Original Article

Clinical presentations and comparative outcomes of primary versus deferred intraocular lens explantation in delayed-onset endophthalmitis

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Purpose: To describe clinical presentations and comparative outcomes of primary versus deferred intraocular lens (IOL) explantation in delayed-onset endophthalmitis. **Methods:** In this retrospective study, a total of 77 eyes of 77 patients that were diagnosed clinically as delayed-onset endophthalmitis and underwent IOL explantation from January 1990 to January 2018 were included undiluted vitreous biopsy and IOL were subjected to microbiologic evaluation. Duration of symptoms, presenting visual acuity, organisms isolated, time to IOL explantation, time to endophthalmitis, resolution after explantation, number of repeat intravitreal injections, and final visual acuity were compared in the primary and the deferred IOL explantation groups. **Results:** There were primary and deferred IOL explantations. Interval between inciting event and endophthalmitis, between onset of symptoms to presentation, total follow-up, complication rate, and final visual acuity was comparable between the two groups. Median time to IOL explantation in the deferred group was 70 days. Between the primary and deferred IOL explantation groups the number of repeat intravitreal injections was 0.58 ± 0.86 and 2.62 ± 1.78 respectively, ($P < 0.0001$, 95% confidence interval, CI 2.00–2.22); the number of days to resolution after IOL explantation was 35.16 ± 14.26 and 55.5 ± 8.24 respectively, ($P < 0.0001$, 95% CI 15.22–25.45). **Conclusion:** Early IOL explantation in delayed-onset endophthalmitis causes faster clinical resolution and reduces the number of repeat intravitreal injections. Final visual improvement, however, may be unaffected.

Key words: Deferred explantation, delayed-onset, endophthalmitis, intraocular lens, primary explantation

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Endophthalmitis is potentially the most vision-threatening condition in the eye. Conventionally, endophthalmitis is classified as acute-onset or delayed-onset. This classification was proposed in the endophthalmitis vitrectomy study.[1] It is based on the time of onset; acute-onset if endophthalmitis symptoms and signs occur within 6 weeks of surgery and delayed-onset when it is after 6 weeks of surgery. In delayed-onset endophthalmitis, the onset is often low grade and persistent inflammation forms the classical presentation. It has been well documented that in cases of delayed-onset endophthalmitis, the organisms could be sequestered in the capsular bag and could be difficult to eradicate.[2,3] Subsequent to this, it is also common knowledge that in cases of persistent inflammation as seen in chronic or a delayed-onset endophthalmitis, the explantation of the intraocular lens (IOL) plays an important role in the final outcome.[2,3]

Though it is propounded that the microorganisms causing endophthalmitis are sequestered on the IOL surface and thus IOL explantation helps in better elimination of those microbes, the timing of the procedure with respect to the clinical presentation is not well established. In the current study, we have compared the impact of early and deferred explanation of IOL in delayed-onset endophthalmitis.

Methods

Study design

This was a retrospective 28-year (January 1990 to January 2018) chart review of cases with delayed-onset endophthalmitis that underwent IOL explantation in a tertiary eye care center.

Materials and Methods

Case records of all cases of delayed-onset endophthalmitis were identified by the institute's medical record system and the microbiology laboratory register. An appropriate institute review board approval was taken. Details of history, clinical examination, clinical features at presentation, microbiological evaluation, antibiotic sensitivity, and clinical response to therapy were noted. Clinical findings noted were presenting and final best corrected visual acuity, corneal edema,

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hypopyon, extent of fundal glow, and status of the retinal vessels if visible. Whenever the fundus was not visible by the binocular indirect ophthalmoscope using the highest illumination, B-scan ultrasonography was done to determine the extent and location of vitreous involvement, and detect any associated ocular disease, such as retinal detachment, choroidal thickening, or choroidal detachment.

Groups and outcome definition

For analysis, the cases were divided into two groups. The first group consisted of those that underwent primary IOL explantation and the second group had those that underwent deferred IOL explantation. Primary explantation was defined as those cases which underwent IOL explantation during the first surgical intervention. A best-corrected visual acuity of ≥20/400 was defined as a favorable visual outcome and absence of hypotony and retinal detachment at the last visit was defined as a favorable anatomic outcome.[4-6]

Intervention

As per institute protocol, the surgical management of delayed endophthalmitis consisted of pars plana vitrectomy, microscopy, and culture of undiluted vitreous, antimicrobial susceptibility testing of bacterial isolates, intravitreal antibiotics (vancomycin [1 mg/0.1 mL] + ceftazidime [2.25 mg/0.1 mL]) with or without dexamethasone (400 mg/0.1 mL). The medical treatment also included intensive topical antibiotics (ciprofloxacin 0.3% 1 hourly), corticosteroid (prednisolone acetate 1% 1 hourly), and oral ciprofloxacin 750 mg two times per day for 7 to 10 days. Additional procedures, such as repeat intravitreal antibiotics or repeat pars plana vitreous lavage, depended on the response to treatment and were left to the decision of the treating physicians. The usage and dosage of oral and topical steroids was also left to the discretion of the treating physician. In cases with hazy view because of corneal involvement, a vitreous biopsy was taken instead of a vitrectomy as the first procedure.

None of the eyes underwent aspirational tap. This was to avoid unnecessary peripheral vitreous traction, which could cause inadvertent retinal tears. A total of 12 eyes underwent vitreous biopsy alone. The rest underwent core vitrectomy. Depending on the presentation, various other surgical procedures were combined as deemed appropriate. Most eyes underwent multiple injections over the follow-up period.

Surgical technique and microbiologic evaluation

A standard 3-port 20-G (1990-2011) r 23/25-G (2011-2018) procedure was performed in all eyes that received a vitrectomy. Topical povidone iodine eye drops were instilled in the cul-de-sac, in all cases, at the end of surgery. Overall, 37 procedures were 20 G and 49 procedures were 23/25 g surgeries. Undiluted vitreous samples were collected at the beginning of the surgery in all cases using a vitrectomy cutter connected to a 2 mL syringe and applying manual suction. About 1–1.5 mL of undiluted vitreous was collected for analysis. Further handling and processing of the samples and final interpretation were done as per the institute's protocol.

The microbiological processing of the vitreous sample included direct microscopy and culture. Smears were examined after staining with 0.1% calcofluor white, Gram and Gomori methenamine silver stains, and the media included for culture were 5% sheep blood agar, chocolate agar, thioglycollate broth, brain heart infusion broth, Sabouraud dextrose agar, and potato dextrose agar. All media were incubated aerobically at 37°C except Sabouraud dextrose agar and potato dextrose agar that were incubated at 27°C for 2 weeks. Chocolate agar was incubated in 5% CO2 at 37°C.[7,8] The explanted IOL was plated in a chocolate agar plate separately.

Statistical analysis

The data was arranged on an Excel spread sheet and analyzed using the statistical software MedCalc ver 12.2.1.0 (Ostend, Belgium). Percentage confidence intervals were calculated using online statistical calculators (https://www.allto.co.uk/tools/statistic-calculators). A P value <0.05 was taken as statistically significant.

Results

Demography

A total of 77 eyes were included in the study. There were 37 males (48.05%) and 40 females (51.94%). The mean age at presentation was 56.18 ± 14.99, median 60 years. The causes of endophthalmitis included trauma (n = 5; 6.54%), endogenous (n = 4; 5.19%), postcataract surgery (n = 61; 79.43%), and 7 (9.09%) post various other surgeries other than cataract (three post keratoplasty, four post trabeculectomy) [Table 1].

Clinical presentation

The mean time interval between the inciting event and occurrence of endophthalmitis, mean time between onset of symptoms to presentation, the number of repeat intravitreal antibiotic injections, the type of procedure at the primary surgery, the total follow-up duration and complications, if any, are summarized in Table 2.

Microbiology

The overall culture positivity was noted for 38/77 cases (48.71%). In the primary explantation group, it was noted to be 9/25 cases (36%), while in the deferred group it was 28/52 cases (53.84%). The various organisms isolated are summarized in Table 3 and the specimens tested positive are listed in Table 4.

Table 1: Type of endophthalmitis

Type of endophthalmitis	Number of eyes (%)
Postcataract surgery	61 (79.43%)
Post trauma	5 (6.54%)
Endogenous	4 (5.19%)
Post noncataract surgeries	7 (9.09%)

Table 2: Type of initial surgical intervention received

Type of initial intervention	Number of eyes
IOL explant	25
Pars plana vitrectomy	24
Therapeutic keratoplasty + IOL explant	12
Vitreous biopsy alone	10
Anterior chamber wash	3
Tissue adhesive + bandage contact lens	2
Patch graft + IOL explant	1

Table 3: Organisms isolated in the two comparative groups

Isolate	Primary explantation	Deferred explantation
Bacteria		
Gram negative bacilli	1	-
Streptococcus pneumoniae	2	2
Enterococcus fecalis	1	-
Staphylococcus hemolyticus	-	1
Staphylococcus epidermidis	-	3
Corynebacterium spp.	-	2
Pseudomonas aeruginosa	-	3
Propionibacterium acnes	1	-
Fungi		
Aspergillus flavus	1	6
Stephanoascus ciferrii	1	4
Cladosporium spp	-	2
Alternaria spp.	-	1
Acremonium spp.	1	-
Unidentified dematecious fungi	1	-
Bipolaris spicifera	-	1
Aspergillus niger	-	1

Table 4: Specimen growing the isolates in the two comparative groups

Specimen	Primary explantation	Deferred explantation
AC tap	-	6
Vitreous	5	15
IOL	2	7
Corneal scraping	2	2
Corneal button	1	1

Outcomes

The mean follow-up duration was 22.43 ± 37.5 months (median 6 months). A total of 34 eyes (31.77%) had a favorable visual outcome at the last visit. The gender distribution, mean age at presentation, favorable vision at presentation, the interval between inciting event and endophthalmitis, the duration between the onset of event and presentation to the clinic and the total follow-up were all comparable in the two groups [Table 5].

The number of repeat intravitreal antibiotic injections required was significantly less in the cases that underwent primary IOL explantation. The incidences of retinal detachment and corneal decompensation were also comparable in the two groups. The marginally favorable vision at last follow-up seen in the deferred IOL explant group was statistically insignificant.

Discussion

In the current study, we concluded that primary IOL explantation required significantly fewer number of repeat intravitreal interventions compared to the deferred IOL explantation. The final visual outcome in the primary explantation group and the procedure-related complication profile were comparable. It has been well documented that delayed-onset endophthalmitis could often have a chronic course with recurrent bouts of inflammation interspersed with periods of quiescence.[9-12] The recommended approach to such cases is a vitrectomy with central capsulectomy and intracameral injection of antibiotics.[13,14] Unfortunately, many such cases require multiple interventions and end up finally with explantation of the IOL. Though there is abundant literature on the benefits of IOL explantation in delayed-onset endophthalmitis, the exact timing of IOL explantation is not clearly stated.[2-4] In the current study, the cases of delayed-onset endophthalmitis that underwent primary IOL explantation resolved faster than those that underwent a deferred explantation. However, the final visual acuity was unchanged irrespective of timing of IOL explantation. Nevertheless, this may still be advantageous as an early resolution would require lesser intravitreal injections and patient visits to the treating physician. A potential cause of concern in attempting IOL explantation relatively early in the course of endophthalmitis would be possible increased incidence of corneal decompensation and rhegmatogenous retinal detachment. However, the current study noted no significant difference between the occurrences in the comparative groups.

The current study also has a few inherent limitations. The effect of various confounding factors could not be independently assessed due to the retrospective nature of the study. The limited sample size did not allow us reach a statistical significance of the impact of certain factors. Though these factors could potentially impact the outcome, the current study did not permit such analysis due to a small sample size. A proportion of cases of endophthalmitis in this series were post trauma. Trauma itself is a confounding factor for a final poor visual outcome. Thus, it would be difficult to clearly differentiate between the effect of trauma and subsequent endophthalmitis. The etiology of endophthalmitis in this study was varied and included both exogenous and endogenous causes. It can be argued that in an endogenous cause, the capsular load of organisms may have been low, whereas it may have been high in an exogenous cause. This potentially may affect the final result interpretation.

Of the cases included, only 37 out of 77 had a positive microbiologic culture. Without a positive culture it is difficult to differentiate a truly infectious endophthalmitis from severe inflammation. Though including only culture positive and postsurgery cases for the study would have been ideal, it would have caused the sample size to reduce to a level where deriving meaningful results would have not been possible. As this is a retrospective study, the cases have been operated by multiple surgeons. In such a scenario, the effect of a personal bias towards or against an early IOL explantation cannot be circumvented. The antibiotic sensitivity was done by the Kirby–Bauer disc diffusion method; minimum inhibitory concentration levels were not measured. As the study does not have a comparative control arm of delayed-onset endophthalmitis where the IOL was retained, no conclusion could be made about the definite indication of explantation. We suggest though, that in cases where an IOL explantation is contemplated, it is better done sooner than later for faster resolution of infection and inflammation.

Table 5: Comparison of groups with primary IOL explant and deferred IOL explant

	Primary IOL explant	Delayed IOL explant	*P* value for difference	95% CI for difference
Number of eyes	25	52	0.32	
Males	14 (56.36%)	23 (44.23%)	0.07	
Mean age	54.09±14.9	58±15.02	0.16	
Following trauma	2 (9.09%)	3 (5.76%)	0.59	
Following cataract surgery	17 (68%)	44 (84.61%)	0.09	
Following endogenous spread	2 (50%)	2 (50%)	1	
Following noncataract surgery	2 (28.57%)	71.42%)	0.12	
Vision at presentation (>20/400)	2 (7.27%)	14 (27%)	0.04	0.14% to 34.1%
Time to IOL explant in days from presentation	0	88.11±66.58 Median 70	<0.0001	61.49 to 114.72
Significant corneal haze at presentation	12 (47.27%)	21 (40.38%)	0.33	
Interval between inciting event and endophthalmitis (days)	268.07±759.02 (Median 78)	198.44±603.84 (Median 80)	0.99	
Interval between onset of symptoms to presentation (days)	6±2.75 (Median 8)	6.84±2.31 (Median 8)	0.09	
Number of repeat intravitreal antibiotic injections required	0.58±0.86 (Median 0)	2.62±1.78 (Median 2)	<0.0001	2.00 to 2.22
Days to resolution after IOL explant	35.16±14.26 (Median 32)	55.5±8.24 (Median 56.5)	<0.0001	15.22 to 25.45
Total follow-up (months)	28.31±46.97 (Median 5.5)	21.03±37.27 (Median 7)	0.8	
Retinal detachment in follow-up	0 (0%)	3 (5.76%)	0.07	
Corneal decompensation in follow-up	6 (24%)	8 (15.38%)	0.28	
Phthisis bulbi	2 (8%)	2 (3.84%)	0.44	
Neovascular glaucoma	1 (4%)	0	0.14	
Culture positive cases	9 (36%)	28 (53.84%)	0.14	
Favorable vision at last follow-up	8 (32%)	20 (38.46%)	0.58	

Conclusion

The results of our study indicate that early IOL explantation in delayed-onset endophthalmitis results in faster clinical resolution of infection and inflammation, and reduces the number of repeat intravitreal injections.

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Conflicts of interest

There are no conflicts of interest.

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