E-ISSN: 3050-9459
Journal of Ophthalmology and Advance Research

ATHENAEUM SCIENTIFIC PUBLISHERS

Research Article

Paediatric Traumatic Endophthalmitis in Western India: A Study of Clinical Presentation, Management and Treatment Outcomes

Shreya Shah[1*], Mehul Shah[1], Raj Vador[1], Vedant Rajoria[1], Riddhi Shah[1], Bhoomi Chadarana[1], Deepak Tiwari[1]

[1]Drashti Netralaya, Dahod, Gujarat, India

***Correspondence author:** Shreya Shah, Drashti Netralaya, Dahod, Gujarat, India; Email: omtrustdahod@gmail.com

Citation: Shah S, et al. Paediatric Traumatic Endophthalmitis in Western India: A Study of Clinical Presentation, Management and Treatment Outcomes. J Ophthalmol Adv Res. 2025;6(1):1-8.

https://doi.org/10.46889/JOAR.2025.6106

Received Date: 16-02-2025

Accepted Date: 13-03-2025

Published Date: 20-03-2025

Abstract

Introduction: Endophthalmitis is devastating sight threatening condition following open globe injury. Study is 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 children treated for OGI at the Drashti Netralaya from January 2008 to December 2022 was conducted according to predefined inclusion and exclusion criteria. The main outcome measure was the rate of endophthalmitis, different variables and visual outcome.

Result: 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 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 clinical findings a stastically significant impact on the visual outcome even in pediatric age group.

Keywords: Pediatric Endophthalmitis; Intraocular Foreign Body; Ocular Trauma; Open Globe Injury

Introduction

Endophthalmitis is inflammation of all contents of eyeball following Open Globe Injury (OGI). Wound contamination may be by object of injury or setting of Injury. Endophthalmitis is devastating complication of ocular trauma. Which is very much serious in case of children as economical and social burden is more [1-18]. Ocular signs associated with posttraumatic endophthalmitis are similar to those with postoperative infections, including Anterior Chamber (AC) cells, but presence of wound foreign body may influence signs and outcome.

Flare, hypopyon and vitreous cell exceeding that expected from the injury [1]. Children have specific problem of amblyopia which may influence outcome. 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 [2]. 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% [3-12]. The most commonly isolated organisms from cases of Post Traumatic endophthalmitis are Streptococcus species (16.9-21.8%) (13, 14), Staphylococcus species (12.0-15.6%) and Bacillus species (8.7-50.0%) [7-15]. 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 closure, isolated corneal injury and lacerating mechanism of injury, as risk factors for the development of

endophthalmitis following OGI [2-16].

Among children with infectious endophthalmitis, posttraumatic endophthalmitis comprised 25-31% of cases [6,15]. The reported incidence rate of endophthalmitis following OGI ranged from 0-16.5%, with evidence of a general decline over the past 70 years [5,7,13,15-21]. Protective factors in the setting of trauma include primary wound repair within 24 h, lack of tissue prolapse into wounds and self-sealing wounds [21,22].

Currently, there are no data for OGI in our country particularly in pediatric age group, but the incidence of open globe injury out of total ocular trauma extrapolated from a large database is 41.9% and that for posttraumatic infectious endophthalmitis is 40.2% [23,24].

No consensus exists regarding the management practices to best prevent endophthalmitis in OGI in pediatric age group. 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 centres [2].

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

Material and Methods

The Institutional Review Board (IRB) of the XXX approved this study prior to data collection and waived the need for informed consent. As it is in pediatric age group all consents were from next to keen. 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 2022 was conducted. The inclusion criteria were clinical diagnosis (Fig. 1-4) and medical or surgical management of OGI during the study period with a minimum follow-up duration of 30 days. 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 children with a history of endophthalmitis. Moreover, eyes that underwent enucleation within 30 days of injury unless diagnosed with endophthalmitis prior to enucleation 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 in pediatric age group was standardized at our setup. 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.

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 under general anaesthesia [25]. 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 life-saving surgeries necessitate the delay. 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 under anaesthesia. After globe closure-operative management, subconjunctival and topical antibiotics, topical corticosteroids and topical cycloplegia are administered.

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

Treatment planned according to severity as in Endophthalmitis vitrectomy study, all eyes are given intra vitreal vancomycin and ceftazidime injection using standard protocol and dosages. Great deal of difficulty found in accessing visual acuity in painful condition. Children who have visual acuity more than hand motion were treated only with intravitreal injections and children who had only perception of light undergone vitrectomy. Children who were not ready for surgical intervention excluded from analyses of visual outcome. Children undergoing surgeries treated by pars plana vitrectomy using 23 g vitrectomy and wide-angle non-contact viewing system. With or without silicone oil injection under general anaesthesia [26,27].

All information exported to excel sheet from Electronic Medical Records and analysed using SPSS 25.

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.

Results

The current cohort consisted of 1751 OGIs, of which 81(4.6%) had endophthalmitis.

Cohort consisted of 32 (39.5%) pediatric age group with median age 7.5 years. Out of which 17/32 (53.1%) cases were males and 15(46.9%) were females (Table 1).

The median interval between injury and presentation was 4 days and median interval between injury and the first intervention was 5days. The mean wound size was 4.06±4.7 mm and the median number of intravitreal injections were 1.13.

A wooden stick was the most common object 12/37.6% causing injury and endophthalmitis and majority activities during injury was play (Table 2).

We found wooden stick foreign bodies in 5(15.62%) cases. 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.

Immediate treatment was administered in the form of intravitreal injection in 81.1% of cases. Surgical management (after wound closure) was carried out in 22 (68.75%) in the form of pars plana vitrectomy with or without silicone oil tamponade.

These children undergo multiple surgeries and the median number of surgeries was 1.16. The majority of the eyes were had zone 1 injury: 48 (90.6%).

32/32(100%) had presenting vision <1/60, including 5(15.6%) No perception. After management 4/53(7.6%) achieved >6/60 and 9(28.9%) had nopl vision with a median follow-up of 49 days. A significant improvement was observed in vision following management (p=0.006). We have studied many variables which are relevant predictors of visual outcome in the case of traumatic endophthalmitis (Table 3).

Object	Number	%
Iron Rod	2	6.3
Iron wire	2	6.3
Sharp-pen	1	3.1
Sharp-Scissors	1	3.1
Stone	3	9.4
Wooden Stick	12	37.5
Wooden stick-Thorn	2	6.3
Unknown	4	12.5

Other	4	12.5
Total	32	100

Table 1: Object of injury.

Pre Treatment			Post Treatment		
Vision category	**Frequency**	**Percent**	**Vision category**	**Frequency**	**Percent**
NOPL	8	25..0	NOPL	10	31.25
HM	24	75.0	HM	5	15.62
FCNF	0		FCNF	3	9.37
>1/60	0		6/60-6/36	2	6.25
	0		6/24-6/18	2	6.25
LF	0		LF	10	31.25
TOTAL	32	100	TOTAL	32	100
P=0.012					

Table 2: Comparative study of visual outcome.

Comparative Study with Variable Vs Final Visual Outcome	P value	Significance
Presenting vision	0.012	Yes
Lid findings	0.945	N0
Corneal signs	0.009	Yes
Findings in anterior chamber	0.785	No
Lens changes	0.925	No
Vitreous opacities	0.035	Yes
B scan	0.550	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	0.000	Yes
Pediatric	0.003	Yes
Age	0.447	No
Sex	0.129	No
Posterior segment findings	0.000	Yes

Table 3: Comparative study of variables with visual outcome.

Discussion

Posttraumatic endophthalmitis is one of the major complications after the repair of OGI in children [25,26]. In this study, we aimed to investigate the incidence and the risk factors of endophthalmitis in children to make the correct decision in the management of such clinical challenges in cases with larger wounds and contaminated objects to decrease the incidence and the consequences of this devastating event.

Next, we reported an endophthalmitis rate of 4.6 % in the eyes with OGI, which was consistent with the previously reported rates between 0.9% and 17.0% these variations because of different settings, geographical locations and habitats of injuries [2-12]. Our protocol for OGI emphasizes no systemic antibiotics in contrast to previous reports [2]. All of the 32 cases of endophthalmitis were diagnosed on presentation;the rate of endophthalmitis developing following globe closure was nil in 1751 cases in contrast to that report by Durrani, et al. [2]. 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 children with OGI [28,29]. Some studies reported a low incidence of endophthalmitis (1-7%) and attributed this to the use of systemic antibiotics [2,31]. 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 sample size of 117 eyes with open globe injury which did not differ significantly from that in the current study [6]. This phenomenon could be attributed to zone 1 injury wherein organisms are not directly inoculated in the vitreous cavity.

Thompson, et al., demonstrated that the eyes repaired after 24 Hours have a high incidence of endophthalmitis [32,33]. Durrani et al. also found that the time to globe repair >24 h after injury was a risk factor for the development of endophthalmitis, as described previously [2,6,7,14,16]. We did not find an association between the interval 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. However, we hypothesized that the anti-bacterial and anti-fungal properties of alocia nilotica in these cases could explain this difference [2,4,6,7,16,35-37].

Tyler, et al., reported incidence of endophthalmitis 9% following open globe injury by wood [38]. 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.

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 [19,20,27]. At our institution, we did not use any prophylaxis as all endophthalmitis cases are presented as full-flagged cases and receive intravitreal injections. We did not find significant difference in visual outcome with the number of intravitreal injections.

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. [38].

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 [3,4,6,7,16]. The current study had IOFB in 15.6% cases. In support of this practice, a multicentre, randomized, control trial found a benefit of prophylactic intravitreal gentamicin and clindamycin in cases of IOFB [12]. 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 enucleation in our study, which was contradictory to the previous studies [2]. Given the speciation we encountered in this study, vancomycin and ceftazidime, are a potent combination of intravitreal antibiotics to treat suspected cases of endophthalmitis [28,33].

The limitations of this study include those inherent to any retrospective study;especially, observer bias and incomplete records for some children. The rate of endophthalmitis may be higher in our cohort than that treated at other centres. Since we are a tertiary referral center in a rural tribal area, the interval between injury and intervention is long;the median is 5 days and delays are inevitable as children first present elsewhere prior to transferring to our center.

Our findings may not be generalizable as they are based on a diverse cohort of children presenting various injuries, including those from urban or remote rural areas. Another potential bias source is that many children diagnosed with OGI during the study period did not meet the inclusion criteria, primarily due to the lack of a 30-day follow-up. All charts of these children were reviewed and none were found to develop any endophthalmitis. Given our large catchment area, many of these children 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 [3-12]. Our rate of endophthalmitis, 4.6 %, is similar to that reported in studies across large academic centres [3-12]. 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 [2,41-43]. Thus, it could be speculated that a standardized protocol is a one-time dose of intravitreal fluoroquinolone antibiotics, globe closure within 24 h whenever possible and prophylactic intravitreal antibiotics for prophylaxis.

Zhang, et al., reported poor outcome in post OGI poor outcome in childen in china(ref china) Wang, et al., reported 18.9% endophthalmitis in cases of pediatric traumatic cataract [25,26].

We could not find many other studies to compare outcome in the pediatric age group but displayed severe inflammatory changes [29,43-47]. 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 but large wooden foreign bodies have poor impact [38]. Wound size in OGI does not have an impact on the visual outcome, which was consistent with that reported by Durrani, et al., [1].

Conclusion

Post trauma endophthalmitis is a devastating condition with poor visual outcomes. Careful and aggressive management can cause a significant improve visual outcomes.

Conflict of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding Details

No funding was received for this review. No other financial disclosures of all authors.

References

1. Banker TP, McClellan AJ, Wilson BD. Culture-positive endophthalmitis after open globe injuries with and without retained intraocular foreign bodies. Ophthalmic Surg Lasers Imaging Retina. 2017;48(8):632-7.
2. Durrani AF, Zhao PY, Zhou Y. Risk factors for endophthalmitis following open globe injuries: A 17-year analysis. Clin Ophthalmol. 2021;15:2077-287.
3. Andreoli CM, Andreoli MT, Kloek CE, Ahuero AE, Vavvas D, Durand ML. Low rate of endophthalmitis in a large series of open globe injuries. Am J Ophthalmol. 2009;147(4):601-8.
4. Verbraeken H, Rysselaere M. Post-traumatic endophthalmitis. Eur J Ophthalmol. 1994;4(1):1-5

5. Faghihi H, Hajizadeh F and Esfahani MR. Posttraumatic endophthalmitis: report no. 2. Retina. 2012;32(1):146-51.
6. Essex RW, Yi Q, Charles PGP, Allen PJ. Post-traumatic endophthalmitis. Ophthalmology. 2004;111(11):2015-22.
7. Thompson JT, Parver LM, Enger CL, Mieler WF, Liggett PE. Infectious endophthalmitis after penetrating injuries with retained intraocular foreign bodies. National Eye Trauma System. Ophthalmology. 1993;100(10):1468-74.
8. Zhang Y, Zhang MN, Jiang CH, Yao Y, Zhang K. Endophthalmitis following open globe injury. Br J Ophthalmol. 2010;94(1):111-4.
9. Sabaci G, Bayer A, Mutlu FM, Karagül S, Yildirim E. Endophthalmitis after deadly-weapon-related open-globe injuries: risk factors, value of prophylactic antibiotics and visual outcomes. Am J Ophthalmol. 2002;133(1):62-9.
10. Thompson WS, Rubsamen PE, Flynn HW, Schiffman J, Cousins SW. Endophthalmitis after penetrating trauma. Risk factors and visual acuity outcomes. Ophthalmology. 1995;102(11):1696-1701..
11. Soheilian M, Rafati N, Mohebbi MR. Prophylaxis of acute posttraumatic bacterial endophthalmitis: a multicentre, randomized clinical trial of intraocular antibiotic injection: Report 2. Arch Ophthalmol. 2007;125(4):460-5.
12. Jindal A, Pathengay A, Mithal K, et al. Endophthalmitis after open globe injuries: changes in microbiological spectrum and isolate susceptibility patterns over 14 years. J Ophthalmic Inflamm Infect. 2014;4(1):5.
13. Long C, Liu B, Xu C, Jing Y, Yuan Z, Lin X. Causative organisms of post-traumatic endophthalmitis: a 20-year retrospective study. BMC Ophthalmol. 2014;14:34.
14. Boldt HC, Pulido JS, Blodi CF, Folk JC, Weingeist TA. Rural endophthalmitis. Ophthalmology. 1989;96(12):1722-6.
15. Li X, Zarbin MA, Langer PD, Bhagat N. Posttraumatic endophthalmitis: An 18-year case series. Retina. 2018;38(1):60-71.
16. Pieramici DJ, Sternberg P, Aaberg TM. A system for classifying mechanical injuries of the eye (globe). The Ocular Trauma Classification Group. Am J Ophthalmol. 1997;123(6):820-31.
17. Meredith TA, Aguilar HE, Shaarawy A, Kincaid M, Dick J, Niesman MR. Vancomycin levels in the vitreous cavity after intravenous administration. Am J Ophthalmol. 1995;119(6):774-8.
18. Aguilar HE, Meredith TA, Shaarawy A, Kincaid M, Dick J. Vitreous cavity penetration of ceftazidime after intravenous administration. Retina. 1995;15(2):154-9.
19. Hariprasad SM, Shah GK, Mieler WF. Vitreous and aqueous penetration of orally administered moxifloxacin in humans. Arch Ophthalmol. 2006;124(2):178-82.
20. El Baba FZ, Trousdale MD, Gauderman WJ, Wagner DG, Liggett PE. Intravitreal penetration of oral ciprofloxacin in humans. Ophthalmology. 1992;99(4):483-6.
21. Ahmed Y, Schimel AM, Pathengay A, Colyer MH, Flynn HW Jr. Endophthalmitis following open-globe injuries. Eye (Lond). 2012;26(2):212-7.
22. Shah SM, Shah MA, Singh R, Rathod C, Khanna R.A prospective cohort study on the epidemiology of ocular trauma associated With closed-globe injuries in pediatric age group. Indian J Ophthalmol. 2020;68:500-3
23. Sharma S, Padhi TR, Basu S, Kar S, Roy A, Das T. Endophthalmitis children seen in a tertiary eye care centre in Odisha: A clinico-microbiological analysis. Indian J Med Res. 2014;139:91-8.
24. Dehghani AR, Rezaei L, Salam H, Mohammadi Z, Mahboubi M. Post traumatic endophthalmitis: Incidence and risk factors. Glob J Health Sci. 2014;6(6):68-72.
25. Zheng L, Tan J, Liu R, Yang X, He H, Xiao H, et al. the impact of primary treatment on post-traumatic endophthalmitis in children with open globe injuries: A study in China. Int J Environ Res Public Health. 2019;16(16):2956.
26. Wang P, Fu Q, Yin H, Wang L, Liu L. Paediatric traumatic cataracts in Southwest China: epidemiological profile. BMC Ophthalmol. 2022;22(1):208.
27. Agrawal R, Shah M, Mireskandari K, Yong GK. Controversies in ocular trauma classification and management: Review Int Ophthalmol. 2013;4:435-45.
28. Vitrectomy E. Results of the endophthalmitis vitrectomy study. Arch Ophthalmol. 1995;113:1479-96.
29. Mehul S, Shreya S, Ashit S, Parth K. Endophthalmitis vitrectomy study: Effectiveness of guidelines in cases of endophthalmitis following manual small incision cataract surgery. Int J Ophthalmol Eye Sci. 2023;2:401
30. Dehghani AR, Rezaei L, Salam H, Mohammadi Z, Mahboubi M. Post traumatic endophthalmitis: incidence and risk factors. Global J Health Science. 2014;6(6):68.
31. Charles S. Principles and techniques of vitreoretinal surgery. Retina. 2013:1696-711.
32. Thompson JT, Parver LM, Enger CL, Mieler WF, Liggett PE. Infectious endophthalmitis after penetrating injuries with retained intraocular foreign bodies. National Eye Trauma System. Ophthalmology. 1993;100(10):1468-74.
33. Bhagat N, Nagori, S, Zarbin M. Post-traumatic infectious endophthalmitis. Surv Ophthalmol. 2011;56(3):214-51.

34. Shah M, Shah S, Khanna R, Gunay R, Thorat D. Can vegetative injuries (offer protection against infection Acacia nilotica-Babool tree) in case of open globe injuries defined by BETTS? Asian J Pharmacy and Pharmacology. 2020;6(6):401-7.
35. Grayer RJ, Harborne JB. A survey of antifungal compounds from plants, 1982-1993. Phytochemistry. 1994;37:19-42.
36. Khan R, Islam B, Akram M, Shakil S, Ahmad A, Ali SM, et al. Antimicrobial activity of five herbal extracts against Multi Drug Resistant (MDR) Strains of Bacteria and Fungus of Clinical Origin. Molecules. 2009;14:586-97.
37. Shekar C, Nagarajappa R, Singh R, Thakur R. Antimicrobial efficacy of Acacia nilotica, Murraya koenigii Sprengel, Eucalyptus hybrid and Psidium guajava on primary plaque colonizers: An in vitro comparison between hot and cold extraction process. J Ind Society of Periodontol. 2015;19(2):174-9.
38. Azad R, Ravi K, Talwar D, Rajpal, Kumar N. Pars planavitrectomy with or without silicone oil endotamponade I post-traumatic endophthalmitis. Graefes Arch Clin Exp Ophthalmol. 2003;241(6):478-83.
39. Pfister T, Bohnak C, Patel S. Wood-related open-globe injuries. J Vitreoretin Dis. 2020;5(1):7-14.
40. Vitrectomy E. Results of the endophthalmitis vitrectomy study. Arch Ophthalmol. 1995;113:1479-96.
41. Boldt HC, Pulido JS, Blodi CF, Folk JC, Weingeist TA. Rural endophthalmitis. Ophthalmology. 1989;96(12):1722-6.
42. Li X, Zarbin MA, Langer PD, Bhagat N. Posttraumatic endophthalmitis: an 18-year case series. Retina. 2018;38(1):60-71.
43. Mittra RA, Mieler WF. Controversies in the management of open-globe injuries involving the posterior segment. Surv Ophthalmol. 1999;44(3):215-25.
44. Zheng L, Tan J, Liu R. The impact of primary treatment on post-traumatic endophthalmitis in children with open globe injuries: A study in China. Int J Environ Res Public Health. 2019;16(16):2956.
45. Van TTK, Hon DN, Anh NTN, Anh BTV, Quyet D, Thai TV, et al. Clinical and microbiological features of pediatric endophthalmitis after open globe injury in the north of Vietnam. Open Access Maced J Med Sci. 2019;7(24):4306-10.
46. Hosseini H, Masoumpour M, Keshavarz-Fazl F, Razeghinejad MR, Salouti R, Nowroozzadeh MH. Clinical and Epidemiologic Characteristics of Severe Childhood Ocular Injuries in Southern Iran. Middle East Afr J Ophthalmol, 2011;18(2):136-40.
47. Narang S, Gupta V, Simalandhi P, Gupta A, Raj S, Dogra MR. Paediatric open globe injuries. Visual outcome and risk factors for endophthalmitis. Ind J Ophthalmol. 2004;52(1):29-34.