



A prospective cohort study on the epidemiology of ocular trauma associated with closed-globe injuries

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Abstract

Purpose: To study the epidemiology of mechanical ocular trauma and closed globe injury category by using the Birmingham Eye Trauma Terminology System.

Material and Methods: This prospective cohort study involves a prospective cohort study of all the enrolled ocular trauma cases. The data were collected using the international ocular trauma society form through our online MIS data and exported in excel sheet. The data were scrutinized by SPSS 22 using univariate analysis and cross tabulation.

Results: Our cohort consisted of 12687 patients with mechanical ocular trauma. There were 7546 (59.4%) eyes with open globe ocular injuries and 5328 (41.9%) with closed globe injuries. Out of the patients with closed globe injuries, 3646 (68.4%) were males and 1682 (31.5%) were females. The mean patient age was 37.4 ± 19.2 years (range, 1–95). Amongst the total closed globe injuries, 4078 (76.5%) were closed globe contusion and 1250 (23.5%) were lamellar laceration.

Conclusion: Closed globe injury is an important cause for loss of sight. The condition is more prevalent among the males and younger people. The treatment has significant impact on the visual outcome.

Keywords: closed globe injuries; Betts; lamellar contusion; closed globe contusion

Introduction

Trauma is a major cause of monocular blindness in the developed world. A few studies have specifically addressed the problem in rural areas ^[1], as the etiology of ocular injury in such places is likely to differ from that in the urban areas and is hence worthy of investigation ^[2, 4]. Any preventive strategy requires a knowledge about the cause of the injury, which may enable a more appropriate targeting of resources for avoiding them. Both the victims of eye trauma and the society at large bear a huge burden, which is potentially preventable ^[3].

Ocular trauma can cause cataracts ^[1]. The methods used to evaluate the visual outcomes of patients treated for traumatic cataracts and senile cataracts are similar ^[5], but the damage to other ocular tissues due to trauma may compromise the visual gain obtained from surgeries performed for the repair of traumatic cataracts. Thus, the success rates may differ between the patients with the two types of cataracts. With the introduction of the Birmingham Eye Trauma Terminology System (BETTS), the documentation of ocular trauma has now been standardized ^[5].

Our study was conducted in a city located in the border of the three Indian states of Gujarat, Madhya Pradesh, and Rajasthan. Qualified ophthalmologists of our institute provide low-cost eye services, primarily to the poor people in the tribal population of 4.2 million residing in the area.

Materials and Methods

We obtained approval from the hospital administrators and research committee to conduct this study. We also obtained the participants' written consent and next to kin in case of children.

This research was a prospective study designed in 2002. All

patients with ocular injury in either eye who were diagnosed and managed between January 2003 and December 2017 were enrolled in the study. Among those who consented to participate, patients with no other serious body injury were included. We divided all the patients in closed globe injuries according to BETTS and studied them.

For each patient enrolled in the study, we obtained a comprehensive history, including details of the injury and information on the treatment and surgery performed to manage the past ocular trauma. Data for both the initial and follow-up reports were collected using the online BETTS format of the International Society of Ocular Trauma. 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 that were fetched included residence, activity at the time of injury, socio economic status (6) object causing the injury, and previous examinations and treatments. After enrollment, all patients were tested using a standardized method. Visual acuity was checked using Snellen's chart in case of adult and using guidelines of American Academy of Ophthalmology in pediatric population and the anterior segment was examined using a slit lamp.

For a lens that was partially opaque, 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.

In children younger than 2 years of age, both lensectomy and vitrectomy via a pars plana route were performed, and the same surgical procedures were used to manage the traumatic cataract. Lens implantation as part of the primary

procedure was avoided in all children younger than 2 years of age.

All patients with injuries were treated with 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-operative patients were re-examined after 24 h, 3 days, and subsequently at 1, 2, and 6 weeks to enable refractive correction. Follow-up was scheduled for the third day, then weekly for 6 weeks, monthly for 3 months, and then every 3 months for 1 year.

At every follow-up examination, visual acuity was tested with a Snellen's chart and using AAO guidelines in children. The anterior and posterior segments were examined using a slit lamp and an indirect ophthalmoscope, respectively.

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

We used the Statistical Package for Social Studies (SPSS 22) to analyze the data. The univariate parametric method was employed to calculate frequency, percentage, proportion, and 95% confidence interval (95% CI). The dependent variable was vision >20/60 noted at the follow-up. The independent variables were age, gender, residence, time interval between injury and cataract surgery, primary posterior capsulectomy and vitrectomy procedures, and type of ocular injury.

Results

Our cohort consisted of 12687 patients with mechanical ocular trauma. There were 7546 (59.4%) eyes with open globe ocular injuries and 5328 (41.9%) with closed globe injuries. Out of the closed globe injuries, 3646 (68.4%) were males and 1682 (31.5%) were females. (Table-1) The mean patient age was 37.4 ± 19.2 years (range, 1–95, median 36). Amongst the total closed globe injuries, 4078 (76.5%) were closed globe contusion and 1250 (23.5%) were Lamellar laceration.

We analysed several demographic factors, including patient entry ($p = 0.4$), socioeconomic status (48.2% belonged to the poor class), and residence (95% from rural areas). However, as inferred from the cross tabulation and statistical tests, none had a significant relationship with the patient's final visual acuity. The object causing the injury ($p = 0.3$) and the activity at the time of the injury ($p = 0.3$) were also not significantly associated with satisfactory final visual acuity.

Out of the total 5328 blunt trauma cases, we identified 1021 of pediatric age group.

Wooden stick 2314 (43.5%) and stone 931(17.3%) were the most common objects of injury (Figure-1).

Domestic (1735, 32.6%) and profession-related (1137, 21.3%) activities were the most frequent ones amongst the adults, while play (Figure-2) was the most common cause among the children.

Comparative studies between pre- and post-treatment yielded a significant difference in the visual outcome (Table-2, $p=0.000$).

Comparative study of visual outcome amongst subcategory of closed globe injury has significant difference. (Table-3, $p=0.000$)

Out of total, only 296 (5.6%) cases required surgical treatment.

3272 (61.1%) eyes regained >6/60 visual acuity.

Conjunctiva was most commonly affected tissue 51.1% cases of closed globe injury. (Table-4)

Table 1: Age and Sex Distribution

Age	Sex		Total
	Female	Male	
0-10	177	337	514
11-20	193	486	679
21-30	257	694	951
31-40	294	645	939
41-50	262	551	813
51-60	322	532	854
61-70	163	330	493
71-80	11	66	77
>80	3	5	8
Total	1682	3646	5328

Table 2: Subcategories of Closed Globe Injury

Category	Frequency	Percent
Contusion	4078	76.5
Lamellar laceration	1250	23.5
Total	5328	100.0

Table 3: Activity of Injury

Activity	Frequency	Percent
By stander	56	1.1
Cattle care	38	.7
Cutting stone	53	1.0
Cutting wood	129	2.4
Driving	18	.3
Fall	61	1.1
Farm work	134	2.5
Fighting	117	2.2
Home work	1735	32.6
Job work	1137	21.3
Labour	5	.1
Other	548	10.3
Plain mobility	69	1.3
Playing	871	16.3
Vehicular accident	314	5.9
Sleeping	34	.6
Unknown	9	.2
Total	5328	100.0

Table 4: Object of Injury

Object	Number	Percent (%)
Stone	980	18.4
Cattle	24	0.4
Wooden-object	2787	52.3
Hand	21	0.3
Foreign body	64	1.2
Sport	10	0.3
Other	757	14.4
Unknown	680	12.8
Total	5328	100

Table 5: Comparative Study of Visual Outcome Pre and Post Treatment Following Closed Globe Injury

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	1396	23	35	16	18	26	0	1514	
1/60-5/60	96	226	145	14	21	12	2	516	
6/60-6/36	58	38	189	82	37	8	1	413	
6/24-6/18	88	40	71	441	157	28	5	830	
6/12-6/9	85	29	44	75	610	240	3	1086	
6/6-6/5	47	18	25	37	108	706	2	943	
Uncoop	1	0	1	5	0	2	17	26	
Total		1771	374	510	670	951	1022	30	5328

P=0.000

Table 6: Comparative Study of Visual Outcome with Sub Groups of Closed Globe Injury

Vision category	Closed globe		Total
	Contusion	Lamellar laceration	
<1/60	1312	202	1514
1/60-5/60	426	90	516
6/60-6/36	321	92	413
6/24-6/18	597	233	830
6/12-6/9	782	304	1086
6/6-6/5	622	321	943
Uncoop	18	8	26
Total	4078	1250	5328

P=0.000

Table 7: Tissues Affected

No	Tissue	Number	Percent (%)
1	Conjunctiva	2723	51.1
2	Cornea	2462	46.2
3	Lens	1668	31.2
4	Led	627	11.8
5	Iris	527	9.2
6	Anterior chamber	502	9.0
7	Sclera	55	1.0
8	Retina	48	0.9
9	Vitreous	40	0.8
10	Extra ocular muscles	28	0.5
11	Adnexa	12	0.2
12	Orbit	10	0.2

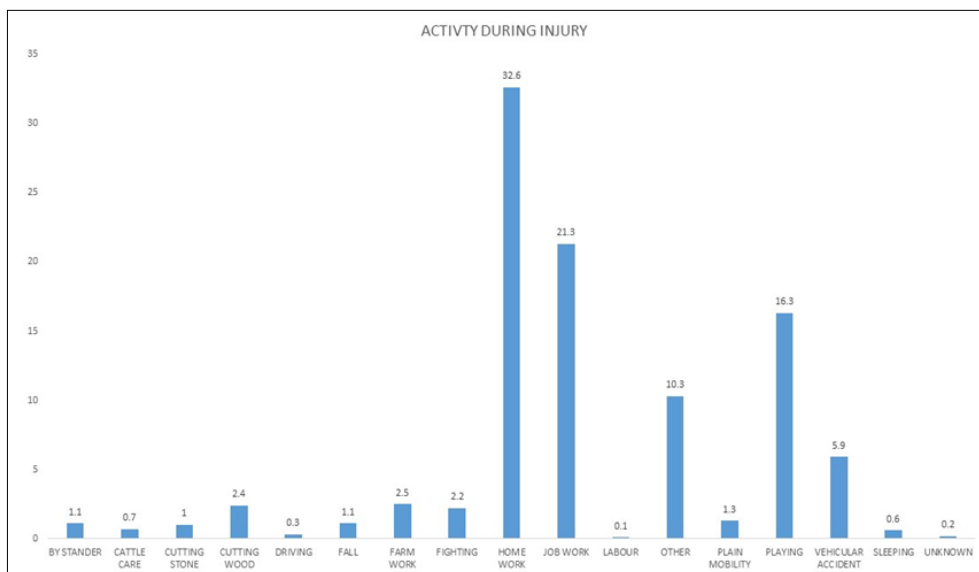


Fig 1

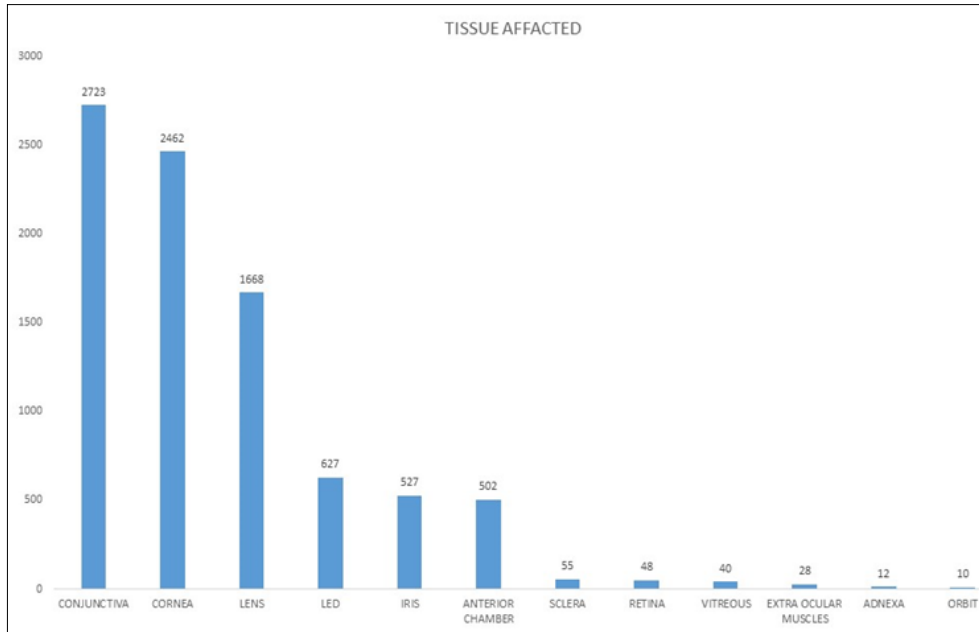


Fig 2

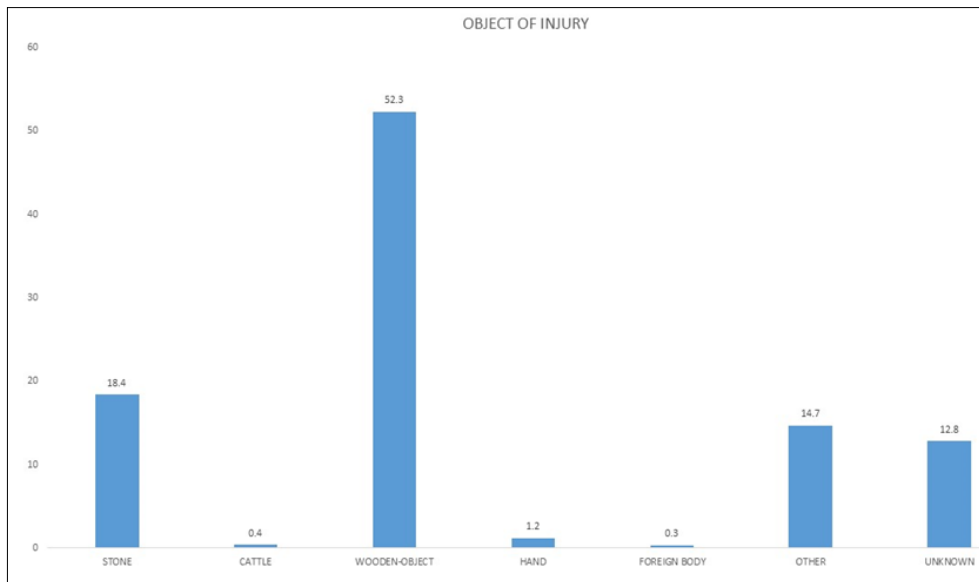


Fig 3

Discussion

Our cohort consisted of 12687 patients with mechanical ocular trauma. There were 7546 (59.4%) eyes with open globe ocular injuries and 5328 (41.9%) with closed globe injuries. Out of the closed globe injuries, 3646 (68.4%) were males and 1682 (31.5%) were females. The mean patient age was 37.4 ± 19.2 years (range, 1–95). Amongst the total closed globe injuries, 4078 (76.5%) were closed globe contusion and 1250 (23.5%) were Lemeller laceration. Most reported investigations were of smaller case series and retrospective studies (7-21) Some studies were cross-sectional design. (22-28) Other prospective studies were overall trauma series rather than specified category of blunt trauma. Only Canavan *et al.* dealt with prospective blunt trauma cases (1048 cases) (29-37) The current study has reported a mean age of 37.4 years. However, Al-Mahrouqi *et al.* documented the mean age to be 23 years and Kinderan stated it as 28.3 years. (1, 10) The present study observed 68.3% of the patients to be

males. Other studies: Al-Mahrouqi: 72%, Wong: 49.5%, Balaghafari: 75.8%, and Kinderan: 69.4%. The gender variation may be attributed to increased injuries during household chores (1, 4, 18) Kinderan *et al.* found 73.3% closed globe injuries and blunt trauma 56.5%; however, in the current study, closed globe injuries were 41.9% and closed globe contusions were 23.5% (18) During comparative studies on the pre- and post-treatment visual outcomes, we found a significant difference (Table- p=0.000) between them. The current study discerned that 53.7% eyes regained >6/18 and 28% visual acuity, while Kinderan reported 74.8% eyes and 8% <3/60. (18) The percentage of surgeries was 5.6% in the closed globe injuries according to BETTS.

Conclusion

Closed globe injury is an important cause for loss of sight and the condition is more common among the males and younger people. Treatment has a significant impact on the

visual outcome.

What was known: Closed globe injuries cause sight loss.

What this paper adds: The incidence of closed globe injuries in less, but the sight loss is more severe.

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