ORIGINAL RESEARCH PAPER VOLUME-6 | ISSUE-8 | AUGUST - 2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

STUDY OF PROGNOSTIC FACTORS AND VISUAL OUTCOME IN OPEN GLOBE INJURIES IN A TERTIARY CARE HOSPITAL IN MUMBAI.

Ophthalmology

Sheela Kerkar Associate Professor, Department of Ophthalmology, Seth G.S. Medical College & K.E.M. Hospital, Mumbai.

Charuta Mandke Assistant Professor, Department of Ophthalmology, HBTMC & DR RNCH, Mumbai. Corresponding author

Janika Shah Ex- registrar, Department of Ophthalmology, Seth G.S. Medical College & K.E.M. Hospital, Mumbai.

ABSTRACT

Ocular trauma is a common cause of monocular visual impairment and blindness worldwide. 50 consecutive patients, with Open Globe Injuries, were studied from January 2012 to October 2013, and primary surgical repair was carried out. Assessment, treatment and 6 months follow up of patients in our study, revealed maximum incidence in the youth with unilateral metallic penetrating injuries being the most common. A good initial visual acuity, early intervention, the absence of a relative afferent pupillary defect, hyphema, retinal detachment & vitreous haemorrhage were significant predictors for a good visual outcome. The zone of injury is significant, with posterior injuries having poorer prognosis. With advances in management modalities, the final visual outcome in open globe injury is improving. Limitaions of the study were due to small sample size and single centre study design.

KEYWORDS:

Open Globe Injuries, Prognosis, Ocular Trauma.

Introduction

Ocular trauma can be sudden, devastating and can change a life in a moment.

It has been reported that up to one-fifth of adult populations have had ocular trauma (OT) at some point in their lives[1]. It may range from occurrence of minor corneal abrasions and sub-conjunctival hemorrhage to a badly lacerated globe with complete loss of vision.
Globally about 55 million eye injuries restricting normal activities for more than one day occur every year; 750,000 cases require hospitalization each year, including some 200,000 open-globe injuries; and almost 19 million with unilateral blindness or low vision from it[2].

Ocular trauma is the leading cause of non-congenital unilateral blindness in children[3]. Children suffer a higher percentage of open globe injuries than adults, comprising 19% -58.3% of all cases of ocular trauma[4]. Worldwide, 2% to 14% of the pediatric ocular trauma patients ended in severe visual impairment or blindness[3]. Compared to closed globe injuries, open globe injuries yield worse visual outcomes in ocular trauma[5].

Ocular trauma is a common cause of monocular visual impairment and blindness worldwide, with significant socioeconomic impact [6]. Previous studies have shown that in penetrating ocular injuries, factors such as initial visual acuity, type of injury, location and extent of the wound, type of lens damage, severity of vitreous hemorrhage, and type of intraocular foreign body correlated with the final visual outcome[7].

Methods

50 consecutive patients with open globe injuries (full thickness injury of the eye wall) were studied at Seth G.S. Medical College & K.E.M. Hospital, a tertiary care teaching hospital in Mumbai between January 2012 and October 2013.

Exclusion Criteria:

- History of previous ocular surgery, ocular trauma, major eye disease in the same eye.
- An uncooperative or comatose patient.
- The presence of a new injury during the follow up period.

Patients or their guardians were explained about the surgery and prognosis and informed consent was taken.
Assessment:

- Demographic data, history of time and mode of injury, relation with work, time of primary care, treatment taken and general condition of the patient was recorded.
- Best corrected visual acuity (BCVA) on presentation, pupillary reaction, ocular motility, intraocular pressure where possible.
- Detailed slit lamp examination.
- Detailed fundus examination, where possible.
- Other examination as required e.g. USG B scan, X-ray orbit, CT scan orbit.

Injury was classified according to Ocular Trauma Classification System and the Birmingham Eye Trauma Terminology System (BETTS), into Type of Injury, Grade of Injury & Zone of Injury8,9. The factors studied were age and sex of the patient, type of injury, initial VA after injury, zone of the injury, lens status, presence or absence of RAPD, hyphema, vitreous hemorrhage, retinal detachment, and endophthalmitis; and requirement of second surgery, as a prognostic factor for final visual outcome at 6 months follow-up.
After initial preoperative medical treatment like systemic antibiotics, steroids (if not contraindicated) and NSAIDs, and topical preservative-free antibiotics, surgical closure of wound was done. Postoperative local antibiotic and steroids and systemic antibiotics for at least 5 days were given in all cases. Second surgery was performed as required.
Visual acuity(VA) assessment was recorded at 3 & 6-month post-operative follow up visits. Final visual acuity was graded according to World Health Organization (WHO) visual impairment categories: ≥ 6/18, (good visual outcome) or <6/18 - 6/60, <6/60 - 3/60, <3/60 (poor visual outcome). The relationship between different factors and the final VA was analysed by $\chi 2$ test. The association between the factors and final VA was considered statistically significant if $P \leq 0.05$.

Results

Age and Gender:

Of the 50 patients, maximum patients, 23 (46%), were in age group of 16 – 25 years, suggesting that ocular trauma is commonest in the youth;11 patients were <15 years, 7 (14%) were 26 – 35 years, 4 (8%) were 36 – 45 years and 5 (10%) were 46 – 55 years. 92% patients were male.

Source of injury:

Maximum injuries were by a metallic object in 30%. (Table 1).
Table 1: Source of Injury

Source Of Injury	No. Of Patients	Percentage %
Metallic object	15	30
Stone	12	24
Wooden object	8	16
Glass	5	10
Projectile (unknown)	4	8
Fingernail	2	4
Firecracker	2	4
RTA	1	2
Belt	1	2

Side affected:
Right eye was injured in 27 patients and Left eye in the rest.

Type of injury:
Type B (Penetrative injury) was most common type of injury accounting for 86% patients while Type A (Rupture) accounted for 4% patients. Type C (IOFB) was present in 10% patients. There was no patient with Type D & Type E injuries in our study.

Zone of injury:
Zone 1 injury was seen in 60%, 18% had Zone 2, while 22% had Zone 3 injury.

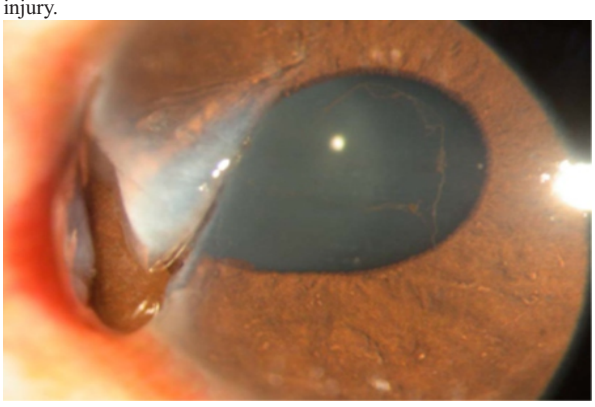

Fig 1: Zone I injury with iris prolapse

Grade of injury:
Grade 4 injury was most common. Grade of injury could not be calculated in 2 patients (Table 2).

Table 2: Grade of Injury

Grade of Injury	No. of Patients	Percentage
Grade 1	1	2
Grade 2	1	2
Grade 3	4	8
Grade 4	35	70
Grade 5	7	14
Cannot measure	2	4

Associated findings are shows in Table 3. Additionally, the lens was found to be cataractous in 28 (56%), absent in 3 (6%) and clear in 19 (38%) patients.

Table 3: Associated findings

Complications	Present (%)	Absent (%)
Hyphema	20 (40)	30 (60)
Retinal Detachment	14 (28)	36 (72)
Vitreous Hemorrhage	15 (30)	35 (70)
Endophthalmitis	2 (4)	48 (96)

Primary Surgery:
Primary closure only in 47 patients, primary closure with IOFB removal/Cataract extraction/ lensectomy-vitrectomy in one each.

Secondary Surgery:
23 patients did not require secondary surgery. 15 patients had cataract extraction with secondary IOL implantation. The rest had additional posterior segment surgeries.

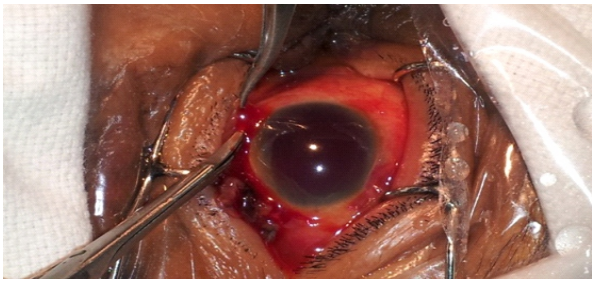

Fig 2: Scleral tear with uveal tissue prolapse.

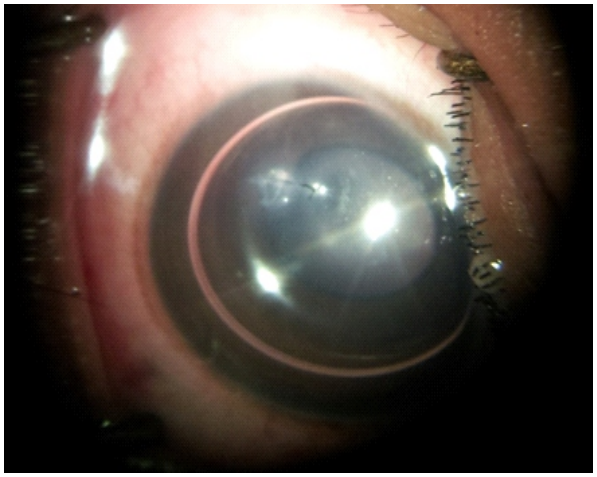

Fig. 3: Sutured corneal tear

Patients were followed up for 6 months. Two patients were excluded from analysis as they were lost to follow up. 56.25% patients had a visual acuity of 6/18 or better, (Table 4).

Table 4: **Final Visual Outcome (WHO category)**

WHO Category		Visual Acuity	No	%
0	Mild or no visual impairment	6/18 or better	27	56.25
1	Moderate visual impairment	6/18 to 6/60	4	8.3
2	Severe visual impairment	6/60 to 3/60	0	0
3	Blindness	3/60 to 1/60	2	4.16
4	Blindness	1/60 to light perception	8	16.66
5	Blindness	No light perception	7	14.58

Epidemiological factors: We compared the final visual acuity with the epidemiological factors like age & gender and found all the factors to be statistically insignificant as prognostic factors. (Table 5).

Table 5: **Epidemiological factors**

		Final Visual Outcome				
		6/18 or better		Worse than 6/18		
		N	%	N	%	P value
Age	<15 years	5	55.55	4	44.44	0.96
	>15 years	22	56.41	17	43.58	
Gender	Male	26	57.77	19	42.22	0.40
	Female	1	33.33	2	66.67	

Side of Injury: Left or right eye involvement was statistically insignificant as a prognostic factor (p = 0.229)
Grade of Injury: The grouped variable of grade (3 or less vs. more than 3) was statistically significant (p = 0.021) as a prognostic factor (Table 6).

Table 6: Grade of Injury – Final Visual Outcome

	Final Visual Outcome			
	6/18 or better		Worse than 6/18	
Grade	N	%	N	%
1	1	100	0	0
2	1	100	0	0
3	4	100	0	0
4	21	60	14	40
5	0	0	7	100

Type of Injury:

Table 7: Type of Injury - Final Visual Outcome

	Final Visual Outcome	
	6/18 or better	Worse than 6/18

Type of Injury	N	%	N	%
Type A	0	0	2	100
Type B	24	58.53	17	41.46
Type C	3	60	2	40
Type D	0	0	0	0
Type E	0	0	0	0

Zone of Injury: The zone of injury was statistically very significant (P = 0.00023) as a prognostic factor. Grouped as zone I (corneal) vs. zones I and III (scleral) due small sample size (Table 8).

Table 8: Zone of Injury - Final Visual Outcome

	Final Visual Outcome			
	6/18 or better		Worse than 6/18	
Zone of Injury	N	%	N	%
1	22	78.57	6	21.42
2	5	55.55	4	44.44
3	0	0	11	100

Pupil: All the patients with positive RAPD (15) had a poor visual outcome at the end of 6 months. 6 of the RAPD negative patients also ahd a poor outcome. This was statistically very significant ($p < 0.001$) as a prognostic factor.

Associated factors: We found presence of hyphema, retinal detachment & vitreous hemorrhage to be statistically significant in predicting poor visual outcome. All patients with concurrent vitreous hemorrhage & hyphema had poor visual outcome. (Table 9).

Table 9: Associated factors

		Final Visual Outcome				
		6/18 or better		Worse than 6/18		
		N	%	N		P Value
Hyphema	Present	6	30	14	70	0.001
	Absent	21	75	7	25	
Lens affected	Yes	16	55.17	13	44.82	0.85
	No	11	57.89	8	42.1	
Retinal Detachment	Present	0	0	14	100	<0.0001
	Absent	27	79.41	7	20.58	
Vitreous Hemorrhage	Present	0	0	15	100	<0.0001
	Absent	27	81.81	6	18.18	
Endophthalmitis	Present	0	0	2	100	0.10
	Absent	27	58.69	19	41.30	

Second Surgery: The requirement for a second surgery was statistically insignificant in predicting the visual outcome (p = 0.826)

Discussion

Ocular trauma is one of the most common causes of unilateral morbidity and blindness in the world today. Despite major advances in diagnostic methods and vitreoretinal surgery, a poor prognosis still persists in certain injuries.

In our study, of the 48 cases that followed up, 27 cases (56.25%) had a visual acuity of 6/18 or better, fulfilling the WHO definition for mild or no visual impairment. These results are comparable with Indian reports. Gothwal et al reported that with the present microsurgical capabilities in India, prompt and meticulous surgical treatment restored vision to 6/18 or better in 60.5% of patients[10].

Demographic data

The mean age was 24.29 years with a peak in the age range of 16 to 25 years. This is similar to the findings of other studies[9]. The 92% male predominance is similar to other studies [2,10,11,12]. This is probably due to an increased likelihood for men to engage in certain behaviours or more hazardous work situations.

Source of Injury

The source of injury was a metallic object in 30% patients, stone in 24%, wooden object in 16%, and glass in 10%. Source of injury in 8% patients remained unknown. This was found to be similar to a study of penetrating eye injuries, where 33% of the injuries were by a metallic object, 23% by a wooden object, 12% by glass and 15% by a stone[12].

Eye involved

Bilateral open globe injuries are common in the mining industry, usually due to an accidental dynamite blast[13]. A bilateral injury is usually the result of significant force and is therefore related to a poor vision. The percentage of bilateral injuries varies greatly, from 0.3% to 27%[2]. We did not have any patients with bilateral injuries.

Nature and Extent of Ocular Involvement

The initial visual acuity, the type of injury, zone of injury and the presence or absence of a relative afferent pupillary defect have been identified by The Ocular Trauma Classification Group as important variables for ocular injury[9]. These variables have been previously identified by a number of retrospective reviews as important factors of prognostic significance.

Initial visual acuity

We concurred with other retrospective reviews that have shown visual acuity at presentation has been the single most significant factor in predicting the final visual acuity in an open globe injury [14,15,16].

Type of Injury

86% patients of the injuries belonged to type B (penetrating injury), 10% patients were of type C (intraocular foreign body) and 4% patients belonged to type A (globe rupture). Most observers have concluded that blunt injuries carry a worse prognosis when compared to injuries with a sharp agent.[14, 17]. Pieramici et al showed that type B injuries (penetrating injury) carried the best prognosis while type A injuries (globe rupture) were 4 times more likely to result in a poor final visual acuity[17]. 58.53% of our patients of the type B injuries and 60% patients of type C injuries had a vision of 6/18 or better while Type A injury resulted in the worst prognosis with all the cases having poor visual outcome at six months. However, we were unable to show any statistical significance compared to Type B and C injury. This was due to inadequate numbers of injuries across categories.

We found that 60% patients of the injuries with an IOFB (type C) resulted in a visual acuity of 6/18 or better. Advances in posterior segment surgeries have led to an improved management so that eyes with intraocular foreign bodies seem to have a good prognosis.

Zone Of Injury

Penetrating eye injuries localized to the anterior segment without prolapse of intraocular tissue have been reported to have the best prognosis[10]. Posterior segment involvement generally leads to worse prognosis. The more posterior the wound extended, the greater the probability of poor visual outcome[17]. In the present study, the zone 3 was involved in 22%, zone 1 in 60% and in the remaining 18% zone 2 was involved. Similar to Mukherjee et al[12], our study was predominated by isolated corneal injuries (Zone 1 injury). In our series, 78.57% patients of Zone 1 injuries achieved a final visual acuity of 6/18 or better while 55.55% patients of those with Zone 2 and none of those with Zone 3 injuries could achieve the same. Zone 1 injuries had a statistically better prognosis compared to Zone 2 & Zone 3 injuries (P = 0.0002).

Presence of a Relative Afferent Pupillary Defect

All patients with a relative afferent pupillary defect had a poor final vision. The presence of relative afferent pupillary defect was found to be statistically very significant ($p < 0.001$) in predicting the outcome, with the "pupil negative" (without an afferent pupillary defect) group having the best prognosis. The findings were similar to other studies[14, 18].

Grade of Injury

The follow up of grade 1 and grade 2 injuries showed mild or no visual impairment at the end of 6 months. All grade 5 injuries had a final visual acuity of worse than 6/18.

Hyphema

The presence of hyphema was found to signify a poor prognosis, especially in patients with concurrent vitreous haemorrhage. In the

present study, 70% patients with hyphema had a final VA less than 6/18 which was statistically significant (p = 0.001). All patients with concurrent vitreous haemorrhage had poor visual outcomes. Presence of hyphema was found to be a poor prognostic factor in previous studies [3,16].

Retinal Detachment

Retinal detachment was found in 28%. On follow-up analysis, 79.41% of those detected to have an attached retina had a good visual outcome which was statistically significant (p < 0.0001). Evidence shows that the presence of retinal detachment is associated with a poor prognosis.[3, 9, 19]. Matthews et al reported that traumatic retinal detachments were post-operatively complicated by proliferative vitreoretinopathy, persistent retinal detachment, macular scar and optic atrophy[20].

Vitreous Haemorrhage

Vitreous haemorrhage has been identified as a significant prognostic factor in open-globe injuries[10,16]. In the present study, 100% patients with Vitreous haemorrhage had a poor visual outcome, that is, VA less than 6/18 (P < 0.0001).

Endophthalmitis

The presence of endophthalmitis is known to be associated with a poor prognosis.[3, 19, 21]. Both of our patients who had endophthalmitis, had a poor visual outcome at six months inspite of aggressive treatment. However, it was statistically insignificant compared to those without endophthalmitis (p = 0.10), probably due to small sample size.

Lenticular Involvement

The involvement of the crystalline lens has been identified as a poor prognostic factor in numerous studies[16, 22]. However, Pieramici et al considered this factor to be of limited importance because of the difficulty in confirming the extent and nature of lenticular involvement in open globe injuries[9]. In our study, 44.82 % of patient with lenticular involvement had poor visual outcome; however it was statistically insignificant (p = 0.85) compared to those without lenticular involvement.

Second surgical intervention

The requirement of a second surgery was found to be associated with a poor visual outcome in a previous study[23]. We found the requirement for a second surgery was statistically insignificant to final outcome (p = 0.826).

Conclusions

Armed with a better understanding of the pathology of ocular trauma and advanced surgical techniques, the prognosis of an open globe injury has vastly improved. Being a tertiary care centre, we are many times the first place the patient presents to and early treatment can be instituted. We have tried to evaluate some of the important prognostic factors of final visual outcome in open globe injuries.

We found that a good initial visual acuity and the absence of a relative afferent pupillary defect could nearly always accurately predict a good visual outcome. The zone of injury was also found to be a significant factor in predicting the visual outcome, with more posterior injuries having poorer prognosis. The absence of hyphema, retinal detachment & vitreous hemorrhage were significant predictors of a good visual outcome. We were unable to comment upon the prognostic significance of the type of injury. However, it is clear that open globe injuries caused by blunt trauma carry a poorer prognosis when compared to those caused by a sharp object. Our study is limited by small sample size and a large number of factors studied. It was a single centre study. A wealth of data can be collected over an extended period of time by continuing the study in order to overcome its present limitations.

Bibliography

1. Wong TY, Klein BE, Klein R. The prevalence and the 5-year incidence of ocular trauma. The Beaver Dam Eye Study. Ophthalmology 2000;107:2196-2202.
2. Négrel AD, Thylefors B. The global impact of eye injuries. Ophthalmic Epidemiol. 1998 Sep;5(3):143-69.
3. Ching-Hsing Lee et al. Prognostic indicators of open globe injuries in children. American Journal of Emergency Medicine (2009) 27, 530–535.
4. Narang S, Gupta V, Simalandhi P, Gupta A, Raj S, Dogra MR. Paediatric open globe injuries. Visual outcome and risk factors for endophthalmitis. Indian J Ophthalmol 2004;52:29-34.
5. Serrano JC, Chalela P, Arias JD. Epidemiology of childhood ocular trauma in a northeastern Colombian region. Arch Ophthalmol 2003; 121:1439-45.
6. Negrel AD. Magnitude of eye injuries worldwide. Community Eye Health Journal. 1997; 10(24):49-53.
7. Esmaeli B, Elner SG, Schork MA, et al. Visual outcome and ocular survival after penetrating trauma. Ophthalmology 1995;102: 393-400.
8. Kuhn F, Morris R, Witherspoon CD. Birmingham Eye Trauma Terminology (BETT): terminology and classification of mechanical eye injuries. Ophthalmol Clin North Am. 2002 Jun; 15(2):139-43.
9. Pieramici DJ, Sternberg P Jr, et.al. A system for classifying mechanical injuries of the eye (globe). The Ocular Trauma Classification Group. Am J Ophthalmol. 1997 Jun; 123(6):820-31.
10. Gothwal VK, Adolph S, Jalali S, Naduvilath TJ. Demography and prognostic factors of ocular injuries in South India. Aust N Z J Ophthalmol. 1999 Oct; 27(5):318-25.
11. Shukla IM, Verma RN. A clinical study of ocular injuries. Indian J Ophthalmol 1979;27:33-36.
12. Mukherjee AK, Saini JS, Dabral SM. A profile of penetrating eye injury. Indian J Ophthalmol 1984;32:269-271.
13. Vasu U, Vasnaik A, Battu RR, Kurian M, George S. Occupational Open Globe Injuries. Indian J Ophthalmol. 2001 Mar; 49(1): 43-47.
14. Pieramici DJ, Eong KG, Sternberg P Jr, Marsh MJ. The prognostic significance of a system for classifying mechanical injuries of the eye (globe) in open-globe injuries. J Trauma. 2003 Apr; 54(4):750-4.
15. Sternberg P Jr, de Juan E Jr, Michels RG, Auer C. Multivariate analysis of prognostic factors in penetrating ocular injuries. Am J Ophthalmol. 1984 Oct 15; 98(4): 467-72.
16. Barr CC. Prognostic factors in corneoscleral lacerations. Arch Ophthalmol. 1983 Jun; 101(6): 919-24.
17. Esmaeli B, Elner SG, Schork MA, Elner VM. Visual outcome and ocular survival after penetrating trauma. A clinicopathologic study. Ophthalmology. 1995 Mar; 102(3):393-400.
18. Pieramici DJ, MacCumber MW, Humayun MU, Marsh MJ, de Juan E Jr. Open globe injury. Update on types of injuries and visual results. Ophthalmology. 1996 Nov; 103(11):1798-803.
19. Agrawal R, Wei HS, Teoh S. Prognostic factors for open globe injuries and correlation of Ocular Trauma Score at a tertiary referral eye care centre in Singapore. Indian J Ophthalmol. 2013;61: 502-6.
20. Matthews GP, Das A, Brown S. Visual outcome and ocular survival in patients with retinal detachments secondary to open- or closed-globe injuries. Ophthalmic Surg Lasers. 1998 Jan; 29(1):48-54.
21. Sunisa Sintuwong, Ruthairat Winitchai. Predictive factors of visual outcome in open globe injuries in Thailand: a prospective study. Asian Biomedicine Vol. 5 No. 2 April 2011; 289 – 294.
22. Thompson WS, Rubsamen PE, Flynn HW Jr, Schiffman J, Cousins SW. Endophthalmitis after penetrating trauma. Risk factors and visual acuity outcomes. Ophthalmology. 1995 Nov; 102(11):1696-1701.
23. Vasnaik A, Vasu U, Battu RR, Kurian M, George S. Mechanical eye (globe) injuries in children. J Pediatr Ophthalmol Strabismus 2002 Jan-Feb; 39:5-10.