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Clinical Outcomes and Management Strategies in Endophthalmitis: A Case Series

Genadi Kostadinov[1], Vasil Haykin[1,2], Yani Zdravkov[1,2]
[1]*Clinic of Ophthalmology, University Hospital "Alexandrovska", Sofia, Bulgaria*
[2]*Department of Ophthalmology, Faculty of Medicine, Medical University of Sofia, Sofia, Bulgaria*
Corresponding Author: genadi.kostadinov@gmail.com

ABSTRACT: *Endophthalmitis is an intraocular infection due to bacteria or fungi involving the vitreous and/or aqueous. The purpose of this study is to analyse and summarize the outcomes of recent endophthalmitis cases, reviewing and assessing the different management strategies.*
Methods: *A total of 10 cases of endophthalmitis were identified between January 2024 and December 2025 in a tertiary vitreoretinal clinic and were reviewed retrospectively for patient age, sex, aetiology, initial and final visual acuity (VA), management, culture results, complications and secondary interventions. Aqueous humor and vitreous humor were cultured for bacteria and fungi in all of the patients.*
Results: *Of the 10 patients, female to male ratio was 4:6. Mean age was 59.5 (range between 2 and 88). In all the patients the VA on admission was worse than 1.0 logMAR (range between 2.70 and 1.00 logMAR). All the cases are exogenous – 7 after cataract surgery, 1 following filtering bleb surgery, 1 following intravitreal injection and 1 developed after trauma. Every single patient received systemic antibiotic treatment. Drugs of choice were Vancomycin, Moxifloxacin and Ceftriaxone. 70% of the patients had negative culture results. The isolates from the positive culture results were E. faecalis, S. haemolyticus, O. anthropi. Regardless of the culture result, the patients received intravitreal antibiotic injections in addition to the systemic treatment. All of the patients underwent vitrectomy on their initial admission. 360° endolaser photocoagulation was performed and silicone oil tamponade was applied, followed by evacuation after 3-4 months. VA after treatment reached up to 0.15 logMAR (in 2 patients). The most common complication was secondary glaucoma (observed in 2 of the patients). There were no cases of retinal detachment observed in the reviewed group.*
Conclusions: *Cataract surgery is the most frequent cause of exogenous endophthalmitis. All the patients required vitrectomy at some point in their treatment. Early vitrectomy with silicone tamponade has been associated with decreased incidence of retinal detachment after treatment. Prompt diagnosis and adequate treatment are important to prevent complications and avoid visual loss.*
KEYWORDS: *Endophthalmitis, Pars plana vitrectomy, Intravitreal antibiotics, Silicone oil tamponade, Visual acuity, Case series.*

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I. INTRODUCTION

Endophthalmitis is an intraocular infection due to bacteria or fungi involving the vitreous and/or aqueous [1]. Endophthalmitis may be either exogenous or endogenous. Endophthalmitis can be classified as follows: 1) postoperative endophthalmitis, including endophthalmitis following cataract surgery (either acute or delayed), following glaucoma surgery – filtering bleb-associated endophthalmitis or associated with glaucoma drainage devices, following elective corneal transplant, 2) posttraumatic endophthalmitis, 3) endogenous endophthalmitis, 4) endophthalmitis associated with keratitis, 5) endophthalmitis associated with intravitreal injection [2]. The relative frequency of the different subtypes of endophthalmitis varies wildly in different studies and populations.

At present, there is no publicly accessible national registry for the incidence of endophthalmitis in Bulgaria, nor nationwide incidence data is being published by the public health authorities. The available information is scarce and limited to institutional reports. According to earlier data from large ophthalmology clinics the incidence of endophthalmitis following ophthalmological procedures is ranging from 0.04% to 0.26% [3]. However, these results date from the late 1900s and early 2000s and due to the significant limitations, the precise incidence of endophthalmitis in recent years cannot be determined.

Bacterial pathogens are the predominant etiological agents recovered from all types of endophthalmitis. Among the bacteria, 94.2% of the isolates were Gram-positive [4], with high predominance of coagulase-negative staphylococci (70%), followed by *Staphylococcus aureus* (9.9%) and *Streptococcus species* (9%) [5].

Endogenous bacterial endophthalmitis is most often caused by *Staphylococcus aureus*, streptococcal species, and gram-negative bacteria such as *Klebsiella pneumoniae* [6].

Recognised preoperative risk factors for developing acute postoperative endophthalmitis in cataract patients include blepharitis, diabetes mellitus and older age. Among the perioperative risk factors are intraoperative complications and preoperative steroid use. The main postoperative risk factor for acute endophthalmitis is wound leak on the first postoperative day [7,8].

The clinical course of endophthalmitis is associated with the presence of inflammatory cytokines in the vitreal cavity, including tumour necrosis factor-α, interleukin-1β, and interferon-γ [9]. This results in neutrophil aggregation leading to suppurative or nonsuppurative inflammation and a variable degree of tissue necrosis [10].

Reduction in vision and pain account for 92.9% and 79% of all symptoms of endophthalmitis [11]. The other common presenting features are swollen eyelid, redness of the eye, circumcorneal congestion, photophobia, ocular discharge, fibrinous membranes in the anterior chamber, iris synechiae formation, loss of fundal red reflex, and floaters. Bleb-related endophthalmitis initially presents as bacterial conjunctivitis with signs and symptoms such as conjunctival hyperaemia and discharge, yellowish coloured filtering bleb, and variable anterior chamber inflammatory reaction, which later progresses to involve the posterior chamber as well [12].

Acute endophthalmitis is defined as inflammation occurring within 6 weeks of surgery. It typically develops 3–10 days postoperatively and runs a fulminant course. Chronic endophthalmitis on the other hand may develop weeks or months after surgery. The clinical manifestations may include chronic iridocyclitis or granulomatous uveitis and is often associated with decreased vision, little or no pain, and a nidus of the infectious agent within the eye [13]. Acute-onset postoperative endophthalmitis is a clinical diagnosis, followed by laboratory confirmation. Gram stain and culture are central to determining the ultimate diagnosis and are a critical step in the management. However, negative culture does not necessarily rule out infection and treatment should be continued [14]. Vitreous specimens provide more accurate and reliable culture results than do aqueous cultures [15].

Treatment of acute postoperative endophthalmitis remains a challenging task. The classic treatment strategy is largely based on the findings of Endophthalmitis Vitrectomy Study (EVS) conducted in 1995, where a comparison of the efficacy was made between vitrectomy and intravitreal antibiotic injections to intravitreal antibiotic injections alone for acute post-cataract surgery. However, the modern clinical practise has evolved considerably and the achieved advancements have changed the current treatment patterns compared to the recommendations set by the EVS [4]. Recent studies have proposed that early and complete vitrectomy could potentially be an effective approach for managing endophthalmitis cases, irrespective of the initial visual acuity [16]. And in 2013 the European Society of Cataract and Refractive Surgeons (ESCRS) concluded complete vitrectomy to be the new gold standard procedure for managing postoperative endophthalmitis [17].

II. METHODS

In this retrospective case series ten patients diagnosed with endophthalmitis and treated in tertiary vitreoretinal clinic between January 2024 and December 2025 were included. The inclusion criteria consisted of a clinical diagnosis, based on characteristic signs and symptoms – reduced visual acuity, pain, injection, photophobia, ocular discharge, fibrinous membranes in the anterior chamber, iris synechiae formation, loss of fundal red reflex, and floaters. The medical records were reviewed and the data collected included age, sex, affected eye, etiology, clinical manifestation, visual acuity on presentation, microbiological culture results, treatment modality, final visual acuity at the last follow-up visit and treatment-associated complications.

All patients underwent a complete ophthalmological examination at presentation that included best-corrected visual acuity, tonometry, biomicroscopy and indirect ophthalmoscopy. In cases of poor fundus visualisation, B-scan ultrasonography was performed to assess the condition. Microbiological evaluation was performed on obtained aqueous and vitreous samples.

The treatment plan included a combination of systemic antimicrobial therapy, intravitreal administration of broad-spectrum antibiotics on presentation, pars plana vitrectomy three days after intravitreal treatment. The primary outcome measure was final BCVA at the last follow-up visit.

The statistical analyses were performed on Jamovi software [18]. Continuous variables were summarized as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages.

III. RESULTS

A total of 10 patients with endophthalmitis were included in the study, of which 6 were males (60%) and 4 were females (40%). Mean age was 59.5 years, ranging from 2 to 88 years-of-age. The youngest patient was a 2-year-old child who developed postoperative endophthalmitis following cataract surgery.

Table No. 1: Demographic data, visual acuity and culture results of the cohort

#	Age [years]	Sex	Etiology	Initial VA [logMAR]	Final VA [logMAR]	Culture results
1	49	Female	Filtering bleb-associated	2.70	0.40	*Enterococcus faecalis*
2	67	Male	Cataract surgery	2.30	0.15	*Staphylococcus haemolyticus*
3	45	Male	Cataract surgery	2.30	0.40	Negative
4	2	Male	Cataract surgery	Unstable eccentric fixation	Stable fixation	Negative
5	76	Female	Cataract surgery	2.70	1.70	Negative
6	83	Female	Cataract surgery	2.30	1.00	*Ochrobactrumanthropi*
7	61	Male	Intravitreal injection	2.70	0.70	Negative
8	88	Female	Cataract surgery	1.30	1.00	Negative
9	85	Male	Cataract surgery	2.30	0.15	Negative
10	39	Male	Trauma	1.00	0.40	Negative

The predominant etiological factor for developing postoperative endophthalmitis was cataract surgery. From the cohort, 7 of the cases (70%) had endophthalmitis after phacoemulsification, while 1 patient (10%) developed endophthalmitis after intravitreal injection, 1 patient (10%) had filtering bleb-associated endophthalmitis. The last patient developed endophthalmitis after trauma.

Samples from aqueous humor and vitreous humor were obtained from all patients. Microbiological cultures were positive in 30%, while for the remaining 7 cases (70%), no causative pathogen was identified, demonstrating that microbiological confirmation cannot be achieved in all patients. The isolated microorganisms were *Enterococcus faecalis*, *Staphylococcus haemolyticus* and *Ochrobactrumanthropi*.

A significant variation of visual acuity at presentation was documented. Seven patients (70%) presented with severely impaired vision – less than 1.30 LogMAR. Two patients presented with visual acuity respectively 1.30 and 1.00 LogMAR. The documented visual function of the pediatric patient was unstable eccentric fixation on admission.

All patients received systemic antimicrobial therapy, as the antibiotics of choice were Vancomycin, Moxifloxacin and Ceftriaxone. In addition, Vancomycin was administered intravitreally on the first day of admission. The number of intravitreal injections ranged from one to three in correlation with the referral timing, as patients with delayed transfer required repeated intravitreal treatment. Seven patients (70%) required a single intravitreal injection, 2 patients received two injections, and one patient (10%) – three injections.

All patients subsequently underwent pars plana vitrectomy with silicone oil tamponade. A 360-degree endolaser was performed in every patient as a prophylaxis against subsequent retinal detachment. The tamponade was evacuated in 3 to 4 months after initial vitrectomy. The surgical management was uniform throughout the cohort.

Follow-up duration ranged from 8 months to 2 years. Six patients (60%) were followed for more than a year, as the remaining four patients had follow-up periods ranging from 8 to 11 months. This relatively long observation period allowed assessment of both visual outcomes and postoperative complications.

Table No. 2: Descriptive statistics of initial and final visual acuity

	Initial VA [logMAR]	Final VA [logMAR]
N	9	9
Missing	1	1
Mean	2.18	0.656
Median	2.30	0.400
Standard deviation	0.616	0.505
Minimum	1.00	0.150
Maximum	2.70	1.70

Final visual outcomes were generally favourable. Recorded visual acuity at presentation was 2.18 ± 0.62 logMAR with median of 2.3 logMAR. The visual acuity of the pediatric patient is excluded as it cannot be reliably converted to logMAR. From the last follow-up of the patients in the cohort the mean best corrected visual acuity (BCVA) has improved to 0.66 ± 0.50 logMAR, with a median of 0.4 logMAR. In accordance with Wilcoxon signed-rank test there is statistically significant improvement between initial and final BCVA following treatment ($p < 0.01$). Two patient reached final visual acuity of 0.15 logMAR, and three patients (30%) achieved visual acuity of 0.4 logMAR. The remaining 4 patients had final BCVA less than 0.4 logMAR.

Table No. 3: Wilcoxon signed-rank test comparing initial and final visual acuity

			Statistic	p	Mean difference	SE difference
Initial VA	Final VA	Wilcoxon W	45.0	0.009	1.57	0.248
Note. H_a μ *Measure 1 − Measure 2 ≠ 0*						

Complications were relatively uncommon in the observation window. The most common complication recorded following treatment was secondary glaucoma refractory to topical treatment. It has developed in two patients (20%). No other postoperative complications were recorded in the remaining 80% of the cohort – there were no cases of retinal detachment or reoccurrence of the infection. Anatomical preservation of the globe was achieved in all patients – no evisceration or enucleation was recorded in the follow-up period.

IV. DISCUSSION

Endophthalmitis remains one of the most visual impairing complications in ophthalmology. The present case series demonstrates favourable anatomical and visual outcomes following a treatment algorithm of prompt diagnosis, systemic and intravitreal antimicrobial therapy, early pars plana vitrectomy, circumferential 360-degree endolaser photocoagulation and silicone oil tamponade. There was a statistically significant improvement in visual acuity of the patients ($p = 0.009$) following treatment. In our experience patients with exogenous acute endophthalmitis may achieve increased visual benefit when surgery is performed within 7-14 days after the first signs of the infection.

In the 1990s the endophthalmitis vitrectomy study (EVS) conducted a significant large-scale prospective randomized controlled trial [4]. Its purpose was: to investigate the role of initial pars plana vitrectomy (three-port 20 g PPV) in the management of postoperative bacterial endophthalmitis; determine the role of intravenous antibiotics in management; and determine which factors, other than treatment, could predict outcomes in postoperative bacterial endophthalmitis. Results for visual acuity and media clarity at 9 months for vitrectomy were that patients presenting with hand motion acuity or better showed no benefit from immediate vitrectomy. However, patients presenting with light-perception-only VA had substantial benefit from immediate vitrectomy. In addition, there was no statistical difference in final visual acuity or media clarity between patients who received systemic antibiotics or not.

Up until recently, recommendations set by the EVS were regarded as the main treatment approach in patients with postoperative endophthalmitis. With advancements in surgical techniques and clinical approaches, some experts argue that there is a more significant reduction of bacterial load and better clearance of toxins and inflammatory debris compared to what was achieved in the EVS [4]. Recent studies also suggest that early and complete vitrectomy could be a highly effective primary approach for managing acute post-cataract surgery endophthalmitis [20]. Progressive microbial proliferation within the vitreous cavity leads to the release of toxins, inflammatory mediators, and cellular debris, resulting in irreversible retinal damage. This makes prompt treatment essential. In a recent clinical trial led by Najafabadi et al., they treated 27 patients with post-cataract surgery endophthalmitis using early and complete vitrectomy, regardless of their initial visual acuity. The study showed promising results, particularly for those who presented within the first 15 days after cataract surgery [21]. The recorded favourable outcomes in the present study also support early vitrectomy to be a treatment modality for better anatomical and visual prognosis.

All the patients in the cohort received antimicrobials intravitreally. The drug of choice was Vancomycin 1 mg/0.1 mL, which has a coverage against Gram-positive microorganisms, representing the most common causative pathogens in exogenous endophthalmitis [22]. The intravitreal route of drug administration helps in achieving high concentrations of the drug in the vitreous cavity without associated systemic side effects. However, it is crucial to dose the drug properly in order to ensure adequate concentration and at the same time avoiding retinal toxicity. EVS study utilized intravitreal vancomycin (1 mg/0.1 ml) and amikacin (0.4 mg/0.1 ml) [4]. However, due to the higher retinotoxic potential of amikacin, it has been replaced by ceftazidime (2.25 mg/0.1 ml) [17].

In addition to the intravitreal antibiotic administration the patients received systemic antimicrobial treatment. Adjunctive systemic antibiotic therapy for treatment of bacterial endophthalmitis is controversial but common practice due to the severity of the disease. The biggest clinical trial that evaluates the role of systemic antibiotics for the treatment of endophthalmitis is the Endophthalmitis Vitrectomy Study, where no significant difference in visual acuity was recorded in patients receiving systemic antibiotic therapy in comparison to the patient receiving only intravitreal treatment [4]. Since then, only small studies have evaluated the efficacy of systemic antibiotic therapy in endophthalmitis with varying methodologies and results [23]. Although Vancomycin doesn't show any accumulation in phakic (including inflamed) eyes in a rabbit study, it's empiric use is due to nearly complete coverage of the Gram-positive organisms causing endophthalmitis [22]. Ceftriaxone can be detected in human phakic non-inflamed eyes after multiple dosing at levels well above streptococci and Enterobacteriaceae breakpoints [24]. As for fluoroquinolones, despite relatively good vitreous

to serum ratios, only Moxifloxacin demonstrated concentrations above breakpoints of relevant microorganisms [25].

Notably, in all patients during surgery was used silicone oil as tamponade. In addition to its established role in retinal stabilization, silicone oil decreases the proliferation of bacteria due to promotion of bacterial toxicity [26]. Silicone oil also has a high interfacial tension that creates a barrier for inflammatory cells and infectious agents. Moreover, it can enhance the effectiveness of the defence mechanisms by high concentrations of biochemical mediators, antibodies, and inflammatory cells within the aqueous compartment [27, 28].

Retinal detachment is the most common complication associated with the removal of silicone oil after vitrectomy. Hence, timing of silicone oil evacuation is controversial. However, extended silicone oil retention has been associated with secondary glaucoma, keratopathy, cataract, and emulsification. In our clinic the evacuation of the tamponade is done 3-4 months after initial vitrectomy. In this period retinal stability is usually achieved and the risk of recurrent infection is minimal, while the incidence of silicone oil-related complication is low. In addition, as a prophylaxis measurement a 360-degree endolaser is performed during the initial vitrectomy as it reduces the risk of developing retinal detachment[29]. In the time before evacuation of the silicone tamponade we observe maturation of the laser-induced chorioretinal adhesions. Evidently, there are no recorded cases of retinal detachment after endophthalmitis treatment in the observed cohort during the follow-up period.

Overall, the combination of prompt diagnosis, systemic and intravireal antimicrobial therapy followed soon after by pars plana vitrectomy with prophylactic 360-degree endolaser and silicone tamponade resulted in favourable anatomical outcome and visual improvement.

V. CONCLUSIONS

Postoperative endophthalmitis remains a serious complication, with cataract surgery identified as its most common etiology. In this study, all patients ultimately underwent vitrectomy, reinforcing its pivotal role in managing intraocular infections. Prompt surgical intervention, alongside systemic and intravitreal antibiotic therapy, is critical in preventing irreversible ocular damage and maximizing treatment outcomes. Given the evolving landscape of ophthalmic care, early vitrectomy should be considered a key strategy in optimizing visual prognosis in severe cases of endophthalmitis.

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