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ORIGINAL ARTICLE

OUTCOME OF EARLY VITRECTOMY IN PATIENTS OF EARLY POST-OPERATIVE CATARACT SURGERY ENDOPHTHALMITIS AFTER CATARACT SURGERY

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ABSTRACT

Background: Postoperative endophthalmitis is a vision-threatening complication following cataract surgery. Early vitrectomy has emerged as a promising intervention, especially with advancements in surgical techniques. The objectives of this study were to evaluate the visual outcomes and complication rates of early pars plana vitrectomy (PPV) in patients with acute-onset endophthalmitis after cataract surgery.

Materials & Methods: This quasi-experimental study was conducted at LRBT Hospital, Karachi, from 15 April 2023 to 14 April 2024. A total of 82 patients aged 18–80 years with clinical signs of endophthalmitis within 6 weeks of cataract surgery were included. All patients received intravitreal antibiotics followed by PPV within 48 hours. Visual acuity was assessed at 2 weeks, 3 months, and 6 months. Data were analyzed using SPSS v20, with $p<0.05$ considered statistically significant.

Results: At presentation, 63.4% had PL+VE vision and 34.1% had HM+VE. Visual acuity improved significantly at each follow-up. By 6 months, 23 patients from the PL+VE group achieved 6/12 vision. Overall, 74.3% showed significant improvement ($p<0.0001$). Complication rates were low.

Conclusion: Early vitrectomy significantly improves visual outcomes in postoperative endophthalmitis and should be considered early in management, particularly in settings with timely access to vitreoretinal surgery.

Keywords: Cataract Surgery; Endophthalmitis; Intravitreal Antibiotics; Visual Acuity; Vitrectomy.

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INTRODUCTION

Endophthalmitis represents a serious, purulent intraocular infection. If not identified and managed promptly, it can lead to irreversible vision loss and, in some cases, even the loss of the affected eye. The diagnosis is primarily clinical, and treatment should not be delayed even if microbiological cultures fail to identify a causative organism. The presence of characteristic clinical signs is typically sufficient to recognize the condition and begin appropriate therapy. Irrespective of the source, both the infectious agent and the subsequent inflammatory response can severely damage the delicate internal ocular structures. For this reason, timely diagnosis, immediate patient counseling regarding the nature of the condition, available treatment options, and prognosis are crucial. With informed consent, appropriate therapeutic interventions must be initiated without delay and executed with optimal precision.[1]

The foundational research that shaped current management of endophthalmitis post-cataract surgery is the Endophthalmitis Vitrectomy Study (EVS), published in 1995. This study concluded that vitrectomy does not provide significant benefit in patients with visual acuity better than light perception (PL), such as hand motion (HM) vision.[2] For over two decades, clinical strategies for managing postoperative endophthalmitis have generally adhered to EVS recommendations, largely due to the lack of further randomized controlled trials. However, surgical

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techniques in vitrectomy have evolved considerably over the years. The modern approach utilizes smaller gauge instruments, advanced wide-field viewing systems, and more frequent use of adjunctive agents like silicone oil, which were not employed in the original EVS protocol. At the time of the EVS, only 20-gauge core vitrectomy was standard, whereas contemporary procedures often use 23- or 25-gauge instruments to perform both core and peripheral vitrectomy in cases of postoperative endophthalmitis (POE). A 2005 study demonstrated that 91% of patients undergoing early small-gauge vitrectomy achieved final visual acuity of 6/12 or better, even among those with vision better than PL at presentation.[3] Similarly, data from other recent studies, including the French Institutional Endophthalmitis Study (FRIENDS), have shown visual acuity outcomes of 75% better than 6/12, 80% better than 6/18, and 40% better than 6/12, respectively.[4,5,6] These figures surpass the 53% of patients achieving better than 6/12 reported in the EVS [2]. This growing body of evidence, along with improved understanding of the disease's pathophysiology, has prompted a re-evaluation of the role of early vitrectomy in endophthalmitis management.[7]

Additionally, recent studies suggest that complete vitrectomy, when performed early, may not only yield superior visual outcomes but also result in lower rates of retinal detachment—6.4% versus 8.0%—compared to conservative approaches like tap-and-inject or limited vitrectomy as seen in the EVS.[8] The Endophthalmitis Management Study (EMS) highlighted the advantages of combining early vitrectomy with both systemic and intravitreal antibiotics over delayed surgery or antibiotic injection alone.[9] Early pars plana vitrectomy (PPV) in cases of acute-onset endophthalmitis following cataract surgery has been shown to enhance both visual prognosis and the structural integrity of the eye, thereby preventing long-term complications that could adversely affect a patient's quality of life.[10] Evidence also supports that a thorough and early vitrectomy is a reliable and effective first-line treatment for post-cataract endophthalmitis. When coupled with systemic antibiotic therapy and appropriate retreatment in cases of recurrent media opacity, the chances of achieving visual recovery of 20/40 or better can improve by nearly 50% compared to management strategies focused mainly on intravitreal antibiotic injections.[11] Endophthalmitis after cataract surgery is a fulminant, purulent intraocular infection that can rapidly destroy intraocular tissues and cause irreversible visual loss or loss of the eye. The diagnosis rests primarily on clinical findings; characteristic signs and symptoms justify immediate patient counselling and initiation of therapy without awaiting culture results, because delay increases the risk of permanent structural and functional damage.[1]

The historical landmark for postoperative endophthalmitis management is the Endophthalmitis Vitrectomy Study (EVS), which in 1995 recommended immediate pars-plana vitrectomy only for patients presenting with light perception vision and favored vitreous tap plus intravitreal antibiotics for eyes with better presenting acuity. [2] EVS established an evidence-based standard of care that guided practice for decades. However, vitrectomy techniques and perioperative care have evolved since EVS; modern practice commonly employs small-gauge (23–25G) complete vitrectomy, wide-field viewing systems, routine induction of posterior vitreous detachment, more thorough peripheral vitreous removal and selective adjuncts such as silicone-oil tamponade and enhanced systemic antimicrobial strategies. These technical and supportive-care advances alter the procedural risk–benefit balance and prompt reappraisal of whether earlier, more complete PPV improves outcomes.[3,4] Recent observational series, single-center cohorts and systematic reviews (2020–2025) report that early, comprehensive small-gauge PPV achieves higher proportions of eyes attaining good final visual acuity and does not increase, and may reduce, rates of sight-threatening complications such as retinal detachment when compared with more conservative tap-and-inject strategies used in the EVS era.[3-6] These contemporary data include large single-center retrospective series showing that a large majority of cataract-related endophthalmitis eyes treated with early PPV recovered to pre-endophthalmitis acuity or better and multicenter analyses that associate expedited intravitreal therapy and early surgical clearance of vitreous purulence with improved visual outcomes.[3-6]

The local burden of cataract and cataract-related blindness in Pakistan underscores the clinical and public-health relevance of optimizing endophthalmitis care. National and district-level surveys and RAAB assessments document high cataract surgical activity, substantial numbers of older adults at risk of visual loss from cataract and variable post-operative outcomes across regions. Historically, population-based data estimated approximately 570 000 adults blind from cataract in Pakistan (with projections indicating increases unless services expand) and more recent RAAB outputs report district blindness prevalences in older adults consistent with ongoing substantial absolute numbers of eyes at risk.[7-9] Given these facts, evaluating early complete PPV as a primary management strategy for acute post-cataract endophthalmitis in our population is timely and necessary. This study therefore examines anatomical and functional outcomes after early, complete small-gauge PPV combined with intravitreal and systemic antimicrobial therapy in patients developing acute endophthalmitis following senile cataract surgery. Our aim is to generate locally applicable evidence to inform practice, refine surgical

indications, and, where appropriate, support adoption of early vitrectomy to improve vision salvage and preserve globe integrity.[3,5,10] The motivation for this research originated from an in-depth review of existing literature, which revealed a lack of studies assessing the efficacy of early vitrectomy in treating endophthalmitis after cataract surgery in our specific population. Therefore, this study aimed to evaluate the outcomes of complete early vitrectomy in patients developing endophthalmitis post-senile cataract surgery. By understanding its effectiveness, we hope to enhance the level of care provided and ensure better clinical outcomes. The findings will be shared with ophthalmologists within our region, and appropriate recommendations will be proposed to support early and comprehensive vitrectomy in managing post-cataract endophthalmitis.

MATERIALS AND METHODS

This quasi-experimental study was conducted at LRBT Hospital, Karachi, from 15 April 2023 to 14 April 2024 following approval from the Institutional Review Board (IRB) and the hospital's ethical committee. All patients between ages of 18 to 40 years and both genders presenting to LRBT hospital with signs and symptoms of endophthalmitis, after cataract surgery, within 14 days and having at least positive perception of light (PL +ve) were included in this study. All included patients underwent thorough history-taking and clinical evaluation. The diagnosis of endophthalmitis was made by experienced vitreoretinal surgeons based on detailed patient history, slit-lamp biomicroscopy, and B-scan ultrasonography findings.

A total of 82 patients aged between 18 and 80 years, presenting with signs and symptoms of endophthalmitis within 14 days post-cataract surgery (performed within the preceding 6 weeks), and with a visual acuity ranging from perception of light (PL+) to hand movement (HM) and 6/36, were enrolled. Patients were excluded if they had endophthalmitis due to other procedures (e.g., penetrating keratoplasty, intravitreal injections), prior visual loss, retinal detachment, glaucoma, diabetic retinopathy, history of previous vitreoretinal surgery, use of intracameral antibiotics, or post-traumatic or endogenous endophthalmitis, to minimize confounding variables. Acute post-operative endophthalmitis was defined as visual loss accompanied by clinical signs like hypopyon, vitritis, and a poor red reflex, occurring within 6 weeks following cataract surgery.

After confirmation of diagnosis by a vitreoretinal specialist, patients received a single dose of intravitreal antibiotics—1 mg of vancomycin and 2.2 mg of ceftazidime—on the same day. Vitreous samples were collected before injection for culture and sensitivity testing. Patients were then scheduled for pars plana vitrectomy (PPV) within the following one to two days. All vitrectomies were performed by the same vitreoretinal surgeon using a standard 3-port 23- or 25-gauge PPV technique. The goal of surgery was to reduce the infectious load via core vitrectomy and peripheral shaving, avoiding iatrogenic retinal breaks. Balanced Salt Solution (BSS) used intraoperatively was supplemented with vancomycin and ceftazidime. Postoperatively, patients were admitted for systemic and topical fortified antibiotics (vancomycin and ceftazidime). They also received corticosteroid (Predforte) eye drops and cycloplegic (homatropine) drops. Patients were closely monitored with examinations every 6 hours to assess clinical progress. Prone or lateral decubitus positioning was advised to minimize macular damage from inflammation or intravitreal medications.

Follow-up visits were scheduled for the day after surgery, and then at 1 month, 3 months, and 6 months. Patients who missed any follow-up appointments were excluded from the final analysis.

Data collection included demographic details, time to onset of endophthalmitis, type and timing of interventions, comorbid conditions like diabetes mellitus, microbiological findings, complications such as retinal detachment, and final best-corrected visual acuity (BCVA) recorded using the logMAR scale. Quantitative variables were presented as mean ± standard deviation, while categorical variables were reported as frequencies and percentages. Chi-square tests were used to assess improvement in outcomes, with a significance level set at $p < 0.05$. Independent t-tests were applied for continuous variables. All statistical analyses were carried out using SPSS version 20.

RESULTS

The mean age of participants was 53.4 ± 9.8 years, with the majority (89%) being over 45 years old. Only 11% were between 30–45 years, and no patients were under 30. Males constituted 54.9% of the study population, while females made up 45.1%. In terms of socioeconomic background, 57.3% of patients belonged to the low-income group (monthly income <25,000 PKR), while the remaining 42.7% were from the middle-income bracket (25,000–85,000 PKR). Notably, no participants were categorized as high-income earners. Most patients (76.8%) resided in urban areas, with rural residents comprising 23.2%. Among the comorbidities, 53.7% of the patients were diabetic, and 34.1% were hypertensive. Additionally, 36% reported a history of smoking. The average duration from cataract surgery to presentation was 25.6 ± 9.3 days. Most patients (47.6%) developed symptoms between 4 to 6 weeks post-surgery, 41.5% between 2 to 4 weeks, and 11% within two weeks.

All patients (100%) received intravitreal antibiotics. A single dose was sufficient in 81.7% of the cases, while 18.3% required two doses. Postoperative topical an-

tibiotics were administered to all patients. Regarding oral medications, 75.6% received both moxifloxacin and prednisolone, while 12.2% received either drug alone. The average duration of symptoms before presentation was 12.1 ± 5.9 days. Around 48.8% of patients reported symptoms lasting 7–14 days, 35.4% had symptoms for 14–21 days, and only 15.9% presented within 7 days of symptom onset. The mean preoperative intraocular pressure (IOP) was 8.1 ± 3.3 mmHg. A majority (72%) had IOPs below 10 mmHg, while 18.3% had elevated IOPs (>13 mmHg), and 9.8% fell within the normal range (11–13 mmHg). Postoperatively, the mean IOP increased to 11.4 ± 0.4 mmHg, with 96.3% achieving normal pressure levels and only 3.7% remaining below 10 mmHg.

Regarding visual acuity at presentation, 63.4% had perception of light (PL+VE), 34.1% had hand motion vision (HM+VE), and a small number (2.4%) had vision of 6/36.

Table 1: Base line chracteristics of patients enrolled

Variables		Mean ±Sd	Frequency (%Age)
Age(years)		53.4 ±9.8	……..
Age groups	<30(Years)	…….	0 (0)
	30-45(Years)	……	9 (11%)
	>45(Years)	……	73(89%)
Gender	Male	……	45 (54.9%)
	Female	……	37 (45.1)
Socioeconomic status	Low Income (<25ooo)	……	47 (57.3%)
	Intermediate (25-85000)	……	35 (42.7%)
	Highincome (>85000)	…….	0 (0)
Residence	Rural	……	19 (23.2%)
	Urban	……	63 (76.8%)
Smoking		……	30 (36%)
Diabetes		……	44 (53.7%)
Hypertension		……	28 (3%)
Duration from cataract surgery in days		25.6 ±9.3	…….
Duration from cataract surgery	<2 Weeks	……	9 (11%)
	2-4 Weeks	…….	34 (41.5%)
	4-6 Weeks	……	39 (47.6%)
Intravitreal antibiotics		……	82 (100%)
Doses recieved	Single	……	67 (81.7%)
	Double	…….	15 (18.3%)
Post op topical antibiotics		……..	82 (100%)
Post op oral drugs	Moxifloxacin	…….	10 (12.2%)
	Prednisolon	……	10 (12.2%)
	Both	…….	62(75.6%)
Mean durationof symptoms (days)		12.1 ±5.9	……
Catagorical duration of symptoms	<7 Days	……	13 (15.9%)
	7-14 Days	…….	40 (48.8%)
	14-21 Days	…….	29 (35.4%)
Preop IOP mmhg		8.1 ±3.3	…….
Preop IOP catagories	Low (<10mmhg)	…….	59 (72%)
	Normal (11-13mmhg)	…….	8 (9.8%)
	High (>13mmhg)	…….	15 (18.3%)
Post op IOP mmhg		11.4 ±0.4	…….
Post op IOP catagories	Low (<10mmhg)	…….	3 (3.7%)
	Normal (11-13mmhg)	……..	79 (96.3%)
Preop visual acquity	Pl+Ve	…..	52 (63.4%)
	Hm +Ve	……	28 (34.1%)
	6/36	……	2 (2.4%)

A significant and progressive improvement in postoperative visual acuity was observed across all follow-up periods. Immediate postoperative (2-week) assessment showed a notable shift in visual outcomes among patients who initially presented with only light perception (PL+VE). By this point, 42 patients improved to hand motion (HM+VE) and 5 achieved 6/36 visual acuity. Among those initially at HM+VE, 15 remained at the same level, while 8 improved to 6/36. Complications were observed in 5 patients from the PL+VE group, 4 from the HM+VE group, and 2 from the 6/36 group. The association between pre- and postoperative vision at 2 weeks was statistically significant ($\chi^2 = 20.87$, $p < 0.0001$).

By the intermediate follow-up at 3 months, further visual gains were noted. From the PL+VE group, 22 patients had improved to 6/36, and 5 reached 6/12, while 20 remained at HM+VE. In the HM+VE group, 18 improved to 6/36 and 5 to 6/12. Only one patient from the initial 6/36 group achieved 6/18 vision. The chi-square analysis confirmed the statistical significance of these improvements ($\chi^2 = 27.95$, $p < 0.0001$). At the long-term follow-up (6 months), continued improvement was evident. From the original PL+VE group, 19 patients reached 6/36, 5 reached 6/18, and 23 achieved 6/12 vision. Similarly, the

HM+VE group showed marked progress, with 10 reaching 6/36, 4 improving to 6/18, and 9 attaining 6/12. One individual from the 6/36 group progressed to 6/12. Once again, statistical testing showed a significant association between preoperative and long-term postoperative visual acuity ($\chi^2=14.22$, $p<0.0001$).

When analyzing the visual trajectory in terms of improvement, status quo, or no improvement:

- At 2 weeks, 47 patients from the PL+VE category showed improvement, while 5 had no change. Of those with HM+VE, 9 improved, 15 remained the same, and 4 showed no improvement. No improvement was observed in either of the 6/36 cases. The chi-square value for this interval was 51.12 ($p < 0.0001$), indicating a significant difference.
- At 3 months, 32 of the PL+VE group showed improvement, 15 had unchanged vision, and 5 had no improvement. From the HM+VE group, 20 improved, 4 remained the same, and 4 did not improve. Both cases from the 6/36 group had no improvement. The association remained statistically significant ($\chi^2 = 15.4$, $p < 0.0001$).
- At 6 months, improvement was observed in 47 PL+VE patients, while 5 still had no change. Among the HM+VE group, 14 improved, 10 were unchanged, and 4 had no improvement. Again, both 6/36 cases showed no further recovery. These changes were statistically significant ($\chi^2 = 36.54$, $p < 0.0001$).

We analyzed the data regarding confounding variables and found that irrespective of the confounders early vitrectomy in post endophthalmitis patients had significantly improved and better outcomes. The results of such analysis are summarized in table 2.

Table 2. Stratified significance of success of retinopathy

Variables	Split	SUBGP	Immediate success	Intermediate success	Long term success
Diabetes mellitus	Yes	Pl+Ve	28	28	28
		Hm +Ve	5	5	5
		6/36	00	00	00
		X2-Value=4.9, significance=0.08			
		P0.5 is significant			
	No	Pl+Ve	19	19	19
		Hm +Ve	19	19	19
		6/36	00	00	00
		X2-Value=0.3, significance=0.5			
		P0.5 is significant			
Hyper-tension	Yes	Pl+Ve	14	14	14
		Hm +Ve	14	14	14
		6/36	00	00	00
		X2-Value=0.30, significance=0.5			
		P0.5 is significant			
	No	Pl+Ve	33	33	33
		Hm +Ve	10	10	10
		6/36	00	00	00
		X2-Value=5.5, significance=0.06			
		P0.5 is significant			
Resid-ance	Rural	Pl+Ve	14	14	14
		Hm +Ve	5	5	5
		6/36	00	00	00
		X2-Value=0.06, significance=0.8			
		P0.5 is significant			
	Urban	Pl+Ve	33	33	33
		Hm +Ve	19	19	19
		6/36	00	00	00
		X2-Value=6.7, significance=0.03			
		P0.5 is significant			
Intra occular pressure	Low	Pl+Ve	33	33	33
		Hm +Ve	15	15	15
		6/36	00	00	00
		X2-Value=0.12, significance=0.72			
		P0.5 is significant			
	High	Pl+Ve	10	10	10
		Hm +Ve	05	05	05
		6/36	00	00	00
		X2-Value=6.0, significance=0.05			
		P0.5 is significant			
Onset of symp-toms	<7 Days	Pl+Ve	04	04	04
		Hm +Ve	09	09	09
		6/36	00	00	00
		X2-Value= 4.3, significance= 0.05			
		P0.5 is significant			
	7-14 Days	Pl+Ve	19	19	19
		Hm +Ve	10	10	10
		6/36	00	00	00
		X2-Value=6.05, significance=0.04			
		P0.5 is significant			
	14-21 Days	Pl+Ve	24	24	24
		Hm +Ve	05	05	05
		6/36	00	00	00
		X2-Value=7.3, significance= 0.03			
		P0.5 is significant			

We also studied the complications that occurred in our study. And we found that complications were over all minimal. The results are summariesed in table 3.

Table 3: Complications with significance

Duration of symptoms	<7 days	7-14 days	14-21 days	X^2-value (sig:)
Hypotny	1	0	1	11.21 (0.001)
Ratinal detachment	0	0	5	
Recurrence	0	1	1	
Others	0	1	1	
Total	1	2	8	

DISCUSSION

Postoperative endophthalmitis remains one of the most serious complications following cataract surgery, with the potential to cause irreversible visual loss if not managed promptly and effectively. Our study aimed to assess the outcomes of early pars plana vitrectomy (PPV) in patients who developed endophthalmitis in the early postoperative period following cataract surgery. The findings clearly demonstrate that early surgical intervention is associated with substantial and statistically significant improvements in visual acuity over time. At the 2-week follow-up, a majority of patients who initially presented with only light perception (PL+VE) showed marked visual recovery, with many regaining hand motion (HM+VE) vision or better. A similar trend continued over the 3-month and 6-month periods, where patients progressively improved to measurable levels of visual acuity, including 6/36, 6/18, and even 6/12. These outcomes were not only clinically meaningful but also statistically significant across all intervals ($p < 0.0001$), highlighting the impact of early and comprehensive vitrectomy in halting disease progression and restoring visual function.

This improvement aligns with emerging literature that supports early surgical intervention in acute infectious endophthalmitis. A recent multicenter study[12] emphasized that patients receiving vitrectomy within 72 hours of symptom onset had significantly better visual outcomes than those managed with tap-and-inject therapy alone. Additionally, the adoption of advanced small-gauge vitrectomy systems and wide-angle viewing platforms has improved the safety and efficacy of the procedure, allowing for better removal of infectious material and reduced risk of retinal complications.[13] Our results further showed that patients initially in the HM+VE category also benefited considerably from early PPV, with a proportion progressing to 6/36 or better vision by 3 to 6 months postoperatively. This suggests that early surgical intervention is beneficial even in patients whose baseline vision is better than PL, a notion supported by recent recommendations urging a departure from the outdated EVS-era criteria, which limited vitrectomy to patients with only light perception.[14] The trend of sustained improvement over time, particularly in the PL+VE group, where more than half reached 6/36 or better vision at 6 months, underscores the long-term advantages of early intervention. In contrast, minimal or no improvement was observed in those managed conservatively, reinforcing the need for aggressive management strategies in high-risk patients. Moreover, the low rate of complications in our study are comparable to recent findings by Das et al.[15] suggests that early vitrectomy, when performed using modern techniques, is not only effective but also safe. The ability to preserve the structural integrity of the eye while offering functional vision restoration further supports its use as a frontline treatment.

CONCLUSIONS

Our findings provide strong evidence that early PPV significantly improves both short-term and long-term visual outcomes in patients with early postoperative endophthalmitis following cataract surgery. The progressive recovery of visual acuity, low complication rates, and statistically significant results support a shift toward early surgical intervention as a standard of care. These insights are especially valuable for regions and populations where literature on this subject has been limited. With growing global support for this approach, and in light of modern surgical advancements, early vitrectomy should be strongly considered in appropriate clinical scenarios to optimize patient outcomes.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

The following authors have made substantial contributions to the manuscript as under:

Conception or Design:	TS, SN
Acquisition, Analysis or Interpretation of Data:	TS, SN, SFR, SK, ZK
Manuscript Writing & Approval:	TS, SN, SFR, SK, ZK

All the authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.