

Original research article

The Clinic-epidemiological Assessment of Ocular Trauma Associated with Closed-Globe Injuries: A Cohort Study

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Abstract

Aim: To study on the epidemiology of ocular trauma associated with closed-globe injuries.

Methods: This was a prospective observational study conducted in the Department of Ophthalmology Darbhanga Medical College and hospital, Laheriasarai, Darbhanga, Bihar, India for 1 year. Children with ocular injury in either of the eye who presented, diagnosed and managed were included in the study. Patients who consented to participate and not presented with any other serious body injury were included. We divided all participants in closed globe injuries according to the BETTS and studied them. We obtained a comprehensive history, including the details of injury and information on the treatment and surgery performed to manage the past ocular trauma.

Results: Our cohort consisted of 500 patients with mechanical ocular trauma. Closed globe injuries were reported in 350 patients which include 238 males (68%) and 112 females (32%). The mean age of patients was 11.2 ± 4.7 years. Of all closed globe injuries, 236 (67.5%) were closed globe contusion and 113 (32.3%) were lamellar laceration. In addition, 23% of patients were under 5 years of age. Conjunctiva was the most commonly affected tissue in closed globe injury, which was found in 52%, followed by the cornea 48%. In terms of outcome, 234 eyes (66.8%) regained $>6/24$ visual acuity, whereas 116 eyes (32.2%) did not regain more than 1/60. We found the involvement of 1-6 tissues in all cases. In addition, we found a significant difference in visual outcome with respect to the number of tissues involved ($P = 0001$).

Conclusion: The 234 eyes (66.8%) regained $>6/24$ visual acuity, whereas 116 eyes (32.2%) did not regain more than 1/60.

Keywords: ocular, closed-globe, injuries

Introduction

Even though certain researchers have focused on ocular trauma in rural areas, the issue is more prevalent in the urban setting and happens to be an important cause of monocular blindness.¹ It is necessary to build a sound epidemiological database and develop a good understanding of the causes/outcomes of injury to devise appropriate strategies for preventing them. The etiology of ocular injury differs markedly between the urban and rural areas and needs to be examined closely.²⁻⁴ As eye injuries pose a large, potentially preventable burden to the victim and the society at large, we need to channelize our resources to prevent such injuries and alleviate the burden.³ Damage to the surrounding ocular tissues may compromise the visual gain after surgery for managing the traumatic cataracts, thereby decreasing the success rate when compared with eyes having non-traumatic cataracts. Traumatic cataracts are often associated with poor visual outcomes in children because of the amblyopia and recurrent inflammation. In pediatric population, the possibility of amblyopia has to be considered as strabismus, refractive errors, or ocular opacity can result in the condition.⁵ The use of Birmingham Eye Trauma Terminology System (BETTS) has standardized the definition of ocular trauma⁵, making it possible to compare the visual outcomes following traumatic cataract surgery and understand the determinants in predicting the outcomes. Various studies have reported the visual outcomes of ocular trauma; however, most were case studies or involved only a small sample size.⁶⁻⁸ Globe rupture is a subgroup of open globe injury with poor prognosis as there are many determinants which influence the outcome.

Material and methods

This was a prospective observational study conducted in the Department of Ophthalmology Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 1 year. After taking the approval of the protocol review committee and institutional ethics committee. Children with ocular injury in either of the eye who presented, diagnosed and managed were included in the study. Patients who consented to participate and not presented with any other serious body injury were included. We divided all participants in closed globe injuries according to the BETTS and studied them.

We obtained a comprehensive history, including the details of injury and information on the treatment and surgery performed to manage the past ocular trauma. The data were collected from both initial and follow-up reports using the online BETTS format of the International Society of Ocular Trauma. The details of the surgery were also gathered using a specified pre-tested online form.

The closed globe group was subdivided into lamellar laceration and contusion.

Other demographic details included residence, activity at the time of injury, object causing the injury, and previous examinations and treatments. After their enrollment, all patients were tested using a standardized method. Visual acuity was checked using the JAAPOS guidelines and the anterior segment was examined using a slit lamp or hand held slit lamp. Ocular and adnexal tissues affected were documented.

For a partially opaque lens, the posterior segment examination was carried out with an indirect ophthalmoscope and a +20 D lens. When the optical medium was not clear, a B-scan was performed to evaluate the posterior segment. Children not allowing the examination were investigated under anesthesia.

In children younger than 2 years, both lensectomy and vitrectomy via a pars plana route were performed, and the same surgical procedures were used to manage the traumatic cataract. The

lens implantation as a part of the primary procedure was avoided in children younger than 2 years.

The patients with injuries without infection were treated with the topical and systemic corticosteroids and cycloplegics. The duration of medical treatment depended on the degree of inflammation in the anterior and posterior segments of the eye. The post-treatment patients were re-examined consecutively after 24 h, 3 days, and 1, 2, and 6 weeks to enable refractive correction. Post which the re-examination was done monthly for 3 months, and then every 3 months for 1 year.

At every follow-up examination, visual acuity was tested with the JAAPOS guidelines. The anterior and posterior segments were examined using a slit lamp and an indirect ophthalmoscope, respectively.

During examination, the data entry was carried out online using a specified pretested format designed by the International Society of Ocular Trauma (initial and follow-up forms) and later exported to Microsoft Excel spreadsheets. The data were audited periodically to ensure completion.

We used the Statistical Package for Social Studies (SPSS 25.0) to analyze the data. The univariate parametric method was employed to calculate the frequency, percentage, proportion, and 95% confidence interval (95% CI). We applied binominal regression analysis to determine the predictors of post-treatment satisfactory vision (>20/60). The dependent variable was vision >20/60 noted at the follow-up.

Results

Our cohort consisted of 500 patients with mechanical ocular trauma. Closed globe injuries were reported in 350 patients which include 238 males (68%) and 112 females (32%). The mean age of patients was 11.2 ± 4.7 years. In addition, 23% of patients were under 5 years of age. Of all closed globe injuries, 236 (67.5%) were closed globe contusion and 113 (32.3%) were lamellar laceration.

Play was the most common activity among kids <5 years (63%) that caused injuries at home or in other places. In contrast, domestic (12%) and professional (5%) activities were the most frequent causative factors among teens and other children.

Wooden object and stone were the most common causative factors for the injury, which were observed in 50% and 20% cases, respectively.

Conjunctiva was the most commonly affected tissue in closed globe injury, which was found in 52%, followed by the cornea 48%.

The pre- and post-treatment data yielded a significant difference in the visual outcome (Table 2, $P = 0.001$). Comparative study of the visual outcome between the subcategories of closed globe injury showed a significant difference [Table 3].

In terms of outcome, 234 eyes (66.8%) regained >6/24 visual acuity, whereas 116 eyes (32.2%) did not regain more than 1/60. We found the involvement of 1-6 tissues in all cases. In addition, we found a significant difference in visual outcome with respect to the number of tissues involved ($P = 0001$).

Table 1: Age and sex distribution

Age category	Sex		Total
	F	M	
Below 2 years	10	19	29
2-5	23	33	56
5-10	31	70	101
10-18	48	116	164
Total	112	238	350

Table 2: Comparison of visual outcome pre and post treatment following closed globe injury in pediatric age group

Post treatment vision	Pre treatment vision							Total
	<1/60	1/60-5/60	6/60-6/36	6/24-6/18	6/12-6/9	6/6-6/5	UNCOOP	
<1/60	77	0	2	3	5	3	0	90
1/60-5/60	2	2	3	5	3	1	2	18
6/60-6/36	3	1	2	6	2	0	1	18
6/24-6/18	5	3	5	42	9	4	2	70
6/12-6/9	5	3	7	13	25	12	2	67
6/6-6/5	8	1	3	5	6	47	4	74
UNCOOP	0	0	0	6	0	0	2	8
TOTAL	100	10	22	80	50	70	13	350

Table 3: Comparison of visual outcome with sub groups of closed globe injury in pediatric age group

Post treatment vision	Closed globe		Total
	Contusion	Lamellar laceration	
<1/60	75	15	90
1/60-5/60	12	6	18
6/60-6/36	13	5	18
6/24-6/18	40	30	70
6/12-6/9	40	27	67
6/6-6/5	49	25	74
UNCOOP	1	7	8
TOTAL	235	115	350
<i>P</i> =0.000			

Results

Our cohort consisted of 500 patients with mechanical ocular trauma. Closed globe injuries were reported in 350 patients which include 238 males (68%) and 112 females (32%). The mean age of patients was 11.2 ± 4.7 years. We could not find any study that has specifically reported only closed globe injuries in patients belonging to the pediatric age group; the majority of the studies have reported overall eye injuries in children.⁹⁻¹⁶

Majority studies reported smaller case series or retrospective studies as far as blunt trauma is concerned.⁹⁻¹⁶ Very few studies had a cross-sectional design.¹⁷ Some researchers have reported

prospective studies, but these are not specific for closed globe injuries and classified according to BETTS.¹⁸⁻²⁴ The current study reported that the mean age of patients was 11.2 ± 4.7 years. The current study reported a significant difference in the visual outcome between below and above 5 years which is in accordance with the report by Shah *et al.*²⁵ In the present study, the percentage of male patients was 68%. Similarly, Serrano has reported 64.9% of male patients⁹ and Sharifzadeh has reported a male to female ratio of 2.3:1.¹⁸ Other prospective studies have involved overall trauma rather than specifically including the blunt trauma. Only Canavan *et al.* have conducted a prospective study with blunt trauma cases; but, the study has not included only the pediatric age group.²⁵

Serrano has reported 35% of blunt trauma and Liu has reported 71% of open globe injuries.⁹ This contradiction may be because of the classifications according to the BETTS.

Khokhar *et al.* have reported that the incidence of open globe injury is three fold higher than the closed globe injury; however, the current study reported that the incidences of closed globe and open globe injuries are 40% and 60%, respectively.²⁶ Shah *et al.* have reported that the visual outcome is better in closed globe injury patients belonging to the pediatric age group. However, we observed a visual regain of $>6/24$ in 64.2% of cases.²⁷ The current study reported that 234 eyes (66.8%) regained $>6/24$ visual acuity, whereas 116 eyes (32.2%) did not regain more than 1/60. Serrano has reported that most of the closed globe injuries do not cause severe visual loss.^{9,28} This may be because of the less severe injuries. Onyekonwu has reported a final visual outcome of $>6/18$ in 35.1% of cases; but, this is not specific for closed globe injuries.¹¹ Majority of the studies have reported that home is the most common location and play is the most common activity related to injuries.²¹ The percentage of surgeries was 6.7 in closed globe injuries according to the BETTS. We did not find any study reporting this.

Rohr *et al.* have reported that the cornea is affected in 54% of eyes in respect to all types of injuries, whereas the current study reported that the cornea is affected in 49% of eyes – only in respect to cases of closed globe injuries.¹⁷ We did not find any study that has reported the number of tissues involved, as well as the comparative differences in visual outcome.

Conclusion

We concluded that the 67% eyes regained $>6/24$ visual acuity, whereas 23% eyes did not regain more than 1/60.

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