Original Research Article

Traumatic Corneal Perforation, Its Clinical Profile and Outcome in Eastern Nepal

Abstract:

Aims: To describe the clinical profile and visual outcome of the patients with traumatic corneal perforation.

Place and Duration of Study: Mechi Eye Hospital, Birtamode, Jhapa, Nepal, 1st January to 31st December 2018

Methods: Retrospective review of 60 eyes of 60 patients presenting with open globe injury zone I from 1st January 2018 to 31st December 2018 was conducted. Demographic data, place of origin, duration required for presentation, inflicting agent, visual acuity at presentation, type of injury as per Birmingham Eye Trauma Terminology classification. Ocular Trauma Score was intended for predicting the final VA. All the cases underwent primary repair of the injury within 24 hours of presentation.

Results: Mean age of patient was 25.63 ± 15.4 years ranging from 6 to 70 years. Preponderance of male was higher than female. Mean duration of injury and time of presentation was 6.02 ± 5.6 days. The most common type of injury was penetrating injury accounting with 56 (96.3%) cases. Metallic object was the most inflicting agent with 46.7%. After surgery, in their latest follow up 17 (28.3%) patients had visual acuity better than 20/40 while four (6.7%) had no light perception. Univariate logistic regression revealed poor presenting visual acuity and endophthalmitis had poor prognosis.

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Conclusion: Open globe injury is the major cause of ocular morbidity among economically productive group of population. The final outcome can be predicted using ocular trauma score at the time of presentation is effective for predicting the visual outcomes and preparing appropriate management plans to reduce the ocular co morbidities.

Keywords: Corneal Perforation; Open Globe Injury; Penetrating; Traumatic

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Introduction

Corneal perforations are ocular emergencies that ought to be managed promptly and aggressively for preserving vision and maintaining ocular integrity. The various etiologies causing it are foreign body, infectious corneal disorders, and stromal melting related to chemical and thermal burns.

Ocular trauma has been classified into open globe injury (OGI) and closed globe injury (CGI) based on the classification of Birmingham Eye Trauma Terminology (BETT).[1] OGI is full thickness penetration of eye wall[2] with a destructive potential to ocular structure ultimately leading to degradation in quality of life. It has got remarkable ocular morbidity, which could lead to permanent or profound loss in vision.[3, 4] Even with prompt and appropriate management, it may lead to visual morbidity due to severe complications like anterior synechiae, cataract, glaucoma and endophthalmitis. BETT has graded the Zone of OGI into, Zone I; isolated to cornea and limbus, Zone II; include 5mm posterior from the limbus and Zone III; include full thickness injury posterior to Zone II. Similarly the type of injury has been classified as rupture, penetrating injury, perforating injury, intraocular foreign body (IOFB) and mixed.[5]

Prevalence of ocular trauma, its recognition and reduction in risk factors has been a great concern worldwide.[6] In Nepal, 7.9 % of blindness is due to trauma, which is the second leading cause.[7] Landen et al reported the annual incidence of eye injuries to be 3.5 per 100000.[8] Négrel AD et al reported unilateral and bilateral loss of vision resultant of ocular trauma have been found around in 19 million and 1.6 million people respectively and among the 750,000 cases that required hospitalization, 200,000 cases were known to be OGIs.[9] Although, substantial efforts for successful surgical repair of OGIs has been practiced through all over world for prevention of blindness, it's a great challenge to ophthalmologist for successful visual rehabilitation.[10] Subsequently in many cases, post-operative visual outcome is unpredictable.

There are two models for prediction of visual outcome in cases of OGI, Classification and Regression Tree (CART)[11] and Ocular Trauma Score (OTS).[12] In OTS, a set of variables readily determined at the time of initial evaluation are used for the calculation. Raw points are provided based on variables such as visual acuity (VA), endophthalmitis, perforating injury, rupture, retinal detachment and afferent pupillary defect as shown on Table 1 and its sum is calculated as the total raw point. The raw point is converted into OTS score and the likelihood of the final visual categories are predicted as depicted in Table 2.[12]

The study was conducted to evaluate the visual outcome of the patients who underwent OGI repair for Zone I in Mechi eye hospital. In addition, we have also tried to describe the profile of patient presenting with Zone I OGI, establish the most common inflicting agents, determine the incidence of lens trauma and endophthalmitis among this group and compare our outcome with that provided by OTS.

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Material and methods

A Retrospective study of all cases of OGI Zone I for a period of one year from 1st January 2018 to 31st December 2018 was done in Mechi Eye Hospital after approved by local ethical committee and the study adhered to the tenets of Helsinki. All the cases who had presented with OGI Zone I (BETT Classification) during this period were included in the study. But cases with additional Zone II and/or III injury were excluded. In addition, those cases with incomplete history and/or finding, had already undergone surgery at the time of presentation and patient whose VA could not be measured were also excluded.

The details regarding age, sex, place of origin, profession, place of injury, duration required for presentation, inflicting agent, type of open globe injury as per BETT classification, VA at presentation, relative afferent pupillary defect, state of crystalline lens, co-existing endophthalmitis and state of vitreous and retina was taken. OTS for every case was calculated for predicting the final visual acuity. All the cases underwent primary repair of the injury within 24 hours of presentation to maintain the ocular integrity. Cases with co-existing breach in the anterior lens capsule with hydrated lens matter underwent lens extraction without intraocular lens (IOL) placement, while those suspected of having endophthalmitis received intravitreal antibiotics after diagnostic vitreous tap for culture and sensitivity at the time of primary repair. Post operatively, all patients received a course of oral ciprofloxacin for 2 weeks along with topical steroid, antibiotics and cycloplegics as per the institutional protocol. During the course of follow up, patient who developed cataract, underwent cataract surgery with IOL placement not earlier than 3 months, those left aphakic underwent secondary IOL placement after the wound

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had stabilized and those suspected of having endophthalmitis underwent intravitreal injection and/or pars plana vitrectomy as per the institutional protocols.

Due to the variable amount of follow up encountered during the review rather than Final Visual acuity we have used the term 'Last Visual Acuity' which accounts for best corrected Visual Acuity in their last follow up, and this visual acuity has been recorded for the study. The data was finally analyzed using SPSS software version 23 with appropriate statistical.

Results

A total of 60 eyes of 60 patients fulfilling all the criteria were included in the study. The mean age of patient was 25.63 ± 15.4 years and age ranged from 6 to 70 years with the 75^{th} quartile of 34.25 years, with maximum number of presentation being in age group 16 – 45 years with 35 (58.33%). The majority of the cases were male (55, 91.7%) with the male to female ratio of 11:1. The details of age and gender distributions are shown in the figure 1.

In our study, all eyes presented with unilateral injury at the time of presentation with left eye (53.3%) being affected more than right eye (46.7%). The most common type of injury was penetrating injury accounting for 56 (93.3%) cases while 3 (5%) case had mixed injury and 1 (1.17%) had IOFB. Metallic object was the most common injury inflicting agent with 46.7%, and metal nail 10 (16.7%) was the commonest agent among the metallic object. Vegetative materials and stones were other commonest agent to inflict injury with 26.7% and 11.7%. In 9 (15%) cases, inflicting agent could not be categorized into any of the above mention agents. The mean duration between time of injury and time of presentation was 6.02 ± 5.6 days while the median duration was 4 days. The details of the inflicting agent are shown in the table 3.

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There were 7 (11.7%) patients having a preoperative VA better than 20/40, 12 (20%) patients had VA between 20/50 < 20/200, 10 (16.7%) patients had VA between 20/200 – CF, 29 (48.3%) patients had VA of HM-PL and the remaining 2 (3.3%) had a preoperative VA of NLP. After surgery, in their last follow up; 17 (28.3%) patients had VA better than 20/40, 14 (23.3%) had VA between 20/50 < 20/200, 16(26.7) had VA between 20/200 to CF, 9 (15%) had VA of HM-PL and rest 4 (6.7%) had NLP. The mean duration of follow up of the patient was 4.25 ± 3.13 months with median of 4 months.

A univariate logistic regression was performed to ascertain the effects of age, duration of presentation, presenting visual acuity, object inflicting trauma, type of injury, lens injury and endophthalmitis on the final visual acuity of the patients. The model was statistically significant with coefficient of 33.45, $p<0.0005$. The model explained 57% of the variance in the condition and correctly classified 80% of cases. Poor presenting VA and endophthalmitis was 9 and 5.278 times likely to result in poor final VA. Increasing age, metallic object and lens trauma was associated with increased likelihood of poor final visual acuity but duration of presentation and penetrating injury had minimal effect on final visual acuity as shown in table 4.

Ocular trauma score was also computed for all the patients and the last visual acuity was correlated with prediction based on international ocular trauma scoring system.[12] Comparative scores for both our study and international ocular trauma scoring system is as shown in table 5.

Incidence of lens trauma was found in 39 (65%) of the cases, and among these 71.8 % underwent cataract surgery. Endophthalmitis was recorded in 10 (16.7%) cases; all of them received intra vitreal antibiotics, while 3 patients required additional core vitrectomy. There was one (1.17%) case each with iridodialysis and retinal detachment.

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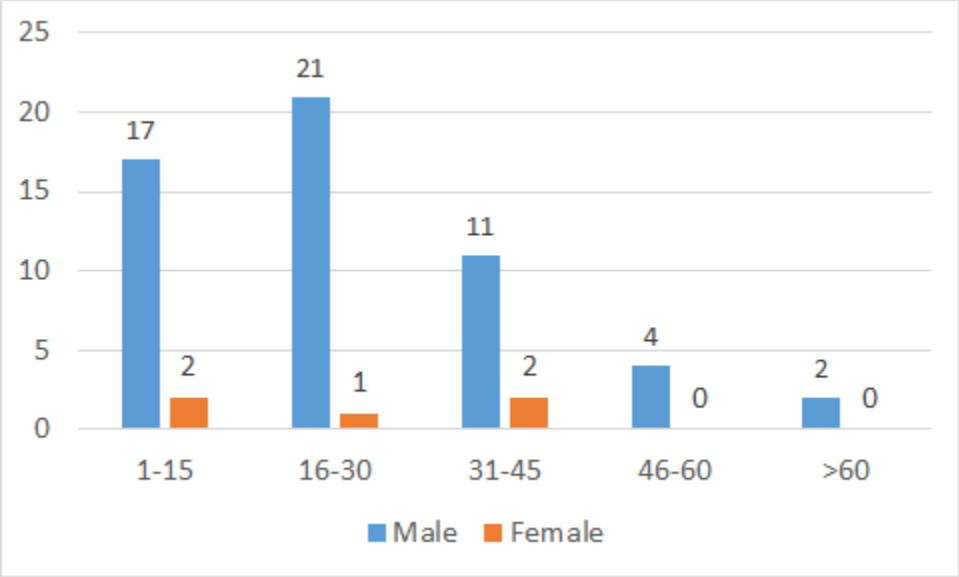
Figure 1 Age and Gender distribution of the patients



Legends:

Table 1 Raw point allocation according to OTS (HM: Hand movement; LP: Light perception; NPL: No perception of light; VA: Visual Acuity)

Variable	**Raw Point**
Presenting VA	
NPL	60
LP/HM	70
1/200-19/200	80
20/200-20/50	90
≥20/40	100
Globe Rupture	-23

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Endophthalmitis	-17
Perforating Injury	-14
Retinal Detachment	-11
Afferent pupillary defect	-10

Table 2 Estimated probability of final visual acuity category (OTS: Ocular Trauma Score; NPL: No perception of light; LP: Light perception; HM: Hand movement)

Raw Score Sum	**OTS score**	**NPL**	**PL/HM**	**1/200 – 19/200**	**20/200 – 20/50**	**≥20/40**
0 – 44	1	73%	17%	7%	2%	1%
45 – 65	2	28%	26%	18%	13%	15%
66 – 80	3	2%	11%	15%	28%	44%
81 – 91	4	1%	2%	2%	21%	74%
92 – 100	5	0%	1%	2%	5%	92%

Table 3 Objects inflicting trauma to the patients

Inflicting agent	**Inflicting Object**	**Number**	**Percentage**
Metal	Iron	6	10
	Knife	3	5
	Nail	10	16.7
	Pin	2	3.3
	Rod	4	6.67
	Screw Driver	1	1.67

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	Wire	2	3.3
Vegetative Materials	Bamboo	9	15
	Fruits	1	1.67
	Plant	1	1.67
	Stick	3	5
	Wood	2	3.3
Others	Bird	1	1.67
	Book	1	1.67
	Fire Cracker	1	1.67
	Gun	1	1.67
	N/A	1	1.67
	Pencil	2	3.3
	Road accident	1	1.67
	Scale	1	1.67

Table 4 Univariate logistic regression: Effect of pre-operative variables with effect on final visual outcome

Pre-operative factors	**Odds Ratio**	**p value**	**95% Confidence interval**	
			Lower	**Upper**
Age	2.589	0.108	0.99	1.109
Gender	1.361	0.653	0.128	26.571
Duration for Presentation	1.451	0.228	0.806	1.053

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Inflicting Agents	2.179	0.14	0.651	21.087
Presenting Visual Acuity	9.004	0.003	1.867	19.608
Type of injury	0.014	0.907	0.02	32.401
Lens Injury	0.026	0.872	0.179	7.615
Enophthalmitis	5.278	0.022	1.651	556.492

Table 5 Comparison of our last visual acuity with that of the ocular trauma score based on the head to head scores. (OTS: Ocular Trauma Score)

LAST VISUAL ACUITY		**NPL**	**PL/HM**	**1/200 – 19/200**	**20/200 – 20/50**	**≥20/40**
OTS Grade						
1	Study	100	0	0	0	0
	OTS	73%	17%	7%	2%	1%
2	Study	10	40	40	0	10
	OTS	28%	26%	18%	13%	15%
3	Study	3.4	17.2	31	27.6	20.7
	OTS	2%	11%	15%	28%	44%
4	Study	0	0	27.3	36.4	36.4
	OTS	1%	2%	2%	21%	74%
5	Study	0	0	0	14.3	85.7
	OTS	0%	1%	2%	5%	92%

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Discussion

OGI is one of the most common ocular injuries and often leads to disability due to permanent vision loss in the working age group. Many prognostic factors that determine the final visual status are incorporated in OTS.[12] In this study we have analysed the preoperative factors that ultimately affects the final visual status with only Zone I injuries and also tried to compare our results with OTS.

In most of the studies the main affected population are male in the working age group,[13] similar to our study with the mean age group of 25.63 ± 15.4 years and male to female ratio of 11:1. Other studies also highlights similar trend with Thevi et al [14] and Kinderan et al [15] with mean age of the 27.25 ± 12.62 years (9-73 year) and 28.28 ± 18.29 years (1-87 years) respectively. In additional studies from other countries also report the similar age group 33.7 ± 20.7 years (1-83year).[16, 17] Although the male to female ratio is very high in our study, comparing literature also presents with a high male preponderance.[14-17] This high male incidence may represent the factor that the male are often engaged in physical activity and their more aggressive and carefree nature. In addition the slight lower mean age may represent the early initiation of work in the population in this part of the world.

Penetrating injuries to the eye has been reported as the most common form of injuries encountered in many literature [15, 16, 18] similar to our study, but there were studies which reported IOFB as the common form of the injury.[19] This difference with our study may have occurred due to the fact that we were only looking for visual prognosis among Zone I injury while rest of the studies are taking into consideration all the variant of open globe injury. In a study by Fujikawa A et al[20] as well, IOFB was the most common variant but this may be due to inclusion of all zones of OGI. The most common inflicting agent was metal objects as other studies.[16] This

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highlight the lack of awareness and protective devices available in our part of the world while working and reluctance among the workers to use it. The vegetative and other objects inflicting injury seems mostly to have occurred accidentally.

Similar to other studies [13, 17], we found that pre-operative visual acuity, increasing age, associated lens injury and endophthalmitis significantly predicted the last visual acuity of the patient. But in our study the effects of mode of trauma and duration for presentation was not adequately discernable, but the effect of inflicting object was more prominent.

We have attempted to stratify our cases based on OTS and outcomes were compared to that of the international OTS system as shown in table 4. Since we were only including zone I injuries, results were significantly better in strata 2 than predicted in terms of last visual acuity of 5/60 to PL, also in strata 3 and 4 than the predicted in terms of the final visual acuity restored to 6/18 to 1/60. But in all these three strata, the vision restored to 6/6 to 6/12 was lower than that of the OTS. Besides these, rest were comparable with that of the OTS. In a series by Agrawal et al[13] and Han and Yu[21] the results were very much in agreement with that of the OTS with some exceptions. This highlights the clinical significance, importance and applicability of OTS in terms of counselling the patients with OGI regarding the prognosis of the condition prior to intervention in our setup.

OGI Zone I are frequently associated with additional injury to the lens capsule worsening prognosis or prolonging visual rehabilitation, often requiring additional procedures. Our study found that 39 (65%) patient who presented had some degree of trauma inflicted on the crystalline lens, with 28 (71.8%) patients necessitating cataract extraction. The reported incidence of lens trauma is variable with study like Thevi et al[14] reporting only 11% while Court et al reports in range of 41.7%.[22] Similar to lens injury, incidence of endophthalmitis is equally variable with

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our reported incidence of 16.7% lying somewhere between that reported by Atik S et al and Guven et al.[19, 23]

Conclusion

The current study highlights Zone I OGI as a major cause of ocular morbidity among economically productive group of population. The final visual outcome is affected by many factors including presenting VA and endophthalmitis that compound the vision loss. The final outcome can be predicted using OTS at the time of presentation aiding in prognosticating the condition to the patient and guardian and preparing appropriate management plans to reduce the ocular co morbidities.

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