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Clinical Profile and Outcomes of Traumatic Endophthalmitis in Western India

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ABSTRACT

Introduction: To determine the rate of endophthalmitis and assess risk factors for the development of endophthalmitis following open Globe Injury (OGI).

Methods: A retrospective review of all patients treated for OGI at the Drashti Netralaya from January 2008 to December 2019 was conducted according to predefined inclusion and exclusion criteria. The main outcome measure was the rate of endophthalmitis, different variables, and visual outcome.

Results: In this study, 53/1551 (3.42%) eyes had endophthalmitis. Cross tabulation and descriptive analyses identified presenting vision (0.012), corneal condition (0.009), vitreous opacities (0.000), and pediatric age group (0.003) as high-risk factors of developing endophthalmitis. Type of interventions and subconjunctival antibiotic injection at the time of globe closure (0.011) was associated with decreased risk of developing endophthalmitis.

Conclusion: Careful aggressive management according to EVS guidelines caused a significant impact on the outcome.

Keywords: Endophthalmitis; Intraocular foreign body; Ocular trauma; Open globe injury

INTRODUCTION

Open Globe Injuries (OGI) are visually devastating and frequently managed at tertiary referral centres worldwide. The incidence of OGI in the USA is 4.49/100,000 persons, with an estimated cost of $793 million to the healthcare system between 2006 and 2014 [1]. Visual Acuity (VA) following OGI is often poor due to numerous factors, with endophthalmitis as one of the most devastating complications. The reported rate of endophthalmitis following OGI varied from 0.9% to 17% [2]. The most commonly isolated organisms from cases of PT endophthalmitis are *Streptococcus* species (16.9–21.8%), *Staphylococcus* species (12.0–15.6%) and *Bacillus* species (8.7–50.0%). *Bacillus* species are well-known for causing fulminant endophthalmitis following an injury involving soil. Previous studies found the presence of an Intraocular Foreign Body (IOFB), delayed wound closure lens capsule violation primary intraocular lens placement at the time of globe

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closure, isolated corneal injury and lacerating mechanism of injury as risk factors for the development of endophthalmitis following OGI [3].

Among patients with infectious endophthalmitis, posttraumatic endophthalmitis comprised 25–31% of cases [4]. The reported incidence rate of endophthalmitis following OGI ranged from 0–16.5%, with evidence of a general decline over the past 70 years (**Table 1**). Prophylactic factors in the setting of trauma include primary wound repair within 24 h, lack of tissue prolapse into wounds, and self-sealing wounds.

Currently, there are no data for OGI in our country, but the incidence extrapolated from a large database is 41.9%, and that for posttraumatic infectious endophthalmitis is 40.2%.

Ocular signs associated with posttraumatic endophthalmitis are similar to those with postoperative infections, including Anterior Chamber (AC) cells, Flare, hypopyon, and vitreous cell exceeding that expected from the injury.

No consensus existed regarding the management practices to best prevent endophthalmitis in OGI. While the literature has consistently shown that expedient globe closure is prudent, the question of when to remove an IOFB remains unclear. Furthermore, prophylactic intravitreal antibiotics and the route and duration of systemic antibiotics vary across centers [5].

The present study aimed to assess the risk factors and protective factors for the development of endophthalmitis following OGI.

MATERIALS AND METHODS

The Institutional Review Board (IRB) of the Drashti Netralaya approved this study prior to data collection and waived the need for informed consent. The study adhered to the tenets of the declaration of Helsinki. Following IRB approval, a retrospective review of all OGIs managed surgically at the Drashti Netralaya between January 2008 and December 2019 was conducted. The inclusion criteria were diagnosis and surgical management of OGI during the study period with a minimum follow up duration of 30 days [6]. The exclusion criteria were as follows: <30 days of follow up, repair of injury at an outside institution, inadequate records, death prior to repair of injury, and patients with a history of endophthalmitis. Moreover, eyes that underwent nucleation within 30 days of injury unless diagnosed with endophthalmitis prior to nucleation were not included in the statistical analysis when determining the risk factors for the development of endophthalmitis.

Clinical data, including presenting clinical characteristics, medical and surgical management choices, and postoperative outcomes, were extracted from the electronic medical records. The protocol for the evaluation and repair of OGI was standardized at DN. All OGIs were seen through the Emergency Department (ED). A limited examination of the injured eye is performed in the ED to determine if an OGI is present, and a complete dilated exam is performed of the fellow eye [7].

Following examination, the injured eye is covered with a shield. Topical antibiotics are started if not already given at the referring center.

Also, a tetanus booster and pain and anti-emetic medication are administered as needed, and consent is obtained for globe closure.

Globe closure is completed at the earliest unless there is a delay in presentation to the ED or in cases of polytrauma wherein the patient is either unstable for surgical intervention, or other lifesaving surgeries necessitate the delay [8]. Standard surgical principles are applied to open globe repairs.

If an IOFB is present in the posterior segment, and the decision is made to remove it secondarily, then intravitreal antibiotics are administered at the time of globe closure. After operative management, topical antibiotics, topical corticosteroids, and topical cyclopedia are administered.

Cases of endophthalmitis were identified as those with clinical signs of endophthalmitis, including increased pain, decreased vision, increased redness, increased intraocular inflammation, or presence of hypopyon.

All potential risk factors for the development of endophthalmitis were assessed for their statistical significance in univariate logistic regression models. A p-value <0.05 was considered statistically significant [9].

RESULTS

The current cohort consisted of 1551 OGIs, of which 53 had endophthalmitis. The overall rate of endophthalmitis was 3.42% [10]. The mean age at the time of OGI was 26.35 ± 19.83, and the mean age of patients having endophthalmitis was 30.34 ± 20.66 years (**Table 1**).

Table 1: Age and sex distribution.

Age categories	Sex		Total
	F	M	
0-10	7	5	12
20-Nov	3	6	9

21-30	4	5	9
31-40	0	6	6
41-50	2	5	7
51-60	3	3	6
61-70	1	1	2
71-80	1	1	2
Total	21	32	53

32/53 (60.4%) cases were males, and 21/53 (39.6%) were females. 18/34 (34%) comprised the pediatric age group. The mean interval between injury and presentation was 5.6 ± 5.06 days. T mean interval between injury and the first intervention was 9.90 ± 7.72 days. The mean wound size was 4.06 ± 4.7 mm, and the mean number of intravitreal injections was 1.21 ± 0.72.

These patients undergo multiple surgeries, and the mean number of surgeries was 2.75 ± 1.34. The majority of the eyes were had zone 1 injury: 48 (90.6%). The type of injury sub group of OGI included globe rupture in 23 (43.4%) and penetrating in 8 (15.1%) cases, while 22 (41.5%) were self-sealed.

Surgical management was carried out in 41 (77.4%) in the form of pars plana vitrectomy with or without silicone oil tamponade [11]. 44/53 (83%) had presenting vision <1/60, including 6 (11.3%) no perception. After management 4/53 (7.6%) achieved>6/60 and 2 (3.8%) >6/24 vision with a median follow up of 49 days. A significant improvement was observed in vision following management (p=0.012) (**Tables 2-4**).

Table 2: Presenting vision.

Vision category	Frequency	Percent
NOPL	6	11.3
<1/60	44	83
1/60-3/60	2	3.8
6/24-6/9	1	1.9
Total	53	100

Table 3: Post treatment vision.

Vision category	Frequency	Percent
NOPL	7	13.2
<1/60	29	54.7
1/60-3/60	8	15.1
6/60-6/36	2	3.8
6/24-6/18	2	3.8
LF	5	9.4
Total	53	100

Table 4: Comparative study of pre and post vision.

Vision category	Vision						Total
	NOPL	<1/60	1/60-3/60	6/60-6/36	6/24-6/18	LF	
NOPL	2	1	0	0	0	3	6
<1/60	5	27	7	2	2	1	44
1/60-3/-760	0	1	1	0	0	0	2
6/12-6/9	0	0	0	0	0	1	1
Total	7	29	8	2	2	5	53
			P=0.012				

Next, we have studied many variables as predictors of visual outcome in the case of traumatic endophthalmitis (Table 5).

Table 5: Comparative study of variables with visual outcome.

Comparative study with variable *vs.* final visual outcome	P Value	Significance
Presenting vision	0.012	Yes
Lid findings	0.945	No
Corneal signs	0.009	Yes
Findings in anterior chamber	0.785	No
Lens changes	0.925	No
vitreous	0.035	Yes
B Scan	0.55	No
Pupillary findings	0.639	No
Hypopyon	0.116	No
Interval between event and presentation	0.523	No
Interval between event and intervention	0.108	No
Object of injury	0.671	No
Activity during injury	0.026	Yes
Wound size	0.227	No
Type of injury	0.05	Yes
Wound shape	0.755	No
Wound zone	0.994	No
Immediate treatment	0.997	No
No of injection	0.948	No
No of surgeries	0.343	No
Type of intervention	0.011	Yes
Type of surgical intervention	0	Yes

Pediatric	0.003	Yes
Age	0.447	No
Sex	0.129	No
Posterior segment findings	0	Yes

A wooden stick was the most common object causing injury and endophthalmitis (Table 6).

Table 6: Object of injury.

Object	Frequency	Percent
Iron rod	4	7.5
Iron wire	6	11.3
Sharp pen	1	1.9
Sharp scissor	1	1.9
Stone	3	5.7
Unknown object	6	11.3
Wooden stick	17	32.1
Wooden stick thorn	7	13.2
Other	9	16.9
Total	53	100

Immediate treatment was administered in the form of intravitreal injection in 81.1% of cases.

DISCUSSION

Posttraumatic endophthalmitis is one of the major complications after the repair of OGI. In this study, we aimed to investigate the incidence and the risk factors of endophthalmitis to make the correct decision in the management of such clinical challenges in high risk patients to decrease the incidence and the consequences of this devastating event [12]. Next, we reported an endophthalmitis rate of 3.42% in the eyes with OGI, which was consistent with the previously reported rates between 0.9% and 17.0%. Our protocol for OGI emphasizes no systemic antibiotics in contrast to previous reports. All of the 53 cases of endophthalmitis were diagnosed on presentation; the rate of endophthalmitis developing following globe closure was nil in 1551 cases in contrast to that report by Durrani, et al. [13]. On the other hand, the incidence rate of endophthalmitis was reported to be 3.4% by the United States eye registry in 2002 and 5.1% in an Iranian study in patients with OGI. Some studies reported a low incidence of endophthalmitis (1–7%) and attributed this to the use of systemic antibiotics. The current study identified several risk factors associated with the development of endophthalmitis. Especially, the presence of zone I injury as a risk factor for the development of endophthalmitis has only been previously reported in another study with a smaller sample size of 117 eyes, which did not differ significantly from that in the current study. This phenomenon could be attributed to zone 1 injury wherein organisms are not directly inoculated in the vitreous cavity. Thompson demonstrated that the eyes repaired after 24 hrs has a high incidence of endophthalmitis. Durrani, et al. also found that the time to globe repair >24 hrs after injury was a risk factor for the development of endophthalmitis, as described previously. We did not find an association between the intervals between injuries because the object of injury is the wooden stick, and the major plants were alocia nilotica which has anti-bacterial and anti-fungal properties [14]. However, we hypothesized that the anti-bacterial and anti-fungal properties of alocia nilotica in these cases could explain this difference. The management of OGI is controversial, and there is limited consensus on the best practices to prevent endophthalmitis. One controversy is the role of systemic antibiotic prophylaxis [15]. In the current study, no statistically significant protective benefit was observed in those patients who received intravenous antibiotics compared to those who did not receive the treatment. Similarly, the use of PO antibiotics was not found to have a protective effect in our study [16]. Only the use of subconjunctival antibiotics at the time of globe closure was associated with decreased risk of endophthalmitis following globe closure. Thus, subconjunctival antibiotics protect against endophthalmitis as they decrease the microbial load at the site of injury. Systemic vancomycin and ceftazidime is a potent combination that

provides coverage of all gram positive and gram negative organisms, but their penetration into the vitreous under different anatomic states is debatable. At our institution, we did not use any prophylaxis as all endophthalmitis cases are presented as full flanged cases and receive intravitreal injections. Data analysis did not find any significant difference in the number of intravitreal injections [17]. The current study reported that pars plana vitrectomy with or without silicone oil tamponade helps in vision improvement, which is in agreement with the finding by Azad, et al. While the use of systemic antibiotic prophylaxis is a common practice for OGI, intravitreal antibiotic prophylaxis and the timing of IOFB removal are debatable. Several studies demonstrated that the presence of an IOFB alone, irrespective of the time of removal, is an independent risk factor for the development of endophthalmitis. The current study did not find the presence of IOFB in a large number of cases. In support of this practice, a multicentre, randomized, control trial found a benefit of prophylactic intravitreal gentamicin and clindamycin in cases of IOFB. Taken together, these findings propose that delayed IOFB removal within a few days of globe closure (the median time to removal was 2 days in our study) with intravitreal antibiotic injection at the time of closure may be an acceptable practice in the management of OGI involving IOFBs, especially if it would be unsafe to remove the IOFB at the time of closure. In addition to the use of intravitreal antibiotics in cases of IOFBs, intravitreal antibiotics are recommended in cases of delayed presentation even without IOFB because the delay might be a risk factor for the development of endophthalmitis. Notably, no eyes with endophthalmitis required nucleation in our study, which was contradictory to the previous studies. Given the speciation we encountered in this study, vancomycin and ceftazidime, are a potent combination of intravitreal antibiotics to treat suspected cases of endophthalmitis [18]. The limitations of this study include those inherent to any retrospective study; especially, observer bias and incomplete records for some patients. The rate of endophthalmitis may be higher in our cohort than that treated at other centers. Since we are a tertiary referral center in a rural tribal area, the interval between injury and intervention is long; the median is 8 days, and delays are inevitable as patients first present elsewhere prior to transferring to our center. Our findings may not be generalizable as they are based on a diverse cohort of patients presenting various injuries, including those from urban or remote rural areas. Another potential bias source is that many patients diagnosed with OGI during the study period did not meet the inclusion criteria, primarily due to the lack of 30 days follow up. All charts of these patients were reviewed, and none were found to develop any endophthalmitis. Given our large catchment area, many of these patients choose to return to their local ophthalmologists for follow up after the postoperative day one appointment. The rate of endophthalmitis following OGI has declined over the past 30 years as prompt diagnosis and closure of the globe has become the standard of care worldwide. Our rate of endophthalmitis, 4.3%, is similar to that reported in studies across large academic centers. All our cases of endophthalmitis were diagnosed at presentation, which is because of late presentation. Owing to the poor visual outcomes in OGI complicated by endophthalmitis, the identification of eyes at maximal risk is critical; hence, close monitoring and prophylactic treatment are essential. Herein, we found that delayed globe closure and zone I injury were not risk factors for the development of endophthalmitis as reported previously. Thus, it could be speculated that a standardized protocol is a one time dose of IV. Fluoroquinolone antibiotics, globe closure within 24 h whenever possible, and prophylactic intravitreal antibiotics for prophylaxis [19].

The outcome in the pediatric age group we could not find any data to compared the visual outcome in children with adult but displayed severe inflammatory changes. Dehgh reported that the lesser age of the patients was found to be associated with a higher rate of endophthalmitis. Nonetheless, these studies did not discuss the visual outcome.

The current study revealed that vitreous opacities have a significant impact on visual outcomes.

Sub groups of OGI, according to BETTS, did not have any significant difference in current study [20].

Wound size in OGI does not have an impact on the visual outcome, which was consistent with that reported by Durrani, et al.

CONCLUSION

Post trauma endophthalmitis is a devastating condition with poor visual outcomes. Careful and aggressive management can cause a significant improve visual outcomes. Endophthalmitis vitrectomy study findings are relevant for post trauma endophthalmitis also.

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