



Original Research Article

CLINICAL PROFILE OF PATIENTS WITH CLOSED GLOBE INJURY IN A GOVERNMENT TERTIARY EYE CARE HOSPITAL: A PROSPECTIVE STUDY

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Received : 23/12/2025
Received in revised form : 03/02/2026
Accepted : 19/02/2026

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DOI: 10.70034/ijmedph.2026.1.363

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (1); 2085-2091

ABSTRACT

Background: Closed globe injury (CGI) is a common yet preventable cause of ocular morbidity, particularly in developing countries, where trauma remains a leading cause of unilateral visual loss. Blunt ocular trauma can result in varied anterior and posterior segment involvement, influencing visual prognosis. Understanding the epidemiological profile and injury patterns is essential for prevention strategies and optimal management. **Objectives:** To evaluate the epidemiological factors and clinical patterns of closed globe injuries presenting to a tertiary eye care hospital.

Materials and Methods: This prospective observational study was conducted at a government tertiary eye care hospital in Visakhapatnam from January 2025 to June 2025. Hundred patients with closed globe injury were enrolled. Demographic details, mode and mechanism of injury, time and place of occurrence, and associated systemic injuries were documented. Ocular examination included assessment of uncorrected and best-corrected visual acuity, slit-lamp biomicroscopy, and fundus evaluation. Injuries were classified according to standardised globe and adnexal trauma terminology. Data were analysed using SPSS version 26.0.

Results: The majority of patients were young males in their second and third decades of life, with a male-to-female ratio of 4.5:1. Road traffic accidents, particularly involving two-wheeler riders without protective helmets, were the most common cause. Most injuries were unilateral and occurred in public places, commonly during evening hours. Zone I involvement and eyelid-conjunctival injuries were most frequent. Seventy percent of patients retained good visual acuity (>6/18). Associated maxillofacial and head injuries were commonly observed, and 12% of patients had a history of psychoactive substance use at the time of injury.

Conclusion: Closed globe injury predominantly affects young, economically productive males and is largely preventable. Road traffic accidents remain the leading cause, with visual prognosis being favourable in the majority of cases. Public health interventions focusing on road safety, use of protective eyewear, and injury-prevention education are essential to reduce the burden of CGI.

Keywords: Closed globe injury; Ocular trauma; Road traffic accidents; Birmingham Eye Trauma Terminology (BETT); ; Tertiary care hospital.

INTRODUCTION

Ocular trauma continues to be a major cause of preventable visual impairment worldwide and

represents a significant public health concern, particularly in developing countries. It is a leading contributor to unilateral vision loss and is associated with long-term visual disability, psychological

impact, and economic burden due to reduced productivity. Despite improvements in ophthalmic care and increased awareness, the incidence of ocular injuries remains high, especially among young and economically productive individuals.^[1]

Closed globe injury (CGI) is characterised by ocular trauma in which the corneoscleral integrity remains intact. These injuries are most commonly caused by blunt force mechanisms and can involve a wide range of ocular structures, including the eyelids, anterior segment, and posterior segment. The underlying mechanism typically involves coup and contrecoup forces, which may result in significant posterior segment pathology even in the absence of an external wound, thereby influencing visual prognosis.^[2,3]

The epidemiological profile and pattern of closed globe injuries vary according to geographic location, occupational exposure, lifestyle factors, and adherence to safety measures. In developing nations, road traffic accidents, occupational hazards, assaults, and sports-related activities are frequently implicated. Young males are disproportionately affected due to greater exposure to high-risk environments and lower utilisation of protective devices.^[4-6] Early presentation and prompt management play a critical role in determining anatomical and functional outcomes in these patients. Uniform classification and terminology are essential for accurate documentation, effective communication, and meaningful comparison of ocular trauma across clinical studies. The Birmingham Eye Trauma Terminology System (BETT) provides a standardised framework for classifying ocular injuries based on the integrity of the globe and mechanism of injury. Within this system, closed globe injuries are further classified into contusion and lamellar laceration, enabling systematic assessment and prognostication.^[2] The BETT classification system relevant to the present study is illustrated in Figure 1.

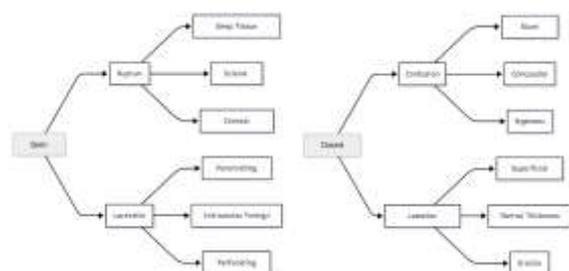


Figure 1: BETT classification flow chart

In addition, closed globe injuries can be anatomically categorised into zones based on the most posterior ocular structure involved, with increasing zone number reflecting deeper tissue involvement and potentially poorer visual prognosis.

There is limited prospective data from tertiary care centers in coastal Andhra Pradesh describing the clinical and epidemiological profile of closed globe injuries. The present study was therefore undertaken to analyse the demographic characteristics, modes of

injury, clinical patterns, and visual outcomes of patients presenting with closed globe injury to a government tertiary eye care hospital, with the aim of contributing regional data and highlighting preventable risk factors.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based prospective observational study was conducted at a government tertiary eye care hospital attached to Andhra Medical College, Visakhapatnam, India.

Study Period

The study was carried out over a period of six months, from January 2025 to June 2025.

Study Population and Sample Size

A total of **100 consecutive patients** presenting with closed globe injury to the outpatient department or emergency services during the study period were enrolled in the study.

Inclusion Criteria

- Patients of all age groups diagnosed with closed globe injury
- Patients willing to participate in the study
- In the case of minors, consent obtained from parents or legal guardians

Exclusion Criteria

- Patients with open globe injury
- Patients unwilling to participate in the study

Ethical Considerations

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Informed written consent was obtained from all participants aged 18 years and above, and from parents or legal guardians for minors, after explaining the nature and purpose of the study.

Clinical Evaluation and Data Collection

Demographic details including age and sex, along with injury-related information such as mode, mechanism, time, and place of injury, were recorded using a predesigned proforma. History regarding the use of protective devices and the presence of associated systemic injuries was also documented. Educational status was categorised based on the Census of India definition. Individuals aged 7 years and above who were able to read and write with understanding in any language were classified as literate. Those unable to read and write were classified as illiterate.

Visual acuity assessment included both uncorrected and best-corrected visual acuity. The Snellen chart was used for literate patients, while the Tumbling E chart was used for illiterate patients and preschool children.

Anterior segment examination was performed using slit-lamp biomicroscopy. Posterior segment evaluation was carried out using a 78-diopter lens or indirect ophthalmoscopy after pupillary dilatation, wherever feasible.

Closed globe injuries were classified according to the Birmingham Eye Trauma Terminology System (BETT) as contusion or lamellar laceration. Anatomical involvement was categorised based on the most posterior structure affected as follows: Zone I injuries involved the ocular surface structures including the conjunctiva, sclera, and cornea; Zone II injuries involved the anterior segment up to the posterior lens capsule, including the pars plicata; and Zone III injuries involved the posterior segment structures.

Statistical Analysis

Data was entered into Microsoft Excel for database creation and graphical representation. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Results were expressed as frequencies, percentages, tables, and graphs.

RESULTS

A total of **100 patients** with closed globe injury were included in the study.

Demographic Profile

Out of 100 patients, 82 were males and 18 were females, with a male-to-female ratio of **4.5:1**. The majority of patients were young adults, most commonly belonging to the second and third decades of life, as shown in figure 2 and table 1.

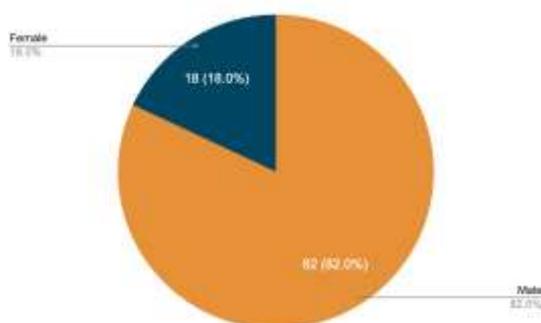


Figure 2: Pie chart showing gender distribution

Age Distribution

The age of patients ranged from childhood to late adulthood. The majority of patients belonged to the second and third decades of life, accounting for the highest proportion of cases. A smaller number of cases were observed in the paediatric age group and in patients above 50 years of age, indicating a predominance of closed globe injuries among young and economically productive individuals, as shown in figure 3 and table 2.

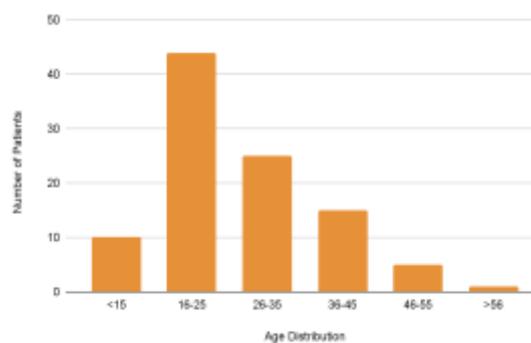


Figure 3: Bar graph showing age distribution in patients with closed globe injury

Injury Pattern in the Paediatric Age Group

Among children below 15 years of age, sports-related injuries were the most common cause of closed globe injury. Shuttlecock, tennis ball, and cricket ball injuries accounted for the majority of cases in this age group.

Educational Status

Out of 100 patients, 63 patients were literate and 37 patients were illiterate. The majority of patients were literate, indicating that closed globe injuries were not confined to individuals without formal education, as shown in figure 4 and table 3.

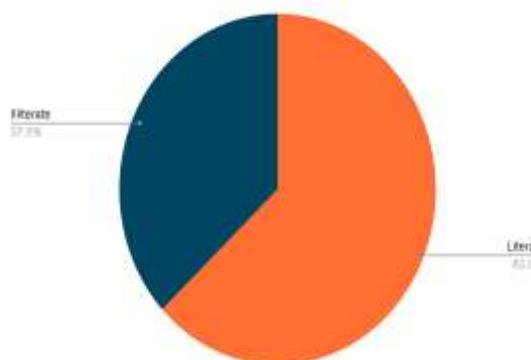


Figure 4: Pie chart showing educational status of patients with closed globe injury

Mode and Circumstances of Injury

Road traffic accidents were the most common cause of closed globe injury, followed by assault, occupational injuries, sports-related injuries, and self-fall, as shown in figure 5 and table 4. A majority of injuries occurred in public places, and most incidents were reported during the evening hours between **4 PM and 8 PM**. **Twelve patients (12%)** had a history suggestive of psychoactive substance use at the time of injury.

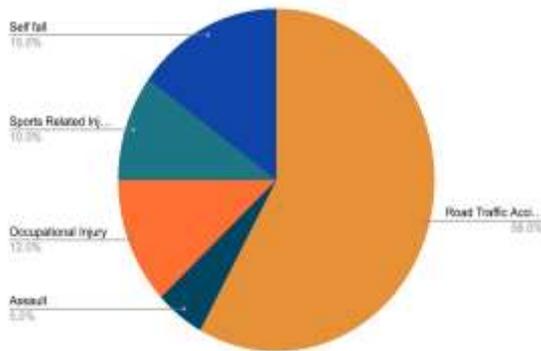


Figure 5: Pie chart showing various modes of injury in patients with closed globe injury.

Laterality and Zone of Injury

Closed globe injuries were predominantly **unilateral**. Based on anatomical involvement, **Zone I injuries were the most frequent**, followed by Zone II and Zone III injuries, as shown in figure 6 and table 5.

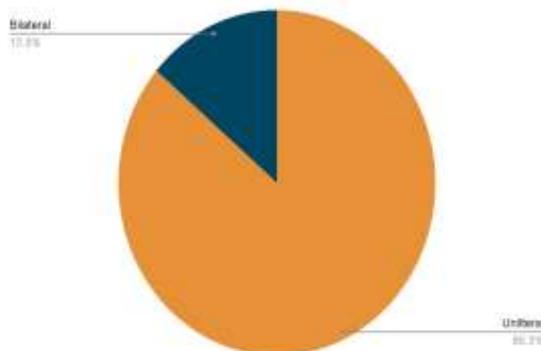


Figure 6: Pie chart showing laterality in eyes of patients with closed globe injury

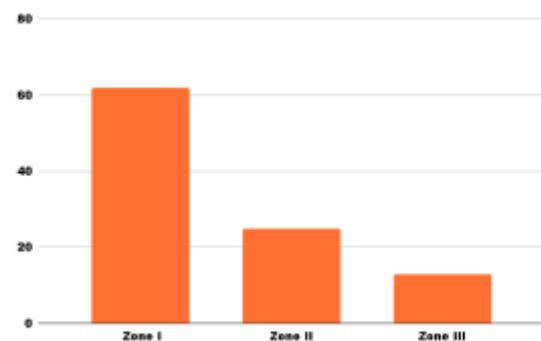


Figure 7: Bar graph showing zone-wise distribution of closed globe injuries

Ocular Structures and Lesion Types Involved (Zone-wise Analysis)

Figure 7, depicts the zone wise distribution of injuries in a bar graph representation, which is listed in table 6.

Multiple ocular structures and lesion types were frequently involved in a single patient; therefore, the total number of lesion occurrences exceeded the total number of patients. The distribution of ocular

structures involved is depicted in figure 11 and listed in table 7,8 and 9..

Zone I involvement was the most common and predominantly affected the eyelids, conjunctiva, and cornea. Eyelid abrasions and lacerations, along with subconjunctival hemorrhage and chemosis, constituted the majority of findings in this zone.



Figure 8: Image showing a) Ecchymosis b) Conjunctival tear

Zone II involvement mainly affected anterior segment structures. Hyphema and iris–pupil complex injuries such as traumatic mydriasis and pupillary margin rupture were commonly observed, while lens involvement was relatively infrequent.

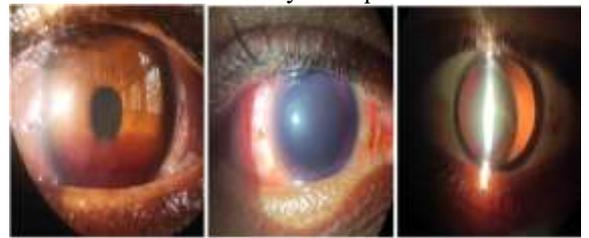


Figure 9: Image showing a) Hyphema b) Traumatic mydriasis c) Traumatic lens subluxation

Zone III involvement was comparatively rare and included vitreous, retinal, choroidal, and optic nerve injuries. Although less common, these injuries represented more severe ocular trauma.

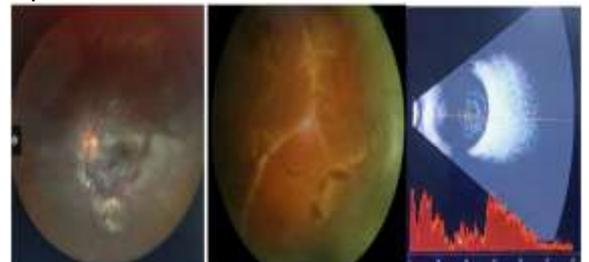


Figure 10: Image showing a) Berlin's edema b) Retinal tear c) Vitreous hemorrhage

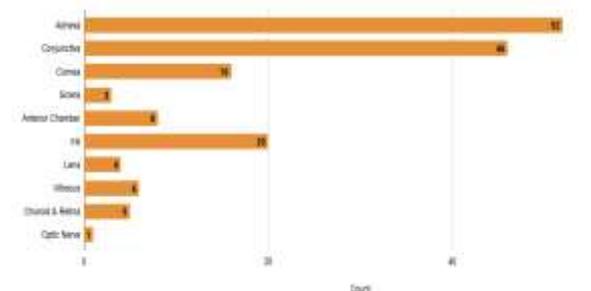


Figure 11: Bar graph showing Distribution of ocular structures involved

Associated Injuries

Associated systemic injuries were noted in several patients, with **maxillofacial and head injuries** being the most frequently associated injuries.

Management of Closed Globe Injuries

Management was individualised based on the type, severity, and anatomical extent of injury.

- **Conservative management** was sufficient in **78 patients (78%)** and included topical antibiotics, topical corticosteroids, cycloplegics, lubricants, and systemic analgesics as indicated. These patients predominantly had Zone I injuries. **Minor surgical procedures** were required in **15 patients (15%)**, mainly for eyelid tear repair or conjunctival suturing.
- **Major surgical interventions** were performed in **7 patients (7%)**, primarily in cases with significant anterior or posterior segment involvement.

Patients with associated systemic injuries were managed in coordination with the respective specialties.

Visual Acuity

At the presentation, the majority of patients had good visual acuity. **Seventy patients (68%)** had best-corrected visual acuity better than **6/18**, as shown in figure 12 and table 10.. Moderate to severe visual impairment was observed in the remaining patients, predominantly among those with posterior segment involvement.

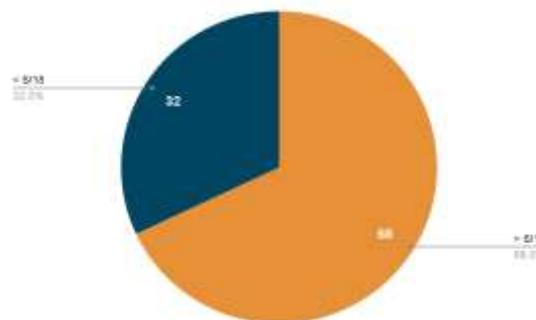


Figure 12: Pie chart showing visual acuity outcome after management

Table 1: Demographic profile of patients

Gender	Number of patients	Percentage(%)
Male	82	82%
Female	18	18%
Total	100	100

Table 2: Age distribution of the patients with closed globe injury

Age Group	Number of patients
<15	10
16-25	44
26-35	25
36-45	15
46-55	5
>56	1
TOTAL	100

Table 3: Educational Status of Patients with Closed Globe Injury

Educational Status	Number of Patients	Percentage (%)
Literate	63	63%
Illiterate	37	37%
Total	100	100

Table 4: Various modes of injury in patients with closed globe injury

Mode of Injury	Number of Patients	Percentage(%)
Road Traffic Accident	58	58%
Self fall	15	15%
Occupational Injury	12	12%
Sports Related Injury	10	10%
Assault	5	5%
Total	100	100%

Table 5: Laterality in eyes of patients with closed globe injury

Laterality	Number of patients	Percentage(%)
Unilateral	86	86%
Bilateral	14	14%
Total	100	100%

Table 6: Distribution of Closed Globe Injuries Based on Zone of Involvement

Zone of Injury	Structures involved	Number of patients	Percentage(%)
Zone I	External structures (conjunctiva, sclera, cornea)	62	62%
Zone II	Anterior segment up to posterior lens capsule (including pars plicata)	25	25%
Zone III	Posterior segment structures	13	13%

Total	-	100	100%
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Table 7: Zone I Structures and Lesion Types Involved (External Structures)

Structure	Lesion type	Frequency
Eyelid	Abrasions	52
	Lacerations	26
	Black Eye	10
	Avulsions	04
Conjunctiva	Subconjunctival	46
	Hemorrhage	12
	Avulsion	04
	Laceration	12
Cornea	Abrasions	16
	Corneal Edema	17
	Partial Thickness Corneal Tear	18
Sclera	Lamellar Laceration	03

Table 8: Zone II Structures and Lesion Types Involved (Anterior Segment)

Structure	Lesion Type	Frequency
Anterior Chamber	Hyphema	08
Iris, Pupil, Ciliary Body	Traumatic Mydriasis	20
	Pupillary Margin Rupture	10
	Iridodialysis	06
Lens	Vossius Ring	03
	Subluxation	01

Table 9: Zone III Structures and Lesion Types Involved (Posterior Segment)

Structure	Lesion type	Frequency
Vitreous	Vitreous Hemorrhage	5
	Vitreous Herniation Into AC	6
Choroid	Rupture	1
	Hemorrhage	1
	Detachment	1
Retina	Comotio Retinae	4
	Hemorrhage	5
	Retinal Tear	2
	Retinal Detachment	3
Optic Nerve Trauma	Traumatic Optic Neuropathy	1

Table 10: Visual acuity outcome after management

Visual Acuity	Number of patients	Percentage (%)
> 6/18	68	68
< 6/18	32	32
Total	100	100

DISCUSSION

Ocular trauma remains a significant cause of preventable visual morbidity worldwide, particularly in developing countries, where it continues to pose a major public health challenge.^[1] Closed globe injuries constitute a substantial proportion of ocular trauma cases and demonstrate wide variability in clinical presentation, anatomical involvement, management requirements, and visual outcomes. The present study evaluates the epidemiological profile, injury patterns, management strategies, and visual outcomes of patients with closed globe injury presenting to a government tertiary eye care hospital. A marked male predominance was observed in the present study, with a male-to-female ratio of 4.5:1,

and the majority of patients belonged to the second and third decades of life. These findings are consistent with several Indian and international studies reporting higher incidence of ocular trauma among young males due to increased outdoor exposure, occupational activity, and involvement in road traffic accidents.^[4-6,10,12-14] In contrast, studies (table 11) from certain developed regions have reported comparatively older age groups and occupational injuries as the predominant etiology, possibly reflecting differences in lifestyle patterns and safety regulations.^[9-11] In the present study, road traffic accidents emerged as the leading cause of injury, aligning with recent Indian data that highlight the growing contribution of vehicular trauma to ocular morbidity.^[6,8,13]

Table 11: Comparison of demographic profile and mode of injury in closed globe injuries across various studies

Study	Region / Country	Predominant Age Group	Sex Predominance	Most Common Mode of Injury
Choovu Thakayon et al	Taiwan	30–50 years	Males	Occupational injury
Voon et al	Singapore	<40 years	Males	Occupational injury

Belmonte Graw et al	Spain	50–60 years	Male = Female	Domestic injury
Kinderan et al	Nepal	20–40 years	Males	Stick-related injury
Mohanty et al	North India	20–30 years	Males	Road traffic accidents
Sahu et al	Eastern India	20–30 years	Males	Road traffic accidents
Present study	Southern India	20–30 years	Males	Road traffic accidents

In the present study, the majority of patients were literate, indicating that ocular trauma affects individuals across different educational backgrounds and is not restricted to illiterate populations. While literacy may improve general awareness, adherence to road safety practices and compliance with protective measures appear to play a more decisive role in prevention. Among children below 15 years of age, sports-related injuries such as shuttlecock, cricket ball, and tennis ball trauma were the predominant causes of closed globe injury, highlighting the vulnerability of children during recreational activities without adequate protective measures.

Zone-wise analysis demonstrated that Zone I injuries were most frequent, followed by Zone II and Zone III injuries, which explains the relatively favourable visual outcomes observed in the majority of patients.^[2,4] Eyelid and conjunctival lesions predominated, followed by corneal involvement, while posterior segment injuries involving the vitreous, retina, choroid, and optic nerve were less common but associated with poorer visual prognosis.^[5,7,8,12] The presence of multiple lesions in a single patient underscores the complex nature of closed globe injuries and supports lesion-frequency-based reporting.

The predominance of superficial injuries was reflected in management patterns, with most patients treated conservatively and only a minority requiring surgical intervention. Favourable visual outcomes were achieved in 70% of patients, particularly those with Zone I injuries, whereas posterior segment and optic nerve involvement were associated with worse outcomes, consistent with previous studies and ocular trauma scoring systems.^[3,7,15] These findings reinforce the importance of anatomical extent in determining prognosis in closed globe injuries.

Visual outcomes after management were favourable in the majority of patients, with 70% achieving best-corrected visual acuity better than 6/18. Good visual outcomes were predominantly observed in patients with Zone I injuries, whereas posterior segment and optic nerve involvement were associated with poorer prognosis. These findings are consistent with previous studies and established ocular trauma scoring systems, which emphasise the prognostic importance of anatomical extent and severity of injury.^[3,7,15]

CONCLUSION

Reducing the burden of closed globe injuries requires focused preventive strategies and strengthened public

awareness. Strict enforcement of road safety regulations, consistent use of helmets, and adoption of protective eyewear are essential to prevent road traffic-related ocular trauma. As injuries were observed predominantly among literate individuals, preventive efforts must extend beyond basic awareness to emphasise behavioural change and compliance with safety measures. Early presentation to government tertiary eye care centers equipped with round-the-clock ophthalmic services is crucial for prompt evaluation and timely management, thereby improving visual outcomes and reducing long-term disability. In children, sports-related injuries such as shuttlecock, cricket ball, and tennis ball trauma highlight the need for parental supervision and the use of appropriate protective equipment during recreational activities. Coordinated efforts in enforcement, education, parental awareness, and timely access to emergency ophthalmic care are vital to reduce the incidence and severity of closed globe injuries.

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