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Original Article

Predictors of Visual Acuity in Traumatic Cataract

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Abstract

Aim: Traumatic cataract has many challenges. Strategic management to achieve the expected visual outcome is necessary. This study evaluates visual outcome and probable predictors of visual prognosis in traumatic cataract.

Materials and Methods: A retrospective study of 43 traumatic cataracts underwent meticulous evaluation for etiology, type of trauma, associated ocular comorbidities, surgical intervention, and final visual outcome. Cases were grouped as per Birmingham Eye Trauma Terminology System (BETTS) classification and managed accordingly with follow-up of 6 months. Secondary procedures were carried out when required. Probable predictors for visual prognosis were assessed and compared with final visual outcome.

Result: In traumatic cataract cases, open globe injury was observed more than closed globe. In mode of injury, iron rod and wooden chip were most common. Corneal tear was most common associated comorbidity and played an essential role in final visual outcome. BETTS classification was helpful to assess predictors for visual prognosis preoperatively.

Conclusion: Categorizing cases as per associated comorbidity and managing them according to BETTs played a key role in knowing probable predictors pre-operatively, which helped in assessing visual gain and explain realistic expectation to the patient.

Key words: Birmingham Eye Trauma Terminology System, Predictors, Traumatic cataract, Visual outcome

INTRODUCTION

Predictors of Visual Acuity [VA] in Traumatic Cataract

Ocular injuries result in approximately 19 million people blind unilaterally and 2.3 million people bilaterally[1] with a prevalence of 2.4% in India.[2]

Presentation of ocular trauma may vary as open or closed globe injury with one of the causes for diminished vision is traumatic cataract.[3] Traumatic cataract can be isolated or associated with ocular comorbidities. They can be lens dislocation, subluxation, corneal tear, hyphema, uveal prolapse, angle recession, retinal detachment, choroidal rupture, retrobulbar hemorrhage, and globe rupture. This association of comorbidities is directly related to severity, type, and mode of injury.[4]

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Thus, associated comorbidities make the management different and challenging in every case.[5] Primary procedures may not be sufficient to manage all comorbidities and required secondary procedures, and the time delay in such procedures affects visual improvement.[6] Early careful assessment and categorizing each case using Birmingham Eye Trauma Terminology System (BETTS)[7] simplify these difficult cases and help in understanding predictors for poor visual outcome, management, and prognosis preoperatively.[8]

This study was undertaken to determine the factors affecting visual outcome in relation to associated ocular comorbidity and time interval between trauma to presentation, type, and mode of injury using BETTS classification.

MATERIALS AND METHODS

This is a mono-institutional retrospective study where 43 cases of traumatic cataract included with different modes of injury coming to ophthalmology department during June 2015–June 2017. The work has been approved by the ethical committee of our institute. Informed consents were taken. Collected data were recorded on a

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standardized form and transferred to a structured database program for analysis (Excel Software, Microsoft Corp.).

All patients were evaluated and examined with detailed history including demographic information (patient age, sex, residence, and socioeconomic status), injury information (mechanism of injury, activity at the time of injury, object of injury, eye involved, VA, open-globe or closed-globe injury, and associated ocular injuries), and time interval between injury and presentation.

These collected data were grouped according to BETTS classification in open and closed globe injury.

Patients underwent detailed examination using a standard protocol. VA recorded using Snellen chart, and anterior segment evaluation was carried out using slit lamp. Photographic records were maintained for future assessment of ocular status. Posterior segment was assessed by an indirect ophthalmoscope, and in hazy optical media excluding sever ocular tissue damage cases, B-scan ultrasonography was performed.

Management strategies were followed according to the type of injury, mode of injury, time interval between injury and presentation of patient, presence of infection, inflammation, and associated ocular comorbidities.

Initial management was started according to the severity of ocular tissue damage, degree of inflammation, and infection. Topical and systemic antibiotics were started in infective cases with cycloplegics and intraocular pressure lowering drugs. In the absences of infection, systemic and topical corticosteroid was added. In cases requiring surgical management, surgery was scheduled after the control of inflammation and intraocular pressure.

In children <2 years, intraocular lens implantation as a part of the primary procedure was avoided.

Postoperatively, topical steroid, antibiotic, and cycloplegics were prescribed. Follow-up was done on 15th day, 30th day, 2nd month, 4th month, and 6th month for VA and anterior and posterior segment examination, and the details were recorded.

RESULTS

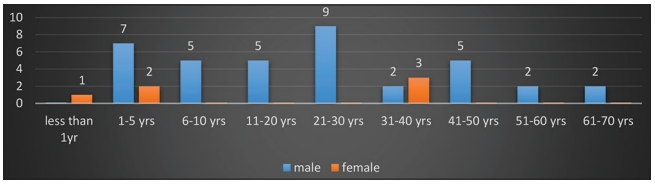
In 43 patients of traumatic cataract [Graph 1], gender distribution was 38 (88.37%) males and 5 (11.62%) females with mean age of 24 years, of which, the youngest patient was of 8 months and eldest was of 68 years. Majority patients were in the age group of 21–30 years, and all were male (9 [20.930%]).

In Table 1, the number of patients presented to our institute after trauma at different intervals is shown. Maximum 27 (62.79%) were reported in first 5 days followed by 14 (32.55%) cases in Group 2. No patient came in Groups 3 and 5. Only 1 (2.32%) case reported, respectively, in Groups 4 and 6. A higher number of cases reported in Groups 1 and 2 due to pain and diminution of vision. Average time interval between trauma and first consultation in the institute was 6 days.

In Graph 2, ocular trauma cases with traumatic cataract were divided according to BETTS classification. A total number of cases in this study were 43 (100%). They were divided into open globe injury (29 [67.44%]) and closed globe injury (14 [32.55%]). Open globe cases were again subdivided into laceration injury (28 [65.11%]) and rupture injury (1 [2.32%]). Patients having laceration were further divided into perforation injury (1 [2.32%]), penetrating injury (25 [58.13%]), and intraocular foreign body (2 [4.65%]). Closed globe injury cases were subdivided into lamellar laceration (1 [2.32%]) and contusion injury (13 [30.23%]).

Table 2 enumerates the etiology of trauma. A detailed history of injury was recorded to note down the etiology and to correlate it with different grades of injury. It was found that iron rod and wooden chip injury was the most common contributing 16.27% followed by road traffic accident (11.62%), firecracker (9.3%), scissor injury (6.9%), and iron wire (6.9%). Other less frequent causes were pencil tip (4.6%), iron nail (2.3%), and thorn injury (2.3%).

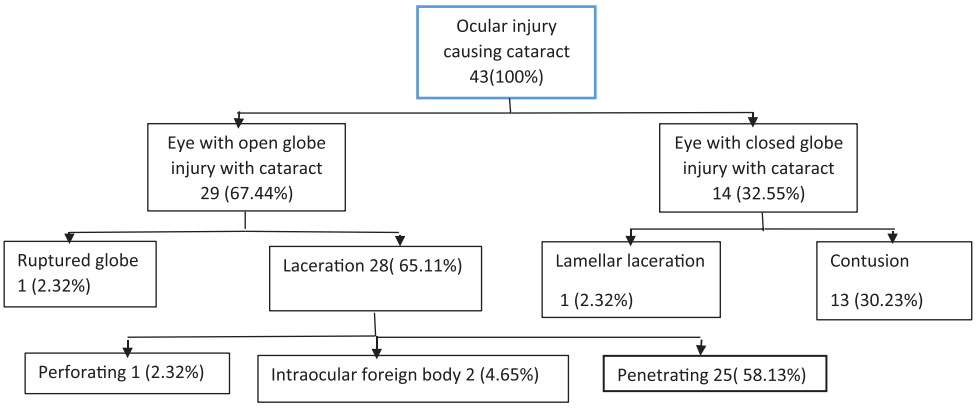
Table 3 shows the activity of patients which caused ocular injury. History helped to understand relationship of thw severity of injury to activity while injury, and it was observed that most common activity was occupational work (25.58%)



Graph 1: Distribution of age and sex

Table 1: Time interval between injury and presentation

Groups	Number of days	Number of cases
Group 1	1–5 days	27 (62.79)
Group 2	6–10 days	14 (32.55)
Group 3	11–15 days	0 (0)
Group 4	16–20 days	1 (2.32)
Group 5	21–25 days	0 (0)
Group 6	26–30 days	1 (2.32)



Graph 2: Type of ocular trauma according to Birmingham Eye Trauma Terminology System classification

Table 2: Causes of trauma

Mode of injury	*n* (%)
Iron rod	7 (16.27)
Wooden chip	7 (16.27)
Scissors	3 (6.9)
Iron nail	1 (2.3)
Fire cracker	4 (9.3)
Thorn	1 (2.3)
Pencil tip	2 (4.6)
Iron wire	3 (6.9)
Cow horn	1 (2.3)
Stone	2 (4.6)
RTA	5 (11.62)
Wooden stick	4 (9.3)
Battery blast	1 (2.3)
Toy	2 (4.6)

Table 3: Activity during injury

Activity	*n* (%)
Fall	4 (9.3)
Fighting	2 (4.6)
Firework	3 (6.9)
Housework	5 (11.62)
Job work	11 (25.58)
Playing	11 (25.58)
RTA	5 (11.62)
Others	2 (4.6)

and ground activity such as playing (25.58%), followed by household job (11.62%), road traffic accident (11.62%), fall (9.3%), firework (6.9%), and fights (4.6%).

Table 4 enumerates the association of ocular comorbidities along with traumatic cataract. Corneal tear (60.46%) was the most common followed by anterior chamber shallowing (27.90%), uveal tissue prolapse (23.25%), and hyphema (20.93%).

In Table 5, surgical management in traumatic cataract was divided into primary and secondary procedures. It was different in each case which was according to associated comorbidities and severity of injury. Procedures required were undertaken as a primary or secondary procedure. Corneal tear repair (60.46%) was performed as a primary procedure. Cataract extraction with posterior chamber intraocular lens (67.44%), synechiolysis (37.20%), iridodialysis repair (27.90%), foreign body removal (4.6%), and vitrectomy (27.90%) was performed as a primary procedures.

Table 4: Comorbidities with traumatic cataract at presentation

Comorbidity	Percentage
Corneal tear	60.46
AC shallow	27.90
Lens matter in anterior chamber	6.9
Hypopyon	2.3
Iridodialysis	6.9
Intraocular foreign body	4.6
Traumatic mydriasis	9.3
Retinal detachment	9.3
Corneal hazy	9.3
Hyphema	20.93
Vitreous matter in the anterior chamber	4.6
Uveal tissue prolapse	23.25
Posterior synechiae	9.3
Cystoid macular edema	2.3
Vitreous hemorrhage	6.9
Zonular dialysis	18.60

Table 5: Surgical management

Management	Primary procedure (%)	Secondary procedure (%)
Corneal tear repair	26 (60.46)	
Cortical matter removed	16 (37.20)	
Synechiolysis	16 (37.20)	5 (11.62)
Iridodialysis repair	12 (27.90)	4 (9.30)
FB removal	2 (4.6)	
ACIOL		1 (2.32)
Scleral fixation IOL		1 (2.32)
PCIOL	29 (67.44)	8 (18.60)
AC wash	15 (34.88)	
Vitrectomy	12 (27.90)	13 (30.23)

PCIOL: Posterior chamber intraocular lens, ACIOL: Anterior chamber intraocular lenses

The secondary procedure performed after primary corneal repair was synechiolysis (11.62%), iridodialysis repair (9.30%), anterior-chamber intraocular lenses (ACIOL) (2.32%), scleral-fixated IOL (2.32%), and vitrectomy (30.23%).

In Table 6, final visual outcome in relation to the type of injury was studied. Postoperatively, visual recovery was variable in different types of injuries. In 14 (56%) cases of penetrating, injury showed worst recovery of <1/60. Best visual gain was found in contusion type of injury with 6 (46.15%) improving to 6/36–6/18 and 4 (30.76%) improving to 6/12–6/6.

Table 7 lists the ocular comorbidities affecting final visual outcome. Patient with corneal scar, vitreous hemorrhage, retinal detachment, and aphakia had VA PL+/FCCF and patient with lesser comorbidities had good visual outcome up to 6/12–6/9.

DISCUSSION

Traumatic cataract management is always challenging as it is difficult to know and predict the final visual outcome.[5] In such a situation it is very important to understand the predictors of visual outcome which helps to plan management strategy and to know visual prognosis.[9] In our study, more of younger patients with average age of 24 years was seen which was similar to Shah *et al.*[10] Male dominance of 88.37% was seen similar to male dominance of 71% in Srivastava *et al.* study[11] and 80% in Smith *et al.* study.[12] The reason of the higher number of younger age cases with male predominance may be due to more exposure of outdoor activities such as playing or occupations related to the field.

The mean time interval between injury and presentation of the patient to institute was 6 days which was similar to observation made by Gogate *et al.*[13] It was also noted that reporting of the patient was earlier in the severe grade of ocular injury which could be correlated to intolerable pain with gross diminution of vision.

It was helpful to classify patients accordingly to BETTS classification as it provides a clear definition for each type of injury. Open globe injuries were more common (67.44%) than closed globe injuries (32.55%) which was comparable with the study of Rizwan *et al.*[14] (62.50% and 37.50%) and Gupta[15] (52.77% and 47.23%). Among open globe injury, laceration injury (65.11%) was the most common. In closed globe injury, contusion injury (30.23%) was seen to be more common. Other studies have also used BETTS classification but had variable results.[16]

It was observed by Thakkar *et al*[17] (RE - 46.43% and LE - 53.57%) and Greven *et al*[18] (RE - 45% and LE - 55%) that left eye injury was more than right eye may be due to physiological reflexes by which right (mostly dominant eye) escapes injuries, but in our study, such preponderance was not observed (RE - 55.81% and LE - 44.18%).

There was a direct correlation of the type of injury to the mode of injury. Mode of injury by the sharp or pointed object was the cause of open globe injury, while injury by blunt objects with considerable force such as iron rod and wooden stick was related to closed globe trauma. Of all modes of injury, close globe injury by iron rod (16.27%) and perforating injury by wooden chip (16.27%) was found to be the most common. Studies had different frequencies for modes of injury involved in traumatic cataract. In Gogate *et al.* study,[13] wooden stick was found to be the most common mode of injury.

Mode of injury was found to be correlated to activity during trauma. In household injury, females and children were more commonly traumatized by objects such as scissors, pencil tip, and toys, resulting in penetrating injury. In outdoor injury, iron rod and wooden stick were the contributing factors. Most common activity leading to

Table 6: Final visual recovery in different types of injury

Type of injury	Parameters	Vision	After	Recovery
	<1/60	4/60–6/60	6/36–6/18	6/12–6/6
Penetrating	14 (56)	1 (4)	5 (20)	5 (20)
Perforating			1 (100)	
IOFB	2 (100)			
Rupture	1 (100)			
Lamellar laceration	1 (100)			
Contusion	1 (7.69)	2 (15.38)	6 (46.15)	4 (30.76)

Table 7: Final visual impairment in correlation with ocular comorbidity

Final visual outcome	Comorbidities
HM+, FC, PL+	Corneal scar (70.58%), Vitreous hemorrhage (29.41%), Retinal detachment (58.88%), Aphakia (23.52%), Foreign body (11.76%)
6/60–6/36	Corneal scar (66.66%), Vitreous hemorrhage (16.66%), Retinal detachment (16.66%)
6/24–6/18	Corneal scar (50%), Vitreous hemorrhage (12.5%), Retinal damage (12.5%)
6/12–6/9	Nebular corneal opacity (30%), CME (10%)

injury was outdoor activities such as occupational trauma at field (25.58%) and playing in ground (25.58%) which was similarly reported by Gogate *et al.*[13]

Association of ocular tissue trauma along with traumatic cataract was a common observation. In our study, most commonly associated comorbidity was corneal tear (60.46%) followed by anterior chamber shallowing (27.9%), vitreous hemorrhage (6.9%), and hyphema (20.93%). Other associated ocular collateral damages were retinal detachment (9.3%), anterior capsule tear (6.9%), lens matter in the anterior chamber (6.9%), iridodialysis (6.9%), intraocular foreign body (4.6%), and hypopyon (2.3%). Other studies also have documented comparable association of ocular tissue injury with traumatic cataract.[19,20] Corneal tear was the most common comorbidity in our study, causing corneal scar which was associated with poor visual outcome which was also observed in a study of Munndada *et al.*[21]

We have managed the cases according to coexisting ocular comorbidities which helped in good visual outcome. Primary procedures were cortical matter removal (37.20%), anterior chamber wash (34.88%), vitrectomy (27.90%), and intraocular foreign body removal (4.6%). Synechiolysis was done as a primary procedure in 37.20% of cases and as secondary procedure in 11.62% of cases. Similarly, iridodialysis repair as the primary procedure was performed in 27.90% and as the secondary procedure in 9.30%. Secondary IOL implantation in the form of ACIOL (one case) and scleral fixated IOL (one case) was performed in cases who left aphakic due to the lack of support of capsular bag. Only one patient had poor VA of HM+ due to retinal detachment and was kept aphakic. One case with focal lenticular opacity not involving visual axis was treated with miotic, and refractive correction was given.

After 6 months of treatment, VA was compared on the basis of the type of injury. It was seen that 1/60 or less was achieved in 56% of cases of perforating type of injury, all cases of intraocular foreign body, and lamellar laceration. Contusion type of closed globe injury had visual recovery of 6/6 in 30.76% of cases. Hence, in our series, perforating visual outcome had poor visual outcome. Similarly, Shah *et al.*[22] observed better visual gain in closed globe injury.

In our study, we tried to find the associated comorbidities which were responsible for decreased visual gain. We found that cases having VA of HM+/PL+ were related to corneal scar (70.58%), vitreous hemorrhage (29.41%), retinal detachment (58.88%), aphakia (23.52%), and intraocular foreign body (11.76%). Cases with lesser ocular damage were having better VA acuity of >6/12.

Categorizing cases and managing them according to ocular comorbidities played important role in achieving better restoration of vision in our study.

We also observed that classifying different types of injury according to BETTS classification, evaluating mode of injury, associated ocular damage, initial vision, comorbidities affecting final visual outcome helps in assessing visual gain and realistic expectation in cases of traumatic cataract.

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