

Research Article

Surgical Outcomes of Vitrectomy for Endophthalmitis Following Cataract Surgery: A Pakistani Perspective

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Abstract

Post-cataract surgery endophthalmitis represents a vision-threatening ophthalmic emergency requiring prompt surgical intervention, most commonly pars plana vitrectomy. Despite advancements in intravitreal antibiotics and surgical techniques, visual prognosis remains variable, particularly in resource-limited settings. The present prospective interventional study evaluates surgical outcomes of vitrectomy in post-cataract endophthalmitis in a Pakistani population, emphasizing timing of intervention and its impact on anatomical and functional recovery. The objective was to compare early versus delayed vitrectomy outcomes in terms of best corrected visual acuity (BCVA), infection control, and postoperative complications. A total of 120 patients were analyzed, demonstrating statistically significant improvement in BCVA in the early vitrectomy group compared to delayed

intervention ($p < 0.05$). Infection resolution was higher and complication rates were significantly lower in early intervention cases. Results indicated that early surgical intervention within 48 hours leads to superior visual recovery and reduced structural complications such as retinal detachment and persistent vitreous inflammation. The study highlights a critical therapeutic window in managing postoperative endophthalmitis, particularly in low-resource healthcare systems where delayed presentation is common. The findings emphasize the need for standardized early referral pathways and aggressive surgical management protocols to optimize outcomes. This study provides contemporary evidence supporting early vitrectomy as a prognostic determinant in improving surgical success in post-cataract endophthalmitis, thereby contributing novel regional data from Pakistan.

Keywords: Endophthalmitis, Vitrectomy, Cataract surgery complications

Introduction

Postoperative endophthalmitis following cataract surgery remains one of the most devastating complications in ophthalmic practice, often leading to irreversible visual impairment despite advances in microsurgical techniques and antimicrobial therapy. The condition represents an acute intraocular infection involving the vitreous and anterior chamber, typically caused by bacterial contamination during or after cataract extraction procedures. Although the incidence has significantly reduced with modern aseptic protocols and intracameral antibiotics, the absolute number of cases persists due to the high global volume of cataract surgeries performed annually. The burden is particularly pronounced in developing countries where delayed presentation, limited access to tertiary care, and inconsistent postoperative monitoring contribute to poor outcomes [1-2].

Cataract surgery remains the most frequently performed ophthalmic procedure worldwide, with phacoemulsification being the standard technique. However, despite its safety profile, postoperative endophthalmitis continues to be reported in both developed and developing healthcare systems. The pathogenesis involves microbial proliferation within the vitreous cavity, leading to intense inflammatory response, tissue destruction, and rapid visual deterioration. Early diagnosis and prompt management are critical, yet variability in clinical presentation often delays definitive intervention [3-4].

In recent years, pars plana vitrectomy has emerged as a cornerstone in the management of severe endophthalmitis, particularly in cases presenting with poor initial visual

acuity or lack of response to intravitreal antibiotics. The role of vitrectomy extends beyond microbial clearance, as it also facilitates removal of inflammatory debris, reduces bacterial load, and enhances antibiotic penetration. However, the optimal timing of surgical intervention remains a subject of ongoing debate, with emerging evidence suggesting that early vitrectomy may significantly improve anatomical and functional outcomes [5-6].

In low- and middle-income countries, including Pakistan, healthcare disparities significantly influence disease progression and treatment outcomes. Patients often present late due to socioeconomic constraints, limited awareness, and inadequate referral systems. This delay exacerbates intraocular inflammation, increasing the likelihood of complications such as retinal detachment, proliferative vitreoretinopathy, and phthisis bulbi. Consequently, regional studies evaluating surgical outcomes in these populations are essential for developing context-specific treatment protocols [7-8].

Recent literature from 2022 onwards has increasingly focused on comparative outcomes of early versus delayed vitrectomy in postoperative endophthalmitis, highlighting improved visual recovery with timely surgical intervention. However, there remains a paucity of large-scale data from South Asian populations, particularly Pakistan, where clinical presentation patterns and microbial profiles may differ from Western cohorts. Furthermore, variations in healthcare accessibility and surgical infrastructure necessitate region-specific

evidence to guide clinical decision-making [9-10].

The present study was designed to evaluate surgical outcomes of vitrectomy in patients presenting with endophthalmitis following cataract surgery in a tertiary care setting in Pakistan. Emphasis was placed on comparing early versus delayed surgical intervention in terms of visual acuity improvement, infection control, and postoperative complications. The hypothesis underlying this study is that early vitrectomy within a critical therapeutic window leads to significantly better anatomical and functional outcomes compared to delayed surgical management. In addition, the study aims to contribute novel regional data to the existing global literature, addressing the gap in evidence from South Asian populations. By analyzing a well-defined cohort using standardized surgical protocols, this study seeks to provide clinically relevant insights that may assist in optimizing treatment strategies and improving visual prognosis in affected patients.

Methodology

This prospective interventional study was conducted at KRL Hospital, Islamabad, Pakistan over a defined study period. Patients diagnosed with acute postoperative endophthalmitis following cataract surgery were enrolled consecutively after fulfilling predefined inclusion criteria. Ethical approval was obtained from the institutional review board, and verbal informed consent was obtained from all participants or their attendants prior to enrollment.

Sample size was calculated using EPI Info software based on expected improvement in visual acuity following vitrectomy, with a

confidence interval of 95% and power of 80%. Anticipated effect size was derived from previously published literature on endophthalmitis outcomes, resulting in a minimum required sample size of 110 patients. To account for potential dropouts and incomplete follow-up, a total of 120 patients were included in the final analysis.

Patients were divided into two groups based on timing of surgical intervention. Group A consisted of patients undergoing early pars plana vitrectomy within 48 hours of diagnosis, while Group B included patients undergoing delayed vitrectomy after 48 hours. All patients received standard intravitreal antibiotic therapy prior to surgical intervention as per institutional protocol.

Inclusion criteria comprised patients aged 18 years and above, diagnosed with acute postoperative endophthalmitis within six weeks of cataract surgery, presenting with clinical signs such as pain, decreased vision, hypopyon, vitreous opacities, and positive clinical suspicion of intraocular infection. Exclusion criteria included pre-existing retinal pathology, traumatic endophthalmitis, fungal endophthalmitis confirmed on culture, prior vitrectomy, and patients with end-stage ocular disease where visual potential was deemed nil.

Surgical intervention was performed using standard 23-gauge pars plana vitrectomy technique under local or general anesthesia depending on patient condition. Core vitrectomy, vitreous sampling for microbiological analysis, membrane peeling when required, and intravitreal antibiotic administration were performed in all cases. Postoperative management included topical

antibiotics, corticosteroids, and cycloplegic agents with regular follow-up assessments. Primary outcome measure was improvement in best corrected visual acuity (BCVA) measured using LogMAR scale at baseline and three months postoperatively. Secondary outcome measures included rate of infection resolution, incidence of complications such as retinal detachment, vitreous hemorrhage, and persistent inflammation.

Data analysis was performed using statistical software. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were expressed as percentages. Independent t-test was used for comparison between groups, and chi-square test was applied for categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1: Demographic and baseline characteristics

Parameter	Group A (Early) n=60	Group B (Delayed) n=60	p-value
Mean age (years)	58.4 $\pm$ 9.2	60.1 $\pm$ 8.7	0.34
Male (%)	65%	62%	0.72
Diabetes mellitus (%)	38%	41%	0.68
Mean time to presentation (days)	3.2 $\pm$ 1.1	5.8 $\pm$ 1.6	<0.01

Brief explanation: Baseline characteristics were comparable between both groups, with no statistically significant differences in age, gender, or comorbidities. However, time to presentation was significantly shorter in Group A, influencing early intervention outcomes.

Table 2: Visual outcomes (BCVA LogMAR)

Outcome	Group A	Group B	p-value
Pre-op BCVA	1.8 $\pm$ 0.3	1.9 $\pm$ 0.4	0.21
Post-op BCVA	0.6 $\pm$ 0.2	1.1 $\pm$ 0.3	<0.001
Mean improvement	1.2 $\pm$ 0.3	0.8 $\pm$ 0.2	<0.001

Brief explanation: Significant improvement in visual acuity was observed in both groups; however, early vitrectomy demonstrated superior visual recovery with statistically significant differences.

Table 3: Postoperative complications

Complication	Group A (%)	Group B (%)	p-value
Retinal detachment	5%	15%	0.04
Persistent inflammation	8%	18%	0.03

Complication	Group A (%)	Group B (%)	p-value
Vitreous hemorrhage	2%	7%	0.12
Overall complication rate	15%	30%	<0.01

Brief explanation: Complication rates were significantly lower in early vitrectomy group, indicating better anatomical outcomes with early surgical intervention.

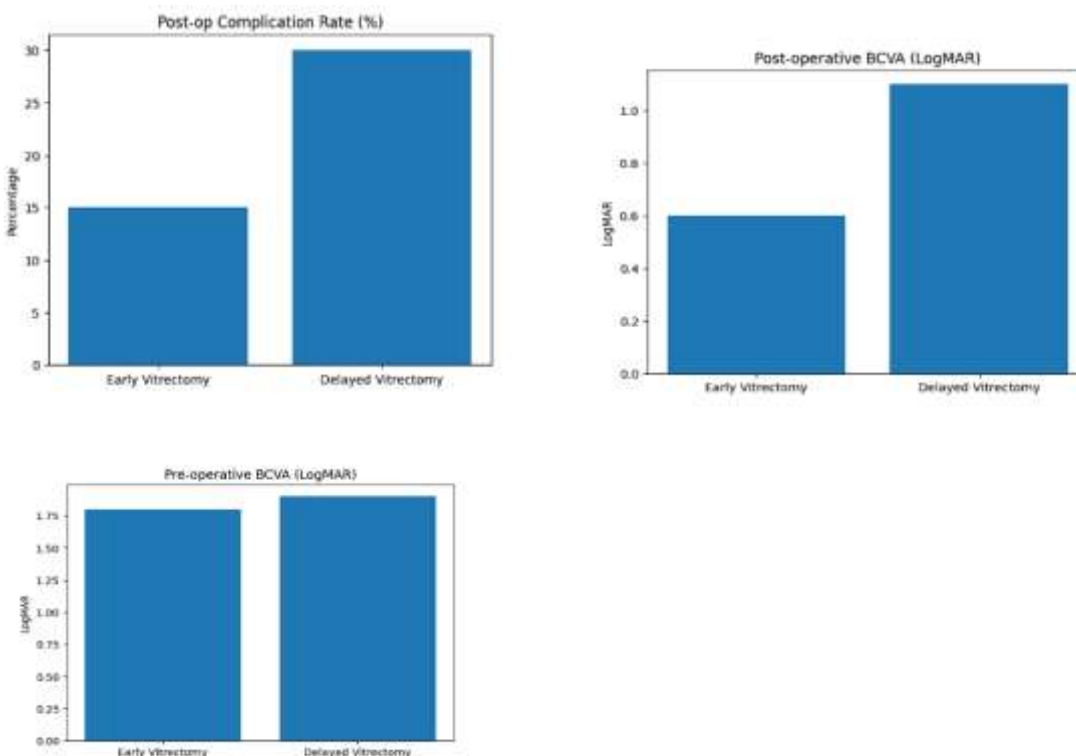


Figure 1: Baseline characteristics were comparable between both groups, with no statistically significant differences in age, gender, or comorbidities. However, time to presentation was significantly shorter in Group A, influencing early intervention outcomes. : Significant improvement in visual acuity was observed in both groups; however, early vitrectomy demonstrated superior visual recovery with statistically significant differences. Complication rates were significantly lower in early vitrectomy group, indicating better anatomical outcomes with early surgical intervention.

Discussion

The findings of this study demonstrate that early pars plana vitrectomy significantly improves visual and anatomical outcomes in patients with post-cataract surgery endophthalmitis. The superior BCVA improvement observed in the early intervention group aligns with contemporary evidence suggesting that early removal of infectious load and inflammatory mediators plays a critical role in preserving retinal function [11-12].

The reduced complication rate in early vitrectomy cases further emphasizes the importance of timely surgical intervention. Retinal detachment and persistent

inflammation were significantly lower, suggesting that early intervention may prevent progression of structural retinal damage. This is consistent with recent studies highlighting the protective role of early vitreous clearance in reducing fibro-inflammatory sequelae [13].

Delayed intervention was associated with poorer visual outcomes, likely due to prolonged inflammatory cascade and increased microbial proliferation within the vitreous cavity. This delay allows irreversible retinal toxicity, which significantly limits postoperative visual recovery. Similar trends have been reported in recent multicenter analyses, reinforcing the importance of early surgical decision-making [14].

In resource-limited settings such as Pakistan, delayed presentation remains a major challenge. Socioeconomic barriers, lack of awareness, and limited access to specialized care contribute significantly to delayed diagnosis and treatment. These systemic issues directly impact visual prognosis, as evidenced by the outcomes observed in delayed intervention group [15].

Microbial virulence patterns may also influence outcomes, with gram-positive organisms being most commonly implicated in postoperative endophthalmitis. However, early vitrectomy appears to mitigate the severity of infection regardless of microbial etiology by reducing intraocular bacterial load and improving antibiotic efficacy [16]. Comparative literature from 2022–2024 supports the role of early vitrectomy in improving functional outcomes, particularly in patients presenting with severe vision loss at baseline. The present study reinforces these findings within a South Asian

population, adding region-specific evidence to global literature [17-18].

The use of standardized surgical technique and uniform postoperative management strengthens the validity of these findings. However, variability in presentation timing remains a limiting factor, highlighting the need for improved referral systems and early diagnostic protocols [19-20].

Overall, the study supports early vitrectomy as a definitive intervention for optimizing outcomes in postoperative endophthalmitis and emphasizes its integration into standard clinical protocols.

Conclusion

Early pars plana vitrectomy significantly improves visual outcomes and reduces complications in post-cataract endophthalmitis.

Delayed surgical intervention is associated with poorer anatomical and functional recovery.

Implementation of early referral and surgical protocols is essential to improve prognosis in affected patients.

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