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VISUAL OUTCOME IN MECHANICAL OCULAR TRAUMA

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ABSTRACT

Aim- Ocular trauma has many challenges. This study evaluates visual outcome and probable predictors of visual prognosis.

Material and method- A retrospective study of 43 cases underwent meticulous evaluation for etiology, type of trauma, associated ocular co-morbidities, surgical intervention, and final visual outcome. Cases were grouped as per BETTS classification and managed accordingly with follow up of 6 months. Probable predictors for visual prognosis were assessed and compare with final visual outcome.

Result: Open globe injury was observed more than closed globe. In mode of injury iron rod and wooden chip were most common. Corneal tear was commonest associated co-morbidity and played an essential role in final visual outcome.

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

KEYWORDS : Ocular trauma, BETTS, Visual outcome.

Ocular trauma is one of the important cause of visual impairment and even may lead to blindness . Ocular injuries results 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 cause for diminished vision is traumatic cataract. [3] Co-morbidities like lens dislocation, subluxation, corneal tear, hyphema, uveal prolapse, angle-recession, retinal detachment, choroidal rupture, retrobulbar haemorrhage and globe rupture. These association of co-morbidities are directly related to severity, type and mode of injury[4].

Thus, associated co-morbidities make the management different and challenging in every case [5]. Primary procedures may not be sufficient to manage all co-morbidities and required secondary procedures, time delay in such procedures affects visual improvement [6]. Early careful assessment and categorising each case using Birmingham Eye Trauma Terminology System (BETTS)[7][8] simplifies these difficult cases by understanding predictors for poor visual outcome, management and prognosis pre-operatively, [9].

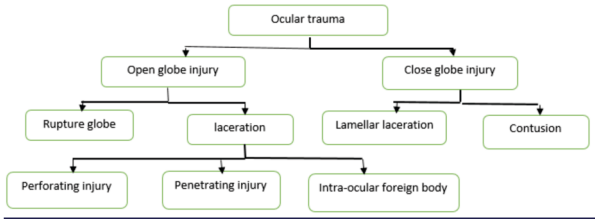
This study was undertaken to determine the factors affecting visual outcome in relation to associated ocular co-morbidity, time interval between trauma to presentation, type and mode of injury using BETTS classification.

MATERIAL AND METHODS

This is a mono institutional retrospective study where 43 cases with different mode of injury coming to Ophthalmology department during period of November 2015 to November 2017. The work has been approved by the ethical committee of our institute. Informed consents were taken. Collected data were recorded on a 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, socio-economic status), injury information (mechanism of injury, activity at the time of injury, object of injury, eye involved, visual acuity, open-globe or closed-globe injury, associated ocular injuries) and time interval between injury and presentation.

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



Patients underwent detailed examination using a standard protocol. Visual acuity [VA] recorded using Snellen's 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 type of injury, mode of injury, time interval between injury and presentation of patient, presence of infection, inflammation and associated ocular co-morbidities.

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 absences of infection, systemic and topical corticosteroid were added. In cases requiring surgical management, surgery was scheduled, either manual small incision cataract extraction or phacoemulsification as per the affordability of patients.

In eyes with zonular weakness of less than a quadrant, IOL were placed in the bag with haptic towards zonular dehiscence to stretch the capsular bag. In sever dehiscence and poor support of posterior capsule, IOL was placed in sulcus, otherwise ACIOL was implanted .
In cases with associated ocular co-morbidities along with cataract management, additional procedures were required as per need. Anterior chamber wash for hyphema, synechiolysis in synechiae formation, membrane peeling for releasing all tractions and vitrectomy for vitreous disturbance was performed.

Post operatively, topical steroid, antibiotic and cycloplegics were prescribed. Follow up was done on 15th day, 30th day, 2nd month, 4th month and 6th month for visual acuity, anterior and posterior segment examination and details were recorded.

RESULTS

Table 1. Distribution of Age and Sex

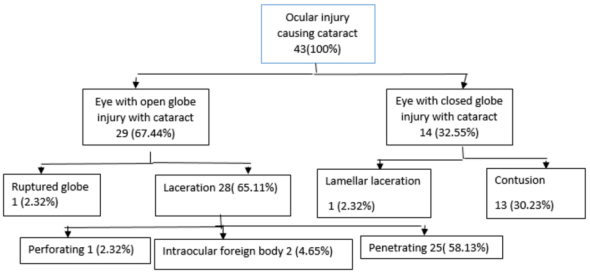
In 43 patients of traumatic cataract (table 1) gender distribution was 38 (88.37%) males and 5 (11.62%) females with mean age of 24 years, out of which youngest patient was of 8 months and eldest was of 68 years. Majority patients were in age group of 21-30 years, and all were male (9(20.93%)).

Table 2. Time Interval between Injury and presentation.

Group	No. of days	No. 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%)

In table 2, number of patients presented to our institute after trauma at a different interval is shown. Maximum 27(62.79%) reported in first five days followed by 14(32.55%) cases in group 2. No patient came in group 3 and group 5. Only 1(2.32%) case reported respectively in group 4 and group 6. Higher number of cases reported in group 1 and group 2 due to pain and diminution of vison. Average time interval between trauma and first consultation in the institute was 6 days.

Table 3. Type of Ocular Trauma According to BETT'S Classification.



In table 3 ocular trauma cases with traumatic cataract were divided according to BETTS classification. 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 intra-ocular foreign body(2 (4.65%)). Closed globe injury cases were subdivided into lamellar laceration (1(2.32%)) and contusion injury (13 (30.23%)).

Table 4. Causes of Trauma.

Mode of injury	Number	%
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 4 enumerates the etiology of trauma. Detailed history of injury was recorded to note down the etiology and to co-relate it with different grades of injury. It was found that iron rod and wooden chip injury was the commonest contributing 16.27% followed by road traffic accident (11.62%), fire cracker (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 5. Activity during Injury.

Activity	number	%
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

Table 5 shows the activity of patients which caused ocular injury. History helped to understand relationship of severity of injury to activity while injury, it was observed that most common activity was occupational work(25.58%) and ground activity like 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 6. Co-morbidities with Traumatic Cataract at Presentation

Co-morbidity	Percentage%
Corneal tear	60.46
AC shallow	27.90
Lens matter in anterior chamber	6.9
Hypopyon	2.3
Iridodialysis	6.9
Intra ocular foreign body	4.6
Traumatic mydriasis	9.3
Retinal detachment	9.3
Corneal hazy	9.3
Hyphema	20.93
Vitreous matter in anterior chamber	4.6
Uveal tissue prolapse	23.25
Posterior synechiae	9.3
Cystoid macular edema	2.3
Vitreous haemorrhage	6.9
Zonular dialysis	18.60

Table 6 enumerates association of ocular co-morbidities along with traumatic cataract. Corneal tear (60.46%) was the commonest followed by anterior chamber shallowing (27.90%), uveal tissue prolapse (23.25%) and hyphema (20.93%).

Table 7. 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%)	
AC IOL		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%)

In table 7 surgical management in traumatic cataract was divided in primary and secondary procedures. It was different in each case which was according to associated co-morbidities 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 PCIOL (67.44%), synechiolysis (37.20%), iridodialysis repair (27.90 %), foreign body removal (4.6%) and vitrectomy (27.90%) were performed as a primary procedures.

Secondary procedure performed after primary corneal repair were synechiolysis (11.62%), iridodialysis repair (9.30%), ACIOL (2.32%), scleral fixated IOL (2.32%) and vitrectomy (30.23%).

Table 8. Final Visual Recovery in Different Types of Injury.

Type of injury		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%)

In table 8 final visual outcome in relation to 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 less than 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 9: Final Visual Impairment in Correlation with Ocular Co-morbidity

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

Table 9 lists the ocular co-morbidities affecting final visual outcome. Patient with corneal scar, vitreous haemorrhage, retinal detachment and aphakia had visual acuity PL+/FCCF and patient with lesser co-morbidities had good visual outcome up to 6/12-6/9.

DISCUSSION

Management is always challenging as it is difficult to know and predict final visual outcome [5]. In such situation it is very important to understand the predictors of visual outcome which help to plan management strategy and to know visual prognosis [10]. In our study, more of younger patients with average age of 24 years were seen which was similar to Shah et al [11] Male dominance of 88.37% was seen similar to male dominance of 71% in Srivastava et al. study [12] and 80% in Smith et al. study [13] .The reason of higher number of younger age cases with male predominance may be due to more exposure of outdoor activities like playing or occupations related to field [14].

The mean time interval between injury to presentation of patient to institute was 6 days which was similar to observation made by Gogate et al [14]. It was also noted that reporting of patient was earlier in severe grade of ocular injury which could be co-related 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 [15] (62.50% and 37.50%) and R.C. Gupta [16] (52.77% and 47.23%). Among open globe injury, laceration injury (65.11%) was commonest. 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 [17].

It was observed by Manoj M. Thakkar et al [18] (RE-46.43%; LE-53.57%) and Craig M Greven et al [19] (RE-45%; 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 direct correlation of type of injury to mode of injury. Mode of injury by sharp or pointed object was the cause of open globe injury while injury by blunt objects with considerable force like iron rod, wooden stick were related to closed globe trauma. Out 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 frequency for modes of injury involved in traumatic cataract. In Gogate et al study [14], 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 traumatised by objects like 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 injury was outdoor activities like occupational trauma at field (25.58%) and playing in ground (25.58%) which was similarly reported by Gogate et al [14].

Association of ocular tissue trauma along with traumatic cataract was common observation. In our study most commonly associated co-morbidity was corneal tear (60.46%) followed by anterior chamber shallowing (27.9%) vitreous haemorrhage (6.9%) and hyphema (20.93%). Other associated ocular co-lateral damage were retinal detachment (9.3%), anterior capsule tear (6.9%), lens matter in anterior chamber (6.9%), iridodialysis (6.9%), intra ocular foreign body (4.6%) and hypopyon (2.3%). Other studies also have documented comparable association of ocular tissue injury with traumatic cataract [20][21] . Corneal tear was the most common co-morbidity in our study, causing corneal scar which was associated with poor visual outcome which was also observed in study of Munnande et al [22].

Extent of co-lateral damage was the deciding factor to plan the surgical strategy. Patients having dense cataract were treated by either phacoemulsification or small incision cataract surgery. In study of Yei et al[23] , patients undergoing phacoemulsification had better visual outcome than those undergoing small incision cataract surgery(SICS) but in our study, both techniques (phacoemulsification 51.67% and SICS 48.33%) showed similar visual outcome.

We have managed the cases according to coexisting ocular co-morbidities which helped in good visual outcome. Primary procedures were cortical matter removal (37.20%), anterior chamber wash (34.88%), vitrectomy (27.90%) and intra ocular foreign body removal (4.6%). Synechiolysis was done as a primary procedure in 37.20% cases and as secondary procedure in 11.62% cases. Similarly, iridodialysis repair as primary procedure was performed in 27.90% and as secondary procedure in 9.30%.

After 6 months of treatment, visual acuity was compared on basis of type of injury. It was seen that 1/60 or less was achieved in 56% cases of perforating type of injury , all cases of intra ocular foreign body and lamellar laceration. Contusion type of closed globe injury had visual recovery of 6/6 in 30.76% cases. So in our series, perforating visual outcome had poor visual outcome. Similarly, Shah et al [24] observed better visual gain in closed globe injury.

In our study we tried to find out the associated co-morbidities which were responsible for decreased visual gain. We found that cases having visual acuity of HM+/PL+ were related to corneal scar (70.58%), vitreous haemorrhage (29.41%), retinal detachment (58.88%), aphakia (23.52%) and intra ocular foreign body (11.76%). Cases with lesser ocular damage were having better visual 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 type of injury according to BETTS classification, evaluating mode of injury, associated ocular damage, initial vision, co-morbidities affecting final visual outcome help in predicting visual outcome helps in assessing visual gain and realistic expectation in such cases.

Declaration of interest: none.

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