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Original Article

Ophthalmology Section

Clinical Profile of Paediatric Ocular and Adnexal Trauma at a Tertiary Healthcare Centre in Southern India: A Prospective Observational Study

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ABSTRACT

Introduction: Paediatric ocular trauma is a leading cause of uniocular blindness in children, with significant physical, psychological and socioeconomic implications. Understanding its epidemiology, clinical spectrum and outcomes is essential for effective management and prevention.

Aims: To evaluate the aetiology, clinical presentation and visual outcomes of paediatric ocular trauma

Materials and Methods: The present prospective observational study was conducted over one year (June 2024 to May 2025) in the Department of Ophthalmology in association with Paediatric Department at a tertiary care centre in Bengaluru, Karnataka, India. Thirty two children aged 2-16 years presenting with ocular trauma were included. Data was collected using a standardised proforma. Injuries were classified using the Birmingham Eye Trauma Terminology System (BETTS) and visual outcomes were recorded. The Ocular Trauma Score (OTS) was calculated and patients were followed up based on severity of injury. Descriptive statistics were used to report frequencies, percentages and means.

Results: The mean age was 9.8±4.5 years, with a male predominance. Closed globe injuries 15 (46.87%) and adnexal injuries 16 (50%) were more common than open globe injuries (n=1, 3.13%). The most frequent causes were blunt trauma and road traffic accidents 8 (25%) each, followed by dog bites 6 (18.75%). Common injuries included lid tear, orbital fractures, corneal abrasion and traumatic uveitis. Surgical management was required in 53.12% of cases. Visual outcomes were favourable in most children after treatment.

Conclusion: Paediatric ocular trauma remains significant but largely preventable cause of visual impairment. Early diagnosis, timely intervention and long-term follow-up are essential to favourable visual outcomes. Public awareness, safety education and access to emergency eye care are essential to reduce the incidence and burden of ocular injuries in children.

Keywords: Corneal abrasion, Orbital fracture, Prognosis, Visual acuity

INTRODUCTION

Trauma to the eye accounts for 7% of body injuries and 10-15% of eye diseases [1]. According to Maurya RP et al., children account for the 30.35% of ocular trauma [2]. Incidence of ocular trauma in children in Saxena R et al., was 20.8% and Madan AH et al., was 18.9% [3,4]. Paediatric orbital fractures account for 15% of paediatric fractures [5].

The introduction of the BETTS has helped to standardise the documentation and classification of ocular injuries [6]. Ocular traumas are typically categorised as open globe or closed globe injuries, with varied presentations such as corneal perforation, traumatic cataract, retinal detachment, etc., BETTS does not include adnexal injuries. OTS by Kuhn F et al., helps in predicting visual prognosis in trauma cases [7,8].

Immediate medical or surgical intervention is often necessary to prevent irreversible vision loss. Long-term visual rehabilitation including management of postoperative astigmatism and amblyopia is critical for achieving optimal visual outcomes [9,10].

Ocular injury is a significant contributor to single-eye blindness in children, with a substantial global prevalence. These injuries not only cause lasting physical and visual impairments but also impose a considerable financial and emotional strain on families and communities. In severe cases, childhood eye injuries may cause irreversible vision loss, affecting a child's psychological well-being and social development [11,12].

Importantly, most ocular injuries in children are preventable. Understanding the epidemiological profile of these injuries is essential for developing targeted preventive strategies. Clinical profile of paediatric ocular trauma varies from developed to developing countries and also varies from region to region. Studies have been done in developed countries and other parts of India but they cannot be applied to this region due to difference in nature of injuries, demographic and social factors [10-12]. Thus, the present study aimed to evaluate the aetiology, clinical presentation and visual outcomes of paediatric ocular trauma.

MATERIALS AND METHODS

The present prospective observational study conducted in the Department of Ophthalmology in association with Paediatric Department at a tertiary care centre in Bengaluru, Karnataka, India from June 1, 2024 to May 31, 2025. Approval was secured from the Institutional Ethics Committee dated 27/1/2024 (KIMS/IEC/A153/M/2024).

Inclusion and Exclusion criteria: The study inclusion criteria was children aged two to 16 years who presented a history of ocular trauma to either the outpatient or referred from Paediatric Department. Exclusion criteria were children whose visual acuity could not be recorded and whose parents or guardians did not give written informed consent.

Sample size calculation: Sample size was determined using formula n= 4p q/d2, considering prevalence of ocular trauma as18.9 % according to Madan AH et al., q= 1- p, d=15% absolute precision [4]. N=4x18.9x81.1/15x15=27. Sample size was increased to 32 to account for dropouts.

Study Procedure

Data was collected using a standardised proforma, which included demographic details (age, sex), mode of injury, treatment given, complications and final visual outcomes. A comprehensive ocular examination was performed on all patients, including assessment of visual acuity, pupillary reflex, slit-lamp biomicroscope and fundus examination. Visual acuity was measured using Snellen's chart in children above five years and picture chart was used in children below five years [13]. Ancillary investigations such as ocular ultrasonography and Computed Tomography (CT)/Magnetic Resonance Imaging (MRI) were conducted where indicated.

Injuries were classified according to the BETTS into open globe and closed globe injuries. The OTS was calculated for open globe injury cases and patients were categorised into five categories. Initial visual acuity, globe rupture, perforating injury, Relative Afferent Pupillary Defect (RAPD), endophthalmitis and retinal detachment are six variables used in OTS. These variables were assigned raw points. Using total raw score sum, OTS score category was calculated. There are five categories. Category-1 with raw score of 0-44 indicates most severe injury and has least visual prognosis. Category-5 indicates least severe injury and has very good visual prognosis [8].

All patients received appropriate medical or surgical treatment. They were followed-up on the basis of the severity and requirement.

STATISTICAL ANALYSIS

All statistical analyses for this study were carried out using Microsoft Excel. Descriptive statistics were used to report frequencies, percentages and means.

RESULTS

A total of 32 paediatric patients presented with ocular trauma during the study period. All patients were presented to either the Paediatric Department or the Ophthalmology Outpatient Department (OPD) within 24 hours of injury. Patient demographics are summarised in [Table/Fig-1]. The age ranged from three years to 15 years with mean age at presentation was 9.8±4.5 years. Children aged 11-16 years formed the largest group 17 (53.12%). 23 (71.88%) had unilateral involvement. A total of 9 (28.12%) children had bilateral involvement, lid tear being the cause in eight of them.

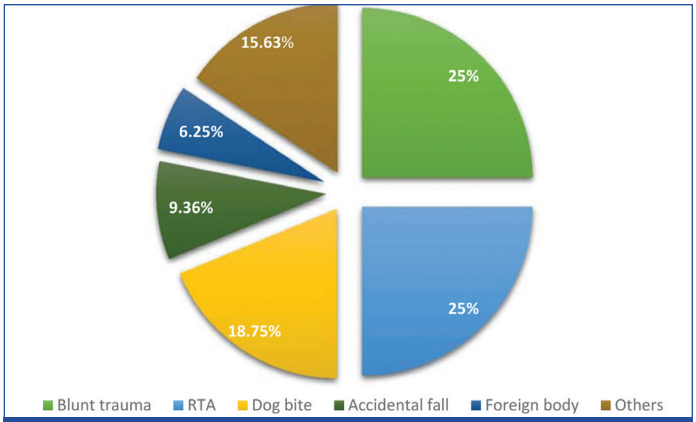
Parameters	n (%)
Gender	
Male	20 (62.5%)
Female	12 (37.5%)
Age group (years)	
2-5	10 (31.25%)
6-10	5 (15.63%)
11-16	17 (53.12%)

[Table/Fig-1]: Demographics of the patients.

Blunt trauma, road traffic accidents and dog bites were the most common modes of injury [Table/Fig-2]. Blunt trauma was due to stone injury, fist fights and tennis/cricket ball. Other causes for trauma included injury from finger nail, stick, pencil and fire cracker.

Visual acuity at presentation and at final follow-up is represented in [Table/Fig-3]. Most of the patients had initial visual acuity of more than 6/60. According to BETTS classification, one patient had open globe injury and 15 sustained closed globe injuries. Sixteen children presented adnexal injuries [Table/Fig-4]. One patient with open globe injury belonged to OTS category 4.

Four children had corneal abrasions and were treated with topical antibiotics and artificial tears substitutes. One child had full thickness corneal tear and underwent corneal tear repair under general anaesthesia. Two children had lamellar corneal tears and were managed conservatively. Three children had traumatic uveitis.



[Table/Fig-2]: Mode of injury.

Vision	At presentation n (%)	At final visit n (%)
<6/60	4 (12.5%)	1 (3.13%)
6/60	4 (12.5%)	1 (3.13%)
6/36	3 (9.38%)	1 (3.13%)
6/24	3 (9.38%)	1 (3.13%)
6/18	5 (15.63%)	3 (9.38%)
6/12	1 (3.13%)	7 (21.87%)
6/9	5 (15.63%)	8 (25%)
6/6	7 (21.87%)	10 (31.25%)

[Table/Fig-3]: Visual acuity.

Pattern of injury	n (%)
Open globe injury	1 (3.13%)
Corneal tear	1 (3.13%)
Close globe injury	15 (46.87%)
Lamellar corneal tear	2 (6.25%)
Subconjunctival haemorrhage	5 (15.63%)
Corneal abrasions	4 (12.50%)
Traumatic uveitis	3 (9.38%)
Choroidal tear	1 (3.13%)
Adnexal injury	16 (50%)
Lid tear	6 (18.75%)
Lid tear with canalicular tear	4 (12.50%)
Lid tear with undisplaced orbital fracture	3 (9.38%)
Orbital fracture displaced	3 (9.38%)

[Table/Fig-4]: Type of injury.

They were treated with topical corticosteroids, cycloplegics and non steroidal anti-inflammatory eye drops. One child had choroidal tear involving macula and this patient's vision did not improve.

Six children had lid tear only, while four children had lid tear with canalicular tears. These patients had associated facial skin lacerations. Dog bite and Road Traffic Accidents (RTA) were the most common cause. Three cases of canalicular tear were due to dog bite. These children received intramuscular tetanus toxoid injection. In dog bite cases, wounds were thoroughly cleaned, given intralesional Rabies monoclonal antibody at 3.3 IU/kg. Lid tears were sutured in layers. Canalicular tears were repaired. Complete course of anti rabies vaccine was given.

Six children had orbital fractures, RTA and blunt trauma being the commonest causes. Three of these patients had undisplaced fractures associated with lid tears. Only lid tears were sutured. Three of the patients had fractures along with muscle entrapment. They underwent muscles entrapment release with fracture reduction. Floor fracture was commonest, seen in four children. Floor and medial wall fracture were seen in two patients. None of the patients had traumatic cataract or retinal detachment in the current study.

Two children with lid tear repair had lower lid ectropion due to scar contraction. They underwent revision surgery to excise the scar tissue and ectropion repair. One child with lid tear had extensive scar for which perilesional injection of 5 fluorouracil (1.8 mL 5 fluorouracil and 0.2 mL triamcinolone acetonide) was given weekly for five weeks. Remarkable improvement was seen in this case.

The follow-up period varied from one week to one year depending on the severity of the injury, average being 5.8±3.9 months. Visual acuity during the final follow-up was good in most of the patient's. One patient had visual acuity less than 6/60 due to choroidal tear. Three patients with corneal tear had vision between 6/60-6/24.

DISCUSSION

Paediatric ocular trauma remains a significant cause of acquired blindness in children. Children are a high-risk group due to their behavioural traits such as curiosity, playfulness and a tendency to imitate adults, which often place them in hazardous situations. Their limited understanding of consequences and difficulty in communication pose unique challenges during diagnosis and management. Moreover, paediatric patients often require general anaesthesia for management [4,13].

Present study observed that paediatric ocular trauma predominantly affected males (62.5%), consistent with the findings of Parija S et al., (74.6%) and Singh S et al., (68.63%) [9,14]. Madan AH et al., in their study from Central Maharashtra also reported a male predominance of 65.1%, reflecting gender-related activity patterns and outdoor exposure [4].

Mean age in present study was 9.8±4.5 Years. Visvanathan S et al., reported mean age of 7.43 years and Singh S et al., reported 8.74±3.9 years [13,14]. Mean age was more in the present study compared to other studies. In the current study, 10-16 year age group was most affected where as in Maurya RP et al., and Madan AH et al., studies 6-10 years age group was most affected [2,4]. In Viswanathan S et al., study, 9 to 12 year group was most affected [13]. According to this study older age group children were more affected which differs from other studies.

All patients in the present study reported within 24 hours of injury. In Raiturcar TP et al., study 40.38% of children reported to hospital within 24 hours [15]. In majority of the study patients (72%) one eye was affected, similar to and Viswanathan S et al., (82%) Sahai M et al., (95%) [13,16].

Blunt trauma due to fist fight, sports related and RTAs were the leading mode of injury in this study. Madan AH et al., reported a high incidence of sports related injuries and blunt trauma [4]. Singh S et al., found blunt trauma as the most prevalent cause, often due to falls and play-related accidents [14]. Saxena R et al., reported a notable incidence of penetrating injuries caused by bow and arrow, firecrackers and household objects, emphasising regional variations in injury mechanisms [3].

Dog bites accounted for 18.75%, which was higher than other studies. It could be due to referral bias. Due to factors like limited defensive ability, curiosity and smaller stature, children under 15 account for up to 40% of reported animal bite incidents [17,18]. All patients fully recovered with no cases of rabies or major complications, due to prompt wound care, timely Rabies monoclonal antibody administration and completion of the anti rabies vaccination.

Regarding injury classification, present study noted that closed globe injuries (46.87%) were more frequent than open globe injuries (3.13%), with adnexal injuries comprising 50% of cases. Singh S et al., reported a higher prevalence of closed globe injuries [14]. Madan AH et al., found a relatively higher proportion of open globe injuries (63.9%) [4]. Maurya RP et al., and Saxena R et al., also reported a predominance of closed globe injuries, consistent with unintentional blunt trauma being a common cause [2,3].

Orbital fractures were more common in adolescent children. Floor was fractured the most common in this study, RTA, blunt trauma being common cause. This result is similar to Boniao EL et al., [19].

In this study one patient was in OTS category 4. Rest of patients had closed globe injury and OTS score was not assigned. Only four patients had final visual acuity of ≤6/24. Madan AH et al. reported that 91.86% of children with closed globe injuries attained Best Corrected Visual Acuity (BCVA) ≥6/12, while visual recovery in open globe cases was less favourable [4]. Similarly, Singh S et al., noted significant visual improvement in conservatively managed closed injuries [14]. In contrast, Saxena R et al., observed poorer outcomes in open globe cases, with only 15.45% achieving BCVA ≥6/12, highlighting the severity of such injuries and the importance of early intervention [3]. Visual outcomes in this cohort were favourable in the majority of cases.

Present study demonstrated high surgical management (53.12%) than medical management. Surgical interventions ranged from corneal tear repair, lid laceration suturing and canalicular tear repair to orbital fracture correction. Lid tear repair was the most common surgery done. These findings are in agreement with Singh S et al., who documented a high surgical requirement among open globe injuries and adnexal trauma [14]. In Viswanathan S et al., study, majority of the patients were managed medically [13]. In Katiyar V, et al., study, 62.5% patient needed surgical treatment [20]. Madan AH et al., noted that while most closed globe injuries responded to medical treatment, nearly all open globe injuries required immediate surgery [4].

Complications seen in this study were ectropian and wound scarring following lid tear repair. Ectropian correction surgery gave good result. Wound scar was treated with perilesional injection of 5 fluorouracil and improvement was seen. Ibrahim A et al., and Deswal J et al., also reported that 5 fluorouracil helps in treating scars [21,22].

[Table/Fig-5] shows compilation of various studies and their salient features [9,13,15,23,24].

S. No.	Author's name and year	Place of study	Sample size	Objective	Parameters assessed	Conclusion
1	Parija S et al., 2023 [9]	Odisha, Eastern India	114 retrospective over 4 years	Identifiy risk factors, demographics, clinical profile, prognostic factors	Demographic profile, visual acuity, cause and type of injuries	Initial visual acuity significant in predicting final outcome. Open globe injury poor prognosis.
2	Visvanathan S et al., 2023 [13]	Tamil Nadu, India	50 perspective	Pattern and mode of ocular trauma, complications, visual prognosis	Mode, place of injury, course in hospital, complications, final visual outcome	High prevalence of RTA and closed globe injury. OTS useful in predicting final visual final visual outcome.
3	Qayum S et al., 2018 [24]	Haryana, Northern India	357 retrospective	Identifiy contributing factors to ocular trauma	Demographics profile, type and cause of injury, final outcome	Children need supervision. Need to Increase family awareness towards mode of injury
4	Raiturcar TP et al., 2019 [15]	Goa, India	52 retrospective	To study clinical profile and visual outcome	Nature of injury time delay in treatment, visual acuity at presentation and at discharge	Good parental supervision and seeking immediate medical care important
5	Beyuo VM et al., 2025 [23]	Ghana,Western Africa	103 prospective	Epidemiology of pediatric ocular trauma	Type, cause of trauma, factors affecting final vision	Open globe injury and injury from organic matter had bad prognosis

6	Present study	Karnataka, India	32 prospective	Aetiology, clinical presentation and visual outcomes of paediatric ocular trauma	Demographics profile, cause of injury, final outcome	The initial visual acuity is a strong predictor of the final outcome. Timely referral and appropriate intervention are crucial.

[Table/Fig-5]: Review of literature comparing various studies on paediatric ocular trauma [9,13,15,23,24].

Limitation(s)

The present study's limitations include single centre design, which restrict statistical power and generalisability. The variable follow-up duration limited the assessment of long term visual outcomes and late complications. Additionally, the absence of a control group hindered the evaluation of risk factors and comparative treatment efficacy.

CONCLUSION(S)

Present study reported higher incidence of adnexal injuries and dog bite injuries. Cracker injuries were less common. The initial visual acuity at presentation is a strong predictor of the final outcome. Timely referral and appropriate intervention are essential to prevent irreversible vision loss. Regular follow-up is critical for identifying and managing secondary complications. Health education targeting children, parents and teachers about ocular hygiene and injury prevention is vital. To reduce the incidence and improve the prognosis of paediatric ocular trauma, strengthening emergency care services, training healthcare workers and enhancing access to specialised care are imperative.

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