Evaluating the acute infective endophthalmitis treatment with immediate pars plana vitrectomy in culture-positive eyes and culture-negative eyes

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ABSTRACT

Purpose: To evaluate the endophthalmitis in culture-positive eyes and culture-negative eyes treated with immediate pars plana vitrectomy (PPV) within 24 hours of application to the hospital.

Method: In this retrospective study, we reviewed the medical records of all cases of endophthalmitis occurring in patients from 2016 to 2022. A detailed medical and ocular history, age, gender, documentation of medications, days to the presentation of symptoms, best corrected visual acuity (BCVA), anterior and posterior segment examinations, intraocular pressure (IOP), humor aqueous, and vitreous culture results, and length of follow-up were collected from the patient's charts. We analyzed the differences between culture-positive eyes and culture-negative eyes.

Results: 18 cases of acute endophthalmitis were identified. Post-intravitreal injection endophthalmitis was the most common type with a rate of 50%. Culture positivity was detected in 10 (55.5%) patient samples. Signs and symptoms such as pain, lid swelling, redness, hypopyon, anterior chamber fibrin reaction, and vitreous haze were more in the culture-positive group, but there was no significant difference between the two groups ($p>0.05$). The increase in BCVA in the culture-negative group was significantly higher than in the culture-positive group ($p=0.025$). Postoperative complications were distinctly more in culture-positive patients.

Conclusion: Culture positivity affects negatively both visual and anatomical results after immediate PPV in patients with endophthalmitis. Eyes with low BCVA are more likely to be culture positive.

Keywords: Endophthalmitis, pars plana vitrectomy**,** culture-positivity

INTRODUCTION

Endophthalmitis is a purulent inflammation of the aqueous, vitreous, and other ocular tissues due to infection.[1] It is a severe complication of intravitreal injection, intraocular surgery [cataract, pars plana vitrectomy (PPV), cornea, and glaucoma surgery], filtering bleb, corneal ulcer, penetrating trauma, and endogenous infections.[2] Endophthalmitis may lead to irreversible blindness in the infected eye even with prompt and appropriate diagnosis and treatment.[3]

Intravitreal treatment with anti-vascular endothelial growth factors (anti-VEFG) agents is the first-line treatment for the most common retinal diseases such as age-related macular degeneration (AMD), diabetic macular edema (DME), and macular edema secondary to retinal vein occlusion.[4] However, the most feared side effect is endophthalmitis. Endophthalmitis incidence after intravitreal injections was about 0 to 0.092%.[5] The category of post-injection endophthalmitis among all endophthalmitis is rising and in Simunovic et al.[6] study this was 52%.

Postoperative infectious endophthalmitis may occur after all intraocular surgeries and is the most frequent category (54%) among all endophthalmitis.[7] The incidence of endophthalmitis after cataract surgery was 0.04% and after PPV was 0.04%.[8] Posttraumatic endophthalmitis may occur following globe rupture, perforation, or penetration. The incidence of endophthalmitis following globe injury ranges from 0 to 16.5%.[9]

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Keratitis-related endophthalmitis occurs when microbial agents pass through the cornea and spread into the eye. The rate of keratitis-related endophthalmitis has been reported to be approximately 0.5%.[10] Endogenous endophthalmitis can occur with the hematogenous spread to the eye from the primary source of bacterial, fungal, viral, and parasitic infection.[11]

One of the two most important methods used in the treatment of endophthalmitis is vitreous tap and intravitreal antibiotic injection and the other is immediate PPV.[12] Advances in surgical instruments and equipment have provided more successful results and safety in PPV surgery.[13]

However, there are not enough studies in the literature evaluating the patients with endophthalmitis with culture results who underwent immediate PPV in the first 24 hours of application to the hospital. Therefore, this study evaluated the endophthalmitis cases treated with immediate PPV within 24 hours of presentation in the last 6 years in our clinic with characteristics, prognostic risk factors, culture results, and visual and anatomic outcomes.

MATERIALS AND METHODS

The protocol of the present study conformed to the Declaration of Helsinki. The institutional review board (IRB) approval number was B.10.1.TKH.4.34.H.GP.0.01 (31.03.2022).

Data collection

In this retrospective study, we reviewed the medical records of all cases of endophthalmitis occurring from 2016 to 2022. A detailed medical and ocular history, age, gender, documentation of medications, days to the presentation of symptoms, BCVA, anterior and posterior segment examinations, intraocular pressure (IOP), humor aqueous, and vitreous culture results, and length of follow-up were collected from the patient's charts. We analyzed the differences between culture-positive eyes and culture-negative eyes.

Diagnosis of endophthalmitis was based on the presence of symptoms such as pain, blurred vision, red eye, swollen lid, and the presence of signs such as hypopyon, fibrin reaction, vitreous and anterior chamber cells, or hazy media. All of these symptoms and signs were noted.

Inclusion criteria

1- Patients with acute endophthalmitis diagnosis including, post-injection, post-surgery (PPV, cataract, cornea, glaucoma), post-traumatic, endogenous, filtering bleb-associated, keratitis-related,

2- The mean time of presentation of symptoms ≤ 10 days,

3- Patients who underwent immediate PPV within 24 hours of application to the hospital.

Exclusion criteria

Patients with

1- Chronic postoperative and chronic endogenous endophthalmitis (> 6 weeks),

2- Non- infectious endophthalmitis,

3- Inadequate data.

Endophthalmitis Treatment

All surgeries were performed by the same surgeon (U.L.) under general anesthesia in the operating room. All cases were treated with pars plana vitrectomy (PPV) and intravitreal antibiotics. Combined phacoemulsification was done in patients with cataracts for the best visualization. In these patients' posterior chamber, one-piece acrylic hydrophobic mono-focal intraocular lens implantation was done after PPV before fluid air exchange.

We used an Eckardt 7mm temporary keratoprosthesis in keratitis-associated endophthalmitis. In these patients, the keratoplasty procedure was completed by a corneal disease specialist (B.I.S.A.) before fluid air exchange.

We took an aqueous and/or vitreous specimen without infusion in all cases before PPV, phacoemulsification, and other surgical procedures. The hypopyon and fibrin in the anterior chamber were cleared. In patients with corneal epithelial edema, the corneal epithelium was scraped. A standard transconjunctival three-port 23-gauge PPV was done with a Constellation Vision System (Alcon Laboratories, Inc. Fort Worth, Texas, USA). Infusion is then initiated and core vitrectomy is performed. Intravitreal triamcinolone (40 mg/mL, Kenacort-A, DEVA) was used to visualize and remove the adherent posterior hyaloid.

All infectious and inflammatory debris in the vitreous and retinal surfaces were removed. The tractional bands and membranes formed on the retinal surface were cleaned. A complete peripheral vitrectomy was performed in all patients. Multiple air-fluid exchanges were done to clear all of the debris in the vitreous cavity. After the air-fluid change, 1,000 cSt silicone oil tamponade was used in all cases except the keratitis-related endophthalmitis. In keratitis-related endophthalmitis, we did not use silicone

oil tamponade to prevent possible corneal graft rejection with silicone oil tamponade. The cannulas were removed after checking the peripheral retina, and sclerotomy sites were sutured with Vicryl 7.0.

At the end of the surgery, 1:4 diluted vancomycin (0.25 mg/0.1 ml) and ceftazidime (0.50 mg/0.1 ml) were given into the silicone oil. In 2 patients for whom we did not use silicone tamponade, vancomycin (1 mg/0.1 ml dose) and ceftazidime (2.25 mg/0.1 ml dose) were intravitreally administered. When we suspected fungal endophthalmitis, intravitreal amphotericin B 5-10 µg/0.1 ml was administered in addition to intravitreal antibiotics.

Silicone endo tamponade was removed from all eyes after 3 or 4 months.

Aqueous humor and/or vitreous specimens

23 gauge vitrectomy probe attached to a syringe is inserted into the vitreous cavity through the sclerotomy and approximately 0,3cc vitreous is removed from the anterior vitreous cavity by using the automated cutting mechanism of the probe and slow, manual aspiration without infusion. Then a 30G needle is inserted near the limbus into the anterior chamber above the peripheral iris and 0.1cc of humor aqueous is withdrawn.

We immediately did the culture inoculation within minutes of obtaining specimens to maximize the recovery of organisms. We inoculated the specimens to the blood and chocolate agar for bacteria culture and Sabouraund dextrose agar for fungus culture. The remaining specimens were sent to microbiology for microscopy, Gram staining, and antibiotic sensitivity testing.

All cases received intravenous antibiotics (vancomycin, ceftazidime, and/or amphotericin, and/or fluconazole). We used an antibiotic regime that varied depending on age, organism identified, and sensitivities. Topical antibacterial treatment was given to all cases.

Primary and secondary outcome measures

Primary outcomes were visual and anatomical differences in culture-positive eyes and culture-negative eyes from baseline over the follow-up period.

Statistical methods

Statistical Package for the Social Sciences (SPSS) 24.0 program was used for statistical analysis. While evaluating the study data, Independent Sample T was used for two-group comparisons of normally distributed parameters as well as descriptive statistical methods (Mean, Standard Deviation, Median, Frequency, Ratio, Minimum, Maximum). The repeated measures test was used to compare the changes seen over time according to positions. Pearson Correlation analysis was used to determine the relationship between the measurements. Significance was evaluated at $p<0.05$ levels.

RESULTS

The medical records of 21 cases of acute endophthalmitis were reviewed. 18 eyes of 18 patients whose data were fully available were included in the study.

Baseline characteristics

The mean age of presentation was 66±9.9 years (range 51-80 years). All of the patients had unilateral ocular involvement (13 [72.2%] right and 5 [27.8%] left eyes). The mean time of presentation after developing endophthalmitis was 5.8±1.7 days (range 4-10 days). The mean duration of follow-up was 29.9±22.54 months (range 3–73 months). The most common accompanying systemic diseases were hypertension 11(61.1%) and diabetes 10 (55.5%).

All patients had multiple presenting symptoms. The most common presenting symptoms were blurred vision in 18(100%) cases, conjunctival redness in 18(100%) cases, and ocular pain in 13 (72.2%) cases. The most common presenting signs were vitreous haze in 18 (100%) cases, hypopyon in 15 (83.3%) cases, and fibrin reaction in 9 (50%).

The most common endophthalmitis was post-injection endophthalmitis with a rate of 50% (9 cases). Of 9 patients secondary to intravitreal injections, 6 (66.6%) were post bevacizumab, 2 (22.2%) post ranibizumab, and 1 (11.2%) post aflibercept.

The rate of endogenous endophthalmitis was 16.6% (3 cases). One of the endogenous cases occurred in an immunocompromised patient with a liver transplant, one occurred in a patient with pyelonephritis, and one occurred in a patient with an intravenous catheter after gastrointestinal surgery.

The rate of post-surgery endophthalmitis was 11.1% (2 cases). One of these cases was post-cataract (phacoemulsification) and 1 was post-PPV(with 23 gauge trocars). The rate of post-traumatic endophthalmitis was 11.1% (2 cases). One of these cases was secondary to a metallic intraocular foreign body and the other is penetrating trauma with a metallic foreign body. One of the post-traumatic endophthalmitis patients underwent PPV 4 days after the primary reparation and one of them 5 days later. The rate of post-keratitis endophthalmitis was 11.1% (2 cases). Table 1 shows baseline characteristics and

Table 1: *Baseline and demographic characteristics of patients*

		Culture-pozitive (n=10)	Culture-negative (n=8)	p-value
Age (year); Mean±Sd (median)		65,4±7,62 (66,5)	69,75±12,37 (76,5)	ƒ0,285
Gander	Female; (n / %)	4 (40)	3 (37,5)	†0,91
	Male; (n / %)	6 (60)	5 (62,5)	
Ocular involvement	Right; (n / %)	8 (80)	5 (62,5)	†0,410
	Left; (n / %)	2 (20)	3 (37,5)	
Intravitreal Anti-VEGF indications				
	AMD; (n / %)	1 (10)	2 (25)	†0,969
	DME; (n / %)	3 (30)	2 (25)	
	RVO; (n / %)	1 (10)	0 (0)	
Intravitreal injection agent				
	Steroid; (n / %)	0 (0)	0 (0)	†0,638
	Bevacizumab; (n / %)	3 (60)	3 (75)	
	Ranibizumab; (n / %)	1 (20)	1 (25)	
	Aflibercept; (n / %)	1 (20)	0 (0)	
Lens	Fakik; (n / %)	6 (60)	2 (25)	†0,138
	Psoudıfafik; (n / %)	4 (40)	6 (75)	
Symptoms and signs				
	Hypopyon; (n /%)	9 (90)	6 (75)	†0,396
	Swollen lid; (n /%)	5 (50)	5 (62,5)	†0,596
	Corneal haze; (n /%)	6 (60)	4 (50)	†0,671
	Pain; (n /%)	8 (80)	5 (62,5)	†0,410
	Redness; (n /%)	7 (70)	5 (62,5)	†0,737
	AC fibrin reaction;(n /%)	6 (60)	3 (37,5)	†0,343
	Vitreous haze; (n /%)	10 (100)	8 (100)	†0,410
Accompanying systemic diseases				
	Diabetes; (n /%)	6 (60)	4 (50)	†0,671
	Hypertension; (n /%)	6 (60)	5 (62,5)	†0,914
	Renal failure; (n /%)	2 (20)	1 (12,5)	†0,671
	Pulmonary disease; (n /%)	1 (10)	1 (12,5)	†0,867
	Coronary artery disease; (n /%)	0 (0)	1 (12,5)	†0,350
	Bipolar disease; (n /%)	1 (10)	1 (12,5)	†0,867
	Sepsis; (n /%)	1 (10)	0 (0)	†0,357
	Pyelonefritis; (n /%)	1 (10)	0 (0)	†0,357
	Liver transplant; (n /%)	1 (10)	0 (0)	†0,357
	Gastrointestinal surgery; (n /%)	1 (10)	0 (0)	†0,357
Evisseration; (n /%)		2 (20)	0 (0)	†0,180
The mean time of presentation (day); Mean±Sd (median)		6,1±2,02 (6)	5,63±1,41 (5,5)	ƒ0,716
BCVA at presentation (logMAR); Mean±Sd (median)		2,19±0,57 (2,3)	2,41±0,16 (2,3)	ƒ0,425
The mean follow-up time (month); Mean±Sd (median)		25±19,4 (20)	36,13±25,68 (37)	ƒ0,422
IOP; Mean±Sd (median)		15,4±2,46 (14,5)	14,13±2,17 (14)	ƒ0,279

AMD: Age-Related Macular Degeneration, DME: Diabetic Macular Edema, RVO: Retinal Vein Occlusion, AC: Anterior Chamber, BCVA: Best-corrected visual acuity, IOP: Intraocular pressure, ƒMann Whitney U Testi, †Pearson Chi-Square test

Table 2 shows the summary of the endophthalmitis cases. Figures 1, 2, and 3 show images of endophthalmitis cases.

Culture results

Culture positivity was detected in 10 (55.5%) patient samples. In other patients, the culture result was negative. Gram-positive bacterias isolated in 5 (50%) patients were the most isolated microbial agents. The gram-positive agents isolated were *Staphylococcus epidermidis* in 2 (20%) patients, *Staphylococcus hominis* in 1 (10%) patient, *Staphylococcus aureus* in 1 (10%) patient, and *Streptococcus agalactiae* in 1 (10%) patient, respectively.

Gram-negative bacterias were isolated in 2 (20%) patients. Isolated gram-negative bacterias were *Haemophilus influenza* in 1(10%) patient and *Enterococcus faecium* in 1 (10%) patient. In both these two cases, gram-negative bacteria grew were undergone evisceration surgery. *Candida albicans* was isolated in 3 (30%) patients with endogenous endophthalmitis.

When culture-positive and culture-negative eyes were compared, there was no significant difference between the two groups in terms of age, gender, the mean time of presentation, and the mean time of follow-up ($p>0.05$). Sings and symptoms such as pain, lid swelling, redness, hypopyon, anterior chamber fibrin reaction, and vitreous haze were more in the culture-positive group, but there was no significant difference between the two groups ($p>0.05$).

Visual outcomes

When we evaluated all patients, the mean BCVA was

Table 2: *Summary of the endophthalmitis cases*

Case	Age(year)/ Gender (F/M)	Days to presentation	BCVA at presentation (logMAR)	Culture Results Organism	Final BCVA (logMAR)	Length of Follow-Up (months)
Post-injection						
1	70/F	5	2.6	Haemophilus influenza	3	27
2	51/F	5	2.3	-	1.3	15
3	59/F	7	1.3	Staphylococcus epidermidis	1.3	24
4	80/F	4	2.3	-	0.4	39
5	65/M	4	2.3	Staphylococcus aureus	0.8	3
6	77/F	7	2.3	-	0.3	37
7	72/M	5	2.3	Streptococcus agalactiae	1.3	38
8	55/F	4	1	Staphylococcus epidermidis	0.2	73
9	51/M	6	2.3	-	0.9	72
Post-PPV						
10	76/M	4	2.3	-	1.3	3
Post-cataract						
11	77/M	6	2.6	-	0.3	72
Post-trauma						
12	59/M	4	2.6	Enterococcus faecium	3	14
13	66/M	5	2.6	-	0.8	37
Endogenous						
14	78/M	10	2.3	Candida albicans	1.3	14
15	68/M	7	2.3	Candida albicans	0.6	26
16	71/M	8	2.6	Candida albicans	1.3	15
Post-Keratitis						
17	57/F	7	2.6	Staphylococcus hominis	0.7	16
18	80/M	8	2.6	-	2	14

F: female, M: male, PPV: pars plana vitrectomy, logMAR: logarithm of the minimum angle of resolution

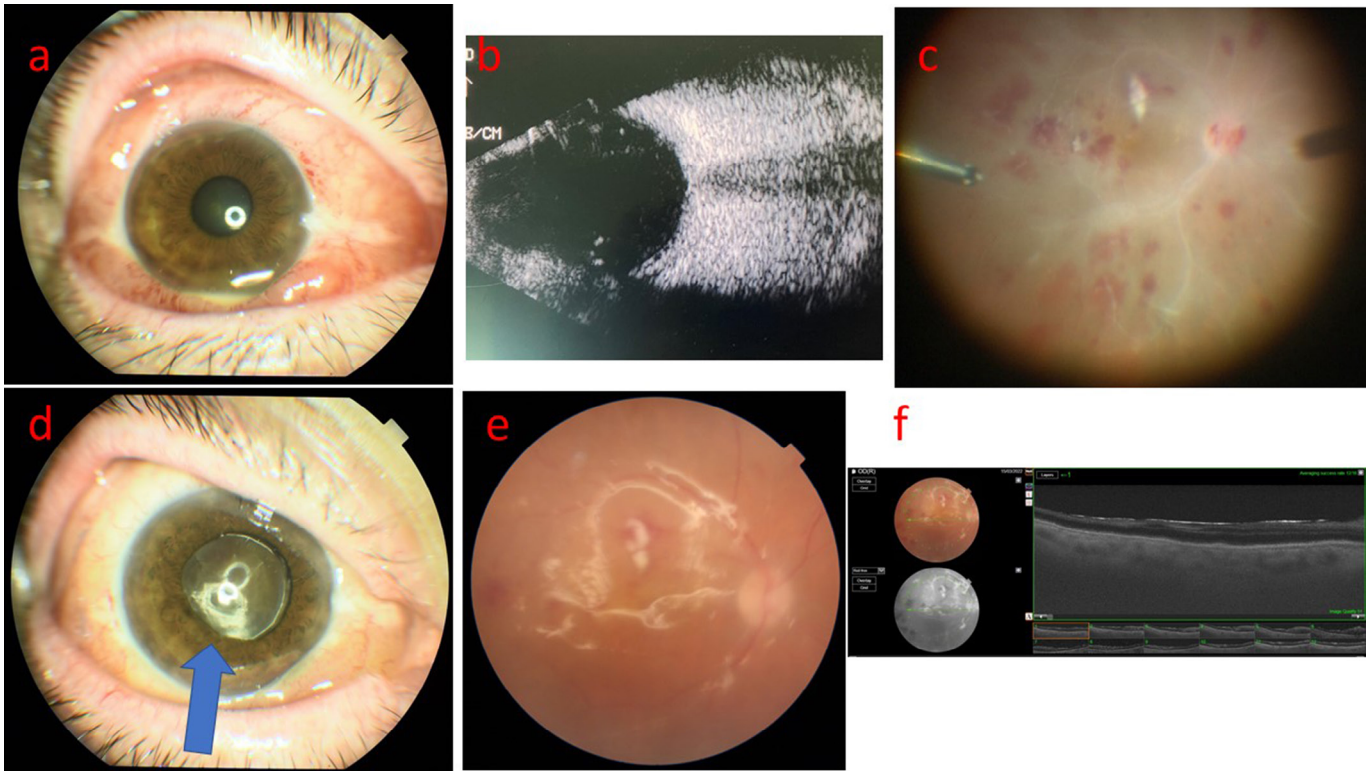

Figure 1: *Images of a 65-year-old male patient who applied to our clinic with pain and vision loss in the right eye 4 days after intravitreal bevacizumab injection due to diabetic macular edema (Case 5).* ***a-*** *Right eye anterior segment image. There is hypopyon and grade 3-4 nuclear cataracts. The right visual acuity was hand movements.* ***b-*** *Right eye ultrasonography does not show any distinctive features except mild hyperechoic areas.* ***c-*** *In the intraoperative fundus image of the patient, there are findings disproportionate to the anterior segment findings and ultrasonography. Widespread arterial occlusion, hemorrhages, and infiltration areas. Methicillin-resistant S. aureus grew in the vitreous culture of the patient.* ***d-*** *Anterior segment image at 3 months after combined PPV and phacoemulsification. There is an inferior posterior synechia.* ***e-*** *In the fundus image in the 3rd month, blood flow was restored in the arteries of the eye under silicone, and hemorrhages and infiltration areas regressed.* ***f-*** *Fundus is flattened in the OCT image. Right vision level 0.16 decimal with correction.*

2.29±0 logMAR preoperatively and improved significantly to 1.16±1 logMAR (p=0.001) at the last follow-up visit. The mean BCVA improved in 16 (88.8%) eyes and worsened in 2 eyes (11.2%). At the last follow-up, BCVA 20/400 or better was obtained in 15 (83.3%) eyes. Only 3 (16.6%) eyes had a final BCVA of 20/40 or more. One patient (5.5%) had a final BCVA of counting fingers. Two patients (11.1%) had a final BCVA of no light perception (Phthisis bulbi).

In culture-positive patients, the BCVA was 2.19±0.57 logMAR at the presentation and increased significantly to 1.44 ±0.98 logMAR at the last control visit (0.038). In culture-negative patients, the BCVA was 2,41±0,16 logMAR at the presentation and increased significantly to 0,80 ±0,37 logMAR at the last control visit (0.012). The increase in BCVA in the culture-negative group was significantly higher than in the culture-positive group (p=0.025). At the last follow-up, BCVA 20/400 or better was obtained in 8 (80%) eyes in culture-positive patients and 7 (87.5%) eyes in culture-negative patients. Only 1 (10%) eye in culture-positive patients and 2 (25%) in culture-negative patients had a final BCVA of 20/40 or more.

In roc curve analysis we find the most appropriate cut-off value for BCVA for determining culture positivity was ≥1.35 logMAR (Figure 4).

Anatomical outcomes

One of the 2 (11.1%) eyes with phthisis bulbi was after post-traumatic endophthalmitis and the other was post-injection endophthalmitis. These 2 eyes needed evisceration at last. The anatomical integrity of the eye was preserved in the other 16 (88.9%) eyes at the final follow-up.

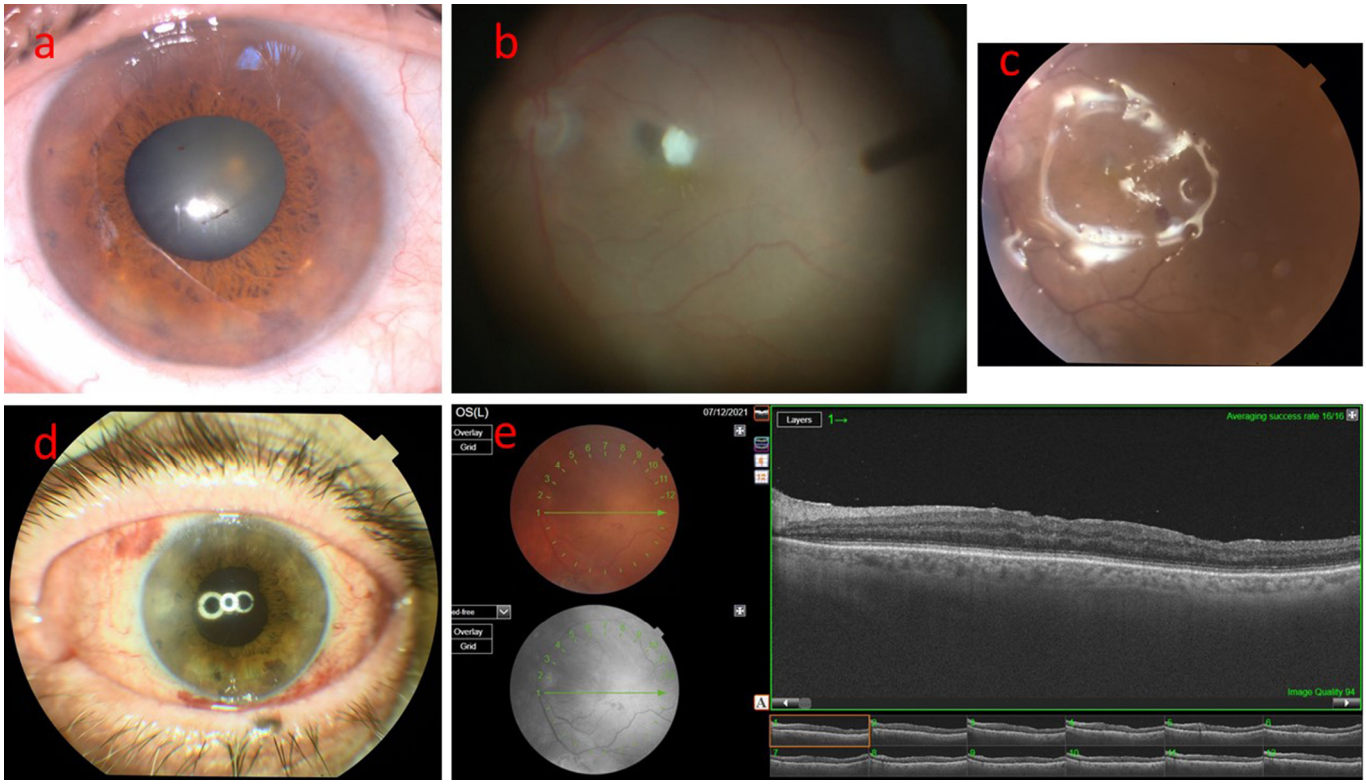

Figure 2: *A 78-year-old male patient who was treated for pyelonephritis was admitted to our clinic with vision loss in the left eye that had lasted 10 days (Case-14).* ***a-*** *In the anterior segment image, there is shallow hypopyon and 3-4 positive nuclear cataracts. Visual acuity was hand motions.* ***b-*** *Infiltrative focus rising in the form of a white mushroom ball just at the edge of the fovea. Candida albicans grew in the patient's vitreous culture.* ***c-d-*** *Fundus and anterior segment image at 2 months after combined PPV and phacoemulsification.* ***e-*** *OCT and fundus images after silicone removal at 3 months. Left visual acuity was 0.05 decimal.*

Complications

Anterior chamber fibrin reaction in 10 (55.5%) eyes and hypopyon in 2 (11.1%) eyes developed within the first postoperative week. Fibrin reaction and hypopyon were controlled with intensive topical and systemic steroid therapy. Posterior iris synechia was seen in 4 (22.2%) eyes at the last control visit.

3 (16.6%) eyes had IOP elevation at the early postoperative period (in week 1) and were controlled with topical anti-glaucoma medications. After silicone oil removal, topical anti-glaucoma medications were discontinued in all 3 patients.

Rhegmatogenous retinal detachment occurred at a mean time of 30,5 days (range 25–36 days) after surgery in 2 (11.1%) eyes 1 with post-traumatic endophthalmitis and 1 with post-injection endophthalmitis. Despite the 2nd PPV, these 2 (11.1%) patients required an evisceration. Three eyes (16.6%) developed epiretinal membrane, 2(11.1%) developed cystoid macular edema, and 1 (5.5%) developed macular ischemia. In 1(5.5%) eye with post-keratitis endophthalmitis, corneal decompensation developed. Postoperative complications were distinctly more in culture-positive patients. However, there was no significant difference between the two groups. Only postoperative fibrin reaction development was significantly higher in the culture-positive group (p=0.031). Intraoperative and postoperative complications were presented in Table 3.

DISCUSSION

In this retrospective study, we evaluated the patients with endophthalmitis who were treated with PPV in the first 24 hours of admission in culture-positive groups and culture-negative groups. Our results demonstrate that the mean BCVA improved in 16 (88.8%) eyes and worsened in 2 eyes (11.2%). Evisceration was required for these 2 eyes whose gram-negative bacteria grew in culture. Sings and symptoms such as pain, lid swelling, redness, hypopyon, anterior chamber fibrin reaction, and vitreous haze were more in the culture-positive group, but there was no significant difference between the two groups (p>0.05). The increase in best-corrected visual acuity (BCVA) in the culture-negative group was significantly higher than in the

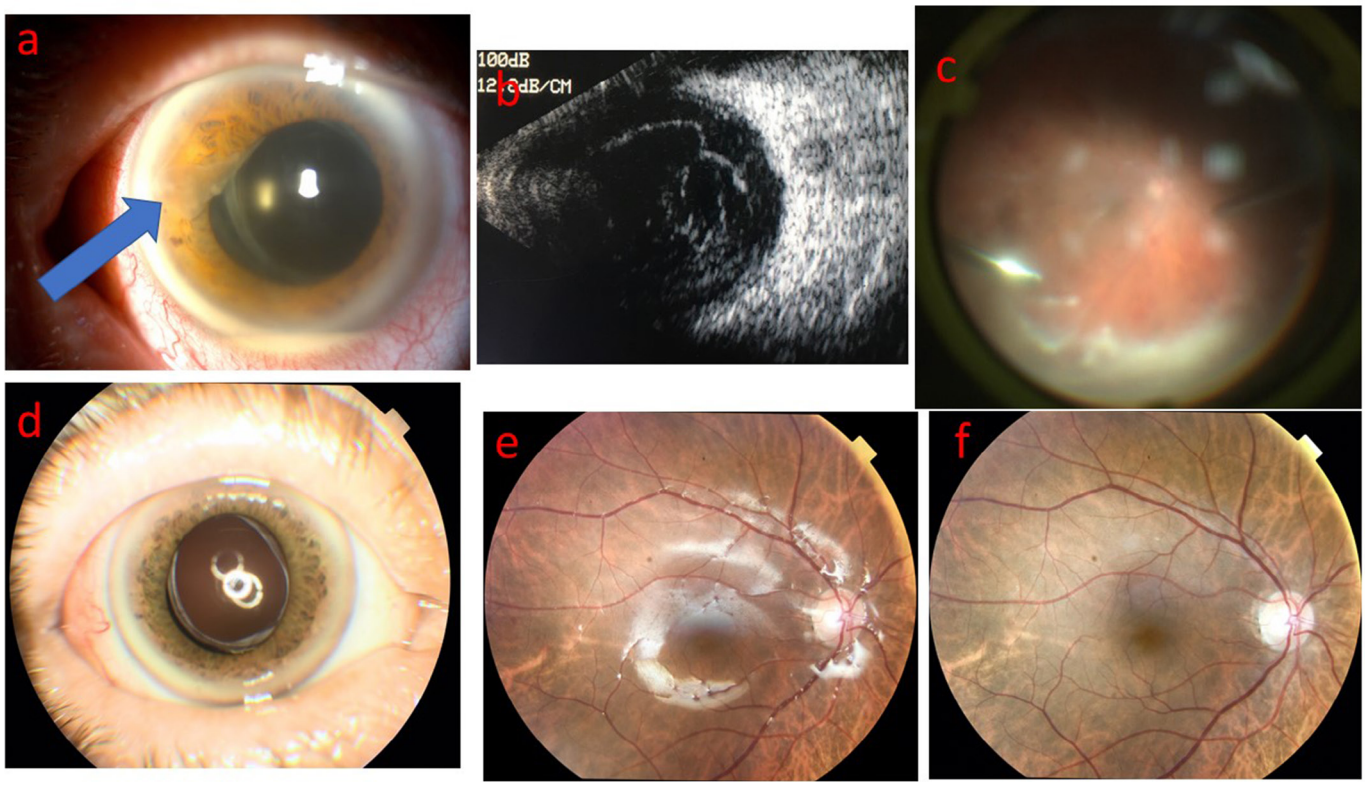

Figure 3: *Anterior and posterior segment images of a 78-year-old male patient who applied with the complaint of loss of right vision and pain 6 days after cataract surgery (Case-11).* ***a-*** *In the anterior segment image, hypopyon and fibrin are indicated by the blue arrow. Visual acuity was hand motions* ***b-*** *There are irregular hyperechoic areas in the ultrasonography of the right eye.* ***c-*** *In the intraoperative image, lower vitreous infiltration areas are seen.* ***d-*** *The anterior segment is normal 2 months after PPV.* ***e-****Retinal was attached under silicone in the 2nd month after PPV.* ***f-*** *The retina is normal in the 3rd month after silicone removal. Right vision 0.5 decimal.*

					95% Confidence Interval	
	Cut Off Value	Area	Sensitivity	Specificity	Lower	Upper
BCVA	≥1,35	0,813	0,800	0,750	0,603	1,000

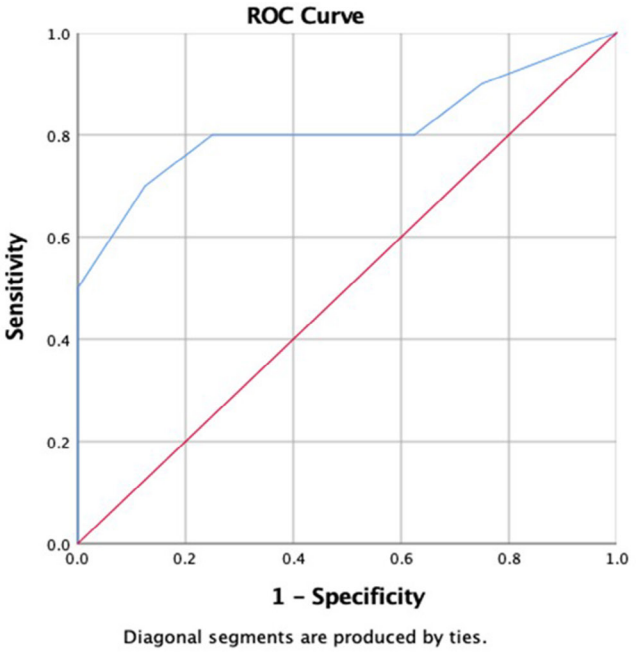

Figure 4: *The cut-off value for BCVA for determining culture positivity.*

Table 3: *Intraoperative and postoperative complications*

	Culture-positive *n*=10 (55.5%)	***Culture-negative*** *n=8(45.5)*	***p-value***
Intraoperative iatrogenic tear	2 (20)	0 (0.0)	*†0,180*
Intraoperative posterior capsular rupture	0 (0.0)	0 (0.0)	
Postoperative retinal detachment	2 (20)	0 (0.0)	*†0,180*
Postoperative hemorrhage	0 (0.0)	0 (0.0)	
Posterior iris sinesia at last visit	3 (30)	1(12.5)	*†0,193*
Postoperative anterior chamber fibrin reaction in 1st week	8 (80)	2(25)	***†0,031***
Postoperative hypopyon in 1st week	2 (20)	0 (0.0)	*†0,180*
IOP elevation	3 (30)	0 (0.0)	*†0,082*
Posterior capsule opacification at last visit	2(20)	1(12.5)	*†0,671*
Neovascular glaucoma	0(0.0)	0 (0.0)	
Decentered IOL	0(0.0)	0 (0.0)	
Evisceration	2(11.1)	0 (0.0)	*†0,180*
Epiretinal membrane	3 (16.6)	0 (0.0)	*†0,082*
Cystoid macular edema	2 (11.1)	0 (0.0)	*†0,180*
Macular ischemia	1(5.5)	0 (0.0)	*†0,357*
Corneal decompensation	1(5.5)	0 (0.0)	*†0,357*

IOL: intraocular lens, †Pearson Chi-Square test

culture-positive group (p=0.025). This may be due to the lower microorganism inoculation in culture-negative cases. We performed a roc analysis to see if we could predict culture positivity with BCVA level. In roc curve analysis we find the most appropriate cut-off value for BCVA for determining culture positivity was ≥1.35 logMAR. This may support performing PPV in patients with low vision.

Vitreous is a suitable environment where microorganisms can easily adhere and multiply. The advantages of immediate PPV are the rapid reduction of infecting organisms, toxins, inflammatory materials, and opacities, allowing a more robust collection of samples for culture, providing better diffusion of antibiotics, and earlier visualization of the retina.[14,15] In addition, the patient becomes more comfortable after PPV as the patient's clinical complaints and pain disappear. At the same time, with immediate PPV tissue damage is prevented, corneal edema is reduced, and the possibility of blurring of the environment and further deterioration of the visualization can be reduced. Thus, complications can be minimized with immediate vitrectomy in patients with possible culture positivity. The disadvantages of immediate PPV are the need for sophisticated equipment, operating room time, and staff.[16]

We took vitreous samples with manual aspiration without infusion. We inoculated samples within minutes of obtaining them to the blood and chocolate agar for bacteria culture and Sabouraund dextrose agar for fungus culture to maximize the recovery of organisms. However, our study results demonstrate that culture positivity was detected in 10 (55.5%) of 18 patients samples. This result is almost the same in the literature. Bacterial identification was achieved in 43.4% of patients in Dossarps et al.[17] studies. In other series, microbial identification was reported between 30% and 60%.[18,19]

We have shown that postoperative complication such as postoperative fibrin reaction development was significantly higher in the culture-positive group. This may be because we did not administer intravitreal steroids to any of our patients at the end of PPV.

Infective endophthalmitis following intravitreal injection is frequently due to coagulase-negative staphylococci.[20] In our study Staphylococcus epidermidis is the most isolated microbial agent after post-injection endophthalmitis. Endogenous endophthalmitis is more frequently caused by fungi and the most common causative organism is Candida albicans in the literature as in our study.[21]

In endophthalmitis after intravitreal injections, clinical findings may be faint, and anterior segment and posterior segment findings may not correlate.[22] This may mislead clinicians and cause delays in treatment. This situation is shown in the images of case-5. With immediate PPV, these cases can be treated earlier and more effectively.

In our series, except for 2 patients, the visual acuity of all patients was hand motions or light perception. Our results which include different acute endophthalmitis cases demonstrate that the number of patients with BCVA 20/400 or better was obtained in 15 (83.3%) eyes at the last follow-up visit (mean 29.9 months). At the last follow-up, BCVA 20/400 or better was obtained in 8 (80%) eyes in culture-positive patients and 7 (87.5%) eyes in culture-negative patients. However, we had only 3 (16.6%) eyes with a final BCVA of 20/40 or more. This may be due to the high percentage of patients with preexisting poor visual potential due to corneal damage, traumatic damage, and macular damage in our study.

Kaynak et al.[23] compared 2 techniques for the surgical management of postoperative endophthalmitis. In group-1 they used cor vitrectomy as an initial procedure according to the EVS. In group-2 they used total pars plana vitrectomy with an encircling band, silicone tamponade, and endolaser. They reported that more radical intervention can increase surgical success and decrease the number of additional procedures in eyes with postoperative endophthalmitis. In our study, we performed a complete vitrectomy with peripheral indentation in all of our patients. However, postoperative complications were distinctly more in culture-positive patients.

Ozdamar et al.[24] showed silicone oil has antimicrobial activity against S. aureus, S. epidermidis, P. aeruginosa, C. Albicans, and Aspergillus spp., which are common endophthalmitis-causing agents. Vitrectomy using silicone, with or without retinal detachment, is thought to have a positive effect on the visual and anatomical results of endophthalmitis patients. Therefore, we used silicone oil in most of the cases in our study.

The limitations of our study are that it is single-centered, has a retrospective design, lack a control group, and has a small number of patients.

CONCLUSION

Any ophthalmologist may encounter endophthalmitis, prompt recognition and aggressive treatment are required. In our series, endophthalmitis was most commonly caused by intravitreal injections and endogenous origin. Despite aggressive treatment with antibiotics and PPV, evisceration was required in 2 eyes with culture positive. Culture positivity affects negatively both visual and anatomical results after immediate PPV in patients with endophthalmitis. Eyes with low BCVA are more likely to be culture positive. More aggressive treatments should be performed on these patients.

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