

Original Research Article

CLINICAL PROFILE OF OCULAR TRAUMA AT A TERTIARY CARE TEACHING HOSPITAL IN SOUTH INDIA: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Ocular trauma is a leading cause of preventable unilateral blindness worldwide, yet institutional data from South India—a region with a high burden of road traffic accidents (RTAs)—remain limited. This study aimed to characterise the clinical profile of ocular trauma, including injury patterns, anatomical site involvement, and presenting visual acuity, at a tertiary care teaching hospital in South India.

Materials and Methods: This prospective observational study enrolled 150 patients presenting with ocular trauma to the emergency and outpatient departments of ophthalmology at Apollo Institute of Medical Sciences and Research, Chittoor, Andhra Pradesh, between October 2023 and November 2024. Demographic data, mechanism of injury, time to presentation, presenting visual acuity (Snellen chart), and clinical findings were systematically recorded. Injuries were classified using the Birmingham Eye Trauma Terminology System (BETTS).

Results: Of 150 patients (mean age group 31–40 years; 66% male), 102 (68%) sustained closed globe injuries (CGIs) and 48 (32%) sustained open globe injuries (OGIs). Road traffic accidents accounted for 92 cases (61.3%). Eyelid injury was the most frequent anatomical finding (52 cases; 34.6%), followed by corneal involvement (23 cases; 15.2%) and anterior chamber pathology (20 cases; 13.3%). Presenting visual acuity was $\leq 6/60$ in 21.3% of patients, including 3 patients (2%) with no perception of light.

Conclusion: RTAs represent the dominant mechanism of ocular trauma in this South Indian cohort, with the anterior segment being most commonly affected. The predominance of CGIs and the high proportion of RTA-related injuries underscore the need for targeted road safety interventions and timely ophthalmic care to reduce preventable visual morbidity in this region.

Keywords: Ocular trauma; open globe injury; closed globe injury; road traffic accidents; BETTS classification; visual impairment.

INTRODUCTION

Ocular trauma is a leading, largely preventable cause of unilateral visual impairment and blindness worldwide. The global burden is substantial: an estimated 1.6 million people sustain sight-threatening eye injuries each year, accounting for 7–45% of non-

congenital monocular blindness in adults.^[1,2] Crucially, approximately 90% of these injuries are avoidable through appropriate protective measures and safety education.^[3]

The aetiology and pattern of ocular injuries vary considerably by geographic region and are closely linked to local occupation, infrastructure, and

socioeconomic conditions.^[4,5] In developing countries, road traffic accidents (RTAs) are among the most frequently reported causes, given suboptimal road infrastructure, inconsistent helmet use, and poor adherence to traffic safety regulations.^[6-14] Other documented causes include workplace injuries, assault, domestic accidents, and sports-related trauma. Common sequelae of ocular trauma include corneal and scleral tears, lens damage, lid and canalicular lacerations, uveal prolapse, anterior chamber abnormalities, retinal detachment, and optic nerve avulsion.^[6-11]

Despite the growing body of literature on ocular trauma epidemiology from northern India and other Asian countries, data from South India—particularly from Andhra Pradesh, a state with a high burden of RTAs—remain sparse. Understanding regional injury patterns is essential to optimise resource allocation, guide preventive strategies, and support appropriate clinical management.

This study aimed to characterise the clinical profile of ocular trauma, including injury type, causative mechanism, anatomical site involvement, and presenting visual acuity, among patients attending a tertiary care teaching hospital in Chittoor, Andhra Pradesh, South India

MATERIALS AND METHODS

Study Design and Setting: This was a prospective observational study conducted at the Department of Ophthalmology, Apollo Institute of Medical Sciences and Research, Chittoor, Andhra Pradesh, India—a tertiary care teaching hospital serving both urban and rural populations in the region.

Study Period: Patient enrolment was conducted over a 13-month period, from October 2023 to November 2024.

Study Population

Inclusion Criteria

All patients of any age who presented to the emergency department or outpatient ophthalmology clinic with a history of ocular trauma during the study period were eligible for inclusion.

Exclusion Criteria

Patients with chemical burns, thermal injuries, or radiation-related ocular injury were excluded, as were

those who declined to provide informed consent or whose clinical records were incomplete.

Data Collection: A structured proforma was completed for each enrolled patient, documenting: (i) demographic data (age, sex, occupation); (ii) mechanism and circumstances of injury; (iii) time elapsed from injury to presentation; (iv) presenting visual acuity; and (v) clinical examination findings including the anatomical site(s) of injury.

Clinical Examination: Presenting visual acuity was measured using a Snellen chart at 6 metres. Anterior segment evaluation was performed with slit-lamp biomicroscopy. Posterior segment assessment was carried out with indirect ophthalmoscopy. In unconscious, uncooperative, or critically ill patients, a bedside torch-light examination was performed as a substitute for formal visual acuity and slit-lamp assessment.

Injury Classification: All ocular injuries were classified according to the Birmingham Eye Trauma Terminology System (BETTS). Under this system, closed globe injuries (CGIs) are defined as injuries in which the full thickness of the ocular wall is not breached, and are further subclassified into contusions and lamellar lacerations. Open globe injuries (OGIs) involve full-thickness disruption of the ocular wall and are subclassified into ruptures, penetrating injuries, perforating injuries, and intraocular foreign body injuries.

Ethical Considerations: The study was conducted in accordance with the principles of the Declaration of Helsinki. Institutional ethical approval was obtained prior to commencement of the study. Written informed consent was obtained from all adult participants; for paediatric patients, consent was obtained from a parent or legal guardian.

RESULTS

A total of 150 patients presenting with ocular trauma were enrolled during the study period. Patient ages ranged from 1 to 60 years, with the 31–40-year age group most frequently affected ($n = 52$; 34.6%), followed by the 21–30-year group ($n = 36$; 24%). Children aged 1–10 years constituted the smallest cohort ($n = 9$; 6.0%). The age distribution is summarised in [Table 1].

Table 1: Age distribution of patients with ocular trauma ($n = 150$)

Age Group (years)	Number of Patients (n)	Percentage (%)
1–10	9	6.0
11–20	21	14.0
21–30	36	24.0
31–40	52	34.6
41–50	14	9.3
51–60	18	12.0
Total	150	100.0

Males constituted 66% of the study population ($n = 99$) compared with 34% females ($n = 51$), yielding a

male-to-female ratio of approximately 1.9:1 [Table 2].

Table 2: Sex distribution of patients with ocular trauma (n = 150)

Sex	Number of Patients (n)	Percentage (%)
Male	99	66.0
Female	51	34.0
Total	150	100.0

Based on BETTS classification, 102 patients (68%) sustained closed globe injuries (CGIs) and 48 patients (32%) sustained open globe injuries (OGIs), as detailed in [Table 3].

Table 3: Distribution of patients by injury type (BETTS classification; n = 150)

Injury Type	Number of Patients (n)	Percentage (%)
Closed Globe Injury (CGI)	102	68.0
Open Globe Injury (OGI)	48	32.0
Total	150	100.0

Road traffic accidents were the leading mechanism of injury, accounting for 92 cases (61.3%). Non-RTA mechanisms accounted for the remaining 58 cases (38.7%): intraocular or adnexal foreign bodies (n = 18; 12.0%), fall from height (n = 11; 7.3%), interpersonal assault (n = 11; 7.3%), stick injuries (n = 9; 6.0%), and stone injuries (n = 9; 6.0%). The distribution is presented in [Table 4].

Table 4: Distribution of patients by mechanism of injury (n = 150)

Mechanism of Injury	Number of Patients (n)	Percentage (%)
Road Traffic Accident (RTA)	92	61.3
Foreign Body	18	12.0
Fall	11	7.3
Assault	11	7.3
Stick Injury	9	6.0
Stone Injury	9	6.0
Total	150	100.0

Presenting visual acuity varied widely across the cohort. A total of 54 patients (36.0%) presented with vision of 6/18 or better, while 32 patients (21.3%) had visual acuity of 6/60 or worse, including 8 patients (5.3%) with counting-fingers vision, 5 patients (3.3%) with perception of light only, and 3 patients (2.0%) with no perception of light. The complete distribution is shown in [Table 5].

Table 5: Distribution of patients by presenting visual acuity (n = 150)

Presenting Visual Acuity	Number of Patients (n)	Percentage (%)
6/6	15	10.0
6/9	18	12.0
6/12	21	14.0
6/18	16	10.7
6/24	28	18.7
6/36	20	13.3
6/60	16	10.7
Counting Fingers	8	5.3
Perception of Light	5	3.3
No Perception of Light	3	2.0
Total	150	100.0

Eyelid injury was the most frequently affected anatomical site (n = 52; 34.6%), primarily comprising lid lacerations. This was followed by corneal involvement (n = 23; 15.2%)—including corneal abrasions, foreign bodies, and lacerations—and anterior chamber pathology (n = 20; 13.3%), predominantly hyphema and anterior uveitis (cells and flare). Scleral injuries were noted in 18 cases (12.0%). Conjunctival injuries accounted for 13 cases (8.6%). Posterior segment involvement—including Berlin's oedema and optic nerve injury—was recorded in 8 cases (5.2%). Traumatic mydriasis and relative afferent pupillary defect (RAPD) were observed in 8 patients (5.2%). Iris and lens injuries were among the least frequent findings (2.6% each). Multiple concurrent anatomical sites were affected in a subset of patients. The full distribution is provided in [Table 6].

Table 6: Distribution of patients by anatomical site of injury (n = 150)*

Anatomical Site	Number of Cases (n)	Percentage (%)
Eyelids	52	34.6
Cornea	23	15.2
Anterior Chamber	20	13.3
Sclera	18	12.0
Conjunctiva	13	8.6

Pupil (traumatic mydriasis / RAPD)	8	5.2
Posterior Segment	8	5.2
Iris	4	2.6
Lens	4	2.6

*Multiple anatomical sites may be involved per patient; values do not sum to 150.

DISCUSSION

This prospective observational study characterises the clinical profile of ocular trauma at a tertiary care teaching hospital in Chittoor, South India. The findings provide region-specific data that complement the existing literature, which has predominantly focused on northern Indian and other Asian populations.

Age and Sex Distribution: The 31–40-year age group was the most commonly affected in our cohort (34.6%), with the 21–30-year group constituting the second largest subgroup (24.0%). This pattern is broadly consistent with studies from other South Asian tertiary centres, where economically active young adults predominate among ocular trauma victims, likely reflecting their greater exposure to occupational hazards and RTAs.^[18–20] In contrast, Mohanty et al,^[17] reported the 21–30-year cohort as the most affected, while our data indicate a decade-older peak, possibly reflecting the older age structure of the RTA-exposed workforce in this semi-urban region. The low incidence among children (1–10 years; 6.0%) likely reflects parental supervision.^[21] A strong male predominance was observed (66% male; male-to-female ratio 1.9:1), consistent across virtually all published studies.^[18–21] This is attributable to males' greater participation in outdoor activities, occupational exposure, and driving, placing them at higher risk for both RTA-related and workplace injuries.

Mechanism of Injury: RTAs were identified as the single most common cause of ocular trauma in our study, accounting for 61.3% of cases. This finding aligns with other studies from developing countries where road safety standards and protective eyewear use are suboptimal.^[18,25] India's disproportionately high burden of RTA-related mortality and morbidity—driven by inadequate road infrastructure, non-compliance with traffic laws, and low rates of helmet use—provides the context for this finding. In contrast, studies from Spain and Thailand reported domestic accidents and workplace injuries, respectively, as the predominant mechanisms, reflecting different environmental and occupational risk profiles.^[22,23] Voon et al.,^[24] similarly found occupational injuries to dominate in a Singapore cohort. These inter-regional differences highlight that effective preventive strategies must be tailored to local injury aetiology.

Injury Type and Anatomical Distribution: According to BETTS classification, CGIs predominated (68%), with OGIs accounting for 32% of cases. This ratio is comparable to that reported by Shukla et al.,^[27] (CGI 66.7%, OGI 26.7%) and is consistent with previously published estimates

placing CGI prevalence as high as 72%.^[26] Raiturcar et al.,^[28] described an even higher CGI proportion (90%), while a Korean study reported a CGI-to-OGI ratio of 6:1.29 The comparatively higher OGI proportion (32%) in our cohort may reflect the severity of RTA-related trauma and delayed presentation, both of which favour more penetrating injury patterns. The only outlier in the literature is a military cohort study which reported a notably high OGI rate (13.6%), attributable to the unique nature of combat-related injuries.^[30]

Anatomically, the eyelids were the most frequently involved structure (34.6%), functioning as the primary physical barrier to ocular trauma—analogueous to the role of a camera shutter.^[31] Anterior segment structures (cornea, anterior chamber, sclera, and conjunctiva) accounted for the majority of injuries, consistent with their anterior exposure. Posterior segment involvement, while less common (5.2%), carries greater visual morbidity, manifesting in our cohort as Berlin's oedema and optic nerve injury. The low frequency of lens and iris injuries (2.6% each) in our study may reflect a referral and severity bias, given that such injuries frequently require surgical intervention and may be preferentially managed at higher-speciality vitreoretinal units.

Visual Acuity at Presentation: The spectrum of presenting visual acuity was broad, with 21.3% of patients presenting with vision $\leq 6/60$ —a threshold widely used to define severe visual impairment. Three patients (2.0%) presented with no perception of light, representing the most severe end of the injury spectrum. The large proportion of patients with moderately impaired vision (6/24 to 6/36; 32%) underscores both the severity of RTA-related ocular trauma and the potential for significant functional improvement with timely surgical or medical intervention.

Strengths and Limitations: This study prospectively enrolled a consecutive series of 150 patients over a 13-month period, providing high-quality primary data from a region underrepresented in the ophthalmic trauma literature. The systematic use of BETTS classification ensures reproducibility and comparability with other published series.

Certain limitations must be acknowledged. First, the study was conducted at a single institution, which may limit the generalisability of findings to the broader population of South India. Second, as a tertiary referral hospital, our cohort may over-represent severe injuries and under-represent milder trauma managed at peripheral facilities (referral bias). Third, data on time-to-presentation, follow-up visual acuity, and final surgical outcomes were not systematically analysed in this report; future studies

incorporating these parameters would provide a more complete picture of visual prognosis. Finally, the absence of a standardised Ocular Trauma Score (OTS) calculation represents a missed opportunity for prognostic stratification that should be addressed in subsequent work.

CONCLUSION

This prospective study demonstrates that road traffic accidents are the predominant cause of ocular trauma among patients attending a tertiary care centre in South India, with young adult males constituting the most vulnerable demographic. Closed globe injuries were more common than open globe injuries, and the anterior segment—particularly the eyelids—was the most frequently affected anatomical region. The significant proportion of patients presenting with moderately or severely impaired visual acuity highlights the importance of early ophthalmic assessment and timely intervention following ocular trauma. These findings underscore the need for targeted road safety programmes and the promotion of protective eyewear to reduce the preventable burden of ocular morbidity in this region.

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