March 2023 to April 2024, focusing on the medicolegal profile of ocular trauma cases. Detailed ophthalmic and forensic examinations were conducted to analyze patterns of ocular trauma, correlate injury characteristics with demographic variables, and evaluate the severity and forensic implications of each case.

Table 1: Showing Gender Wise Distribution of Victims.

Gender	No. of Cases	Percentage
Male	85	85 %
Female	15	15 %
Total	100	100 %

The gender distribution of the study participants shows a significant male predominance, with 85% (85 individuals) being male and only 15% (15 individuals) female. This suggests a higher exposure or susceptibility of males to ocular trauma cases within the study population.

Table 2: Domicile Distribution

Domicile	Frequency	Percent
Rural	51	51 %
Urban	49	49 %
Total	100	100 %

The domicile distribution shows a nearly even split, with 51% (51 individuals) from rural areas and 49% (49 individuals) from urban areas. This balanced distribution indicates that ocular trauma cases affect both rural and urban residents equally.

Table 3: Cause of Injury Distribution

Cause of Injury	Frequency	Percent
Fist injury	42	42 %
Vehicle Accident	45	45 %
Blunt Object	1	1 %
Branch of Tree	1	1 %
Fall from Height	1	1 %
Glass Injury	1	1 %
Injury with Metal	4	4 %
Injury with Stick	3	3 %
Injury with Stone	1	1 %

Pointed Object	1	1 %
Total	100	100.0

Vehicle accidents (45%) and accidental-fist injuries (42%) were the leading causes of injury. 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.

Table 4: Frequency of Various types of injuries

Type of Injury (n = 100)		Frequency	Percentage
Abrasion	No	1	1%
	Yes	99	99%
Contusion	No	4	4%
	Yes	96	99%
Laceration	No	43	43%
	Yes	57	57%

Abrasion injuries were present in 99% (99 individuals) of cases, indicating that abrasions were highly common in ocular trauma. Contusion injuries were recorded in 96% (96 individuals) of cases, indicating a high prevalence, with only 4% (4 individuals) showing no signs of contusion. Lacerations were present in 57% (57 individuals) of cases, reflecting a significant occurrence of laceration injuries in ocular trauma cases.

Table 5: Frequency of injury to various part of eye

Part of Eye		Frequency	Percentage
Eyelid Injury	No	47	47%
	Yes	53	53%
Conjunctiva Injury	No	46	46%
	Yes	54	54%
Sclera Injury	No	49	49%
	Yes	51	51%
Corneal Injury	No	60	60%
	Yes	40	40%
Corneo-Scleral Tear	No	73	73%
	Yes	27	27%
Anterior Chamber Injury	No	82	82%
	Yes	18	18%



Iris Injury	No	90	90%
	Yes	10	10%
Lens Injury	No	97	97%
	Yes	3	3%
Retina Injury	No	99	99%
	Yes	1	1%
Close Globe Injury	No	99	99%
	Yes	1	1%
Open Globe Injury	No	100	100%
	Yes	0	0%

In this study, eyelid (53%), conjunctiva (54%), and sclera (51%) injuries were the most common. Corneal injuries occurred in 40%, while corneo-scleral tears were seen in 27%. Less frequent were anterior chamber (18%), iris (10%), lens (3%), and retinal injuries (1%). Open globe injuries were absent.

Table 6: Frequency of Vision loss

Eye (n = 100)	Vision Loss	Frequency	Percentage
Right Eye	Absent	73	73%
	Present	27	27%
Left Eye	Absent	64	64%
	Present	36	36%

Right eye vision loss was absent in 73% (73 individuals), while 27% (27 individuals) experienced it. This indicates that a notable portion of cases resulted in right eye vision impairment. 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.

Table 7: Vision Loss by Cause of Injury

Cause of Injury	Right Vision Loss	Left Vision Loss
Fist Injury	6	12
Blunt Object	0	0
Branch Of Tree	0	1
Fall From Height	1	0
Glass Injury	1	1
Injury with Metal	0	1
Injury with	1	0

Stick		
Injury with Stone	0	1
Pointed Object	0	1
Vehicle Accident	18	19
Total	27	36

This table summarizes the relationship between various causes of injury and the occurrence of vision loss in the right and left eyes. Fist is the most frequent cause of vision loss, with 6 cases in the right eye and 12 in the left. Blunt Object injuries did not result in any vision loss for either eye. Branch of Tree caused vision loss in only one case, specifically affecting the left eye. Fall from Height caused vision loss in one case, but only in the right eye. Glass Injury resulted in vision loss for both eyes, with one case each for the right and left.

DISCUSSION

In our study, 85% of participants were male, reflecting a common gender disparity in ocular trauma. This aligns with findings from **Bauza AM et al. (2012)**¹⁶, **Kushwaha R et al. (2013)**¹² and **Yadav H et al. (2016)**¹⁴, who reported male predominance ranging from 84% to 96%, often linked to hazardous occupations and outdoor activities. **Salama and El Dine (2014)**¹³ noted a lower male proportion (58.5%) in Egypt, likely due to regional and cultural differences. These consistent findings highlight the need for safety measures in male-dominated work environments. Our study found a nearly equal number of rural (51%) and urban (49%) participants, indicating similar ocular trauma risks in both settings. Unlike **Mahalingappa R et al. (2021)**¹⁵, who saw more rural cases due to farming hazards, we observed that both environments pose distinct risks—rural areas from manual labour and debris, and urban areas from RTAs and industrial work, as noted by **Wadwekar A et al. (2021)**¹⁷. This highlights the need for setting-specific prevention, like protective gear in rural areas and stricter road safety in urban zones. In our study, vehicle accidents (45%) and accidental fist injuries (42%) were the main causes of ocular trauma, highlighting diverse risks in both urban and rural areas. RTAs, also reported by **Wadwekar A et al. (2021)**¹⁷ and **Jha S et al. (2019)**¹⁸, point to poor road safety, including speeding and lack of helmet use.



Fist injuries, linked to interpersonal conflicts, align with findings by **Tripathy K et al. (2016)**¹⁹. Industrial injuries were less common in our study but are a critical consideration in ocular trauma research. **Bauza AM et al. (2012)**¹⁶ documented nail gun injuries as a primary cause in industrial trauma cases, highlighting the unique risks posed by tools and machinery. These patterns underline the need for targeted safety interventions across different environments road safety in urban areas, conflict resolution in workplaces, and protective gear use in industrial settings.

In our study, the left eye was affected by vision loss more often (36%) than the right eye (27%). This may be because most people are right-handed and naturally protecting their right side, leaving the left more exposed. Similar results were seen in studies by **Kushwaha R et al. (2013)**¹² and **Wadwekar A et al. (2021)**¹⁷. This shows the need for proper eye protection for both eyes, especially in risky jobs. Even though the left eye is slightly more at risk, both eyes can be injured depending on the situation. Using protective eyewear can help prevent vision loss. Our study revealed key insights into the types of ocular injuries and their causes. Most injuries were due to mechanical trauma, similar to **Tripathi K et al. (2016)**¹⁹, who found globe injuries in 69% and lid/orbit injuries in 21% of patients. Abrasions were seen in 99% of cases, showing the cornea's high vulnerability. This matches **Panda A et al. (2019)**²¹, who found similar results in blunt trauma, especially in children.

Contusions (96%) were also common, often from blunt force, as seen by **Das and Sharma (2017)**²⁰, and can lead to swelling or bleeding inside the eye. Lacerations affected 57%, usually caused by sharp objects or assaults, as noted by **Gupta V et al. (2021)**¹¹. Injuries to the eyelid (53%) and conjunctiva (54%) were also frequent, showing the eye's outer structures are easily hurt, especially in blunt trauma, which aligns with **Sahu R et al. (2024)**²².

Scleral injuries (51%) were linked to deeper trauma, similar to **Soni A et al. (2022)**²³. Corneal injuries (40%) and corneo-scleral tears (27%) show how both blunt and sharp trauma can affect the outer eye. Less common injuries included the anterior chamber (18%), iris

(10%), pupil (8%), and lens (3%), while posterior chamber injuries were rare (2%).

In our study, fist injuries were the most common cause of vision loss, affecting 6 right eyes and 12 left eyes. This finding is consistent with the study by **Kim YK et al. (2010)**²⁴ which reported that blunt-force trauma, including assaults, frequently led to significant ocular injuries and visual impairment in trauma center cases. Vehicle accidents were also a major contributor to vision loss in our study, responsible for 18 cases in the right eye and 19 in the left. This aligns with findings from a study in **Pondicherry (2009)**²⁵ where road traffic accidents were the leading cause of ocular trauma, particularly associated with posterior segment involvement leading to permanent visual damage.

CONCLUSION

Our study highlights that ocular trauma predominantly affects males (85%), reflecting occupational and environmental exposures common in male-dominated labor sectors. Both rural and urban populations face comparable risks, with rural injuries often related to manual labor and sharp objects, while urban cases stem largely from road traffic accidents (RTAs) and fist injuries. The findings underscore the urgent need for occupational safety measures, including mandatory use of protective eyewear in industrial and agricultural settings, strict enforcement of road safety regulations, and workplace conflict resolution programs. Prevention, early intervention, and targeted public health education are essential to reduce vision loss and improve ocular trauma outcomes.

RECOMMENDATION OF STUDY

Based on our study, we recommend targeted interventions to prevent ocular trauma. Protective eyewear should be mandated in high-risk occupations, especially in rural and industrial settings. Urban areas need stricter road safety enforcement to reduce injuries from vehicle accidents. Conflict resolution programs in workplaces may help reduce fist-related trauma. Public awareness campaigns on eye safety and early treatment are essential. These measures can significantly reduce preventable ocular injuries and associated vision loss across both rural and urban populations.



LIMITATIONS OF THE STUDY

This study, limited to SMS Hospital, Jaipur, may lack broader generalizability due to its specific population, retrospective data collection, absence of long-term follow-up, focus on conservative treatment, limited analysis of sociocultural and environmental factors, and potential influence of early police investigations on injury reporting.

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CONFLICT OF INTEREST: Nil

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