Results Of Early Vitrectomy for Endophthalmitis Treatment in a Tertiary Care Hospital

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ABSTRACT

Purpose: In this study, we aimed to share our clinical experience and results in patients who have undergone primary PPV surgery with the diagnosis of endophthalmitis.

Methods: Sixteen eyes of 16 patients presented with acute onset of endophthalmitis and had undergone PPV surgery were reviewed retrospectively. Clinical records of the patients including age, sex, best corrected visual acuity (BCVA) at presentation, BCVA achieved postoperatively, time from the onset of complaints to surgical intervention, type of endophthalmitis, microbiologic culture results, type of intraocular tamponade used after PPV surgery, presence of postoperative phthisis, retinal detachment, and other complications, the requirement of a second surgery, and follow-up time were scanned retrospectively.

Results: The mean time from the onset of symptoms to PPV surgery was 45.8 hours (range 27 to 75 hours). Sixteen samples from 16 patients were sent for microbiological analysis. Bacterial pathogens were reported in 7 cases (43.7%), and 9 of 16 samples (56.3%) were negative. Complications after the PPV surgery were as follows: retinal detachment was reported in 3 cases (18.7%), glaucoma was reported in 3 cases (18.7%), cystoid macular edema was reported in a case (6.3%), and macular hole with choroidal neovascular membrane (CNVM) was reported in a case (6.3%). Eight patients out of 16 (50%) had no complications after the PPV surgery.

Conclusions: Based on our results, we can suggest that performing early PPV surgery may be an option for the management of endophthalmitis patients whose initial vision is better than light perception.

Keywords: Endophthalmitis, Pars plana vitrectomy, Endophthalmitis vitrectomy study, Visual acuity, Ocular inflammation

INTRODUCTION

Endophthalmitis is an inflammatory condition of the internal tissues and fluids (vitreous and aqueous humor) of the eye usually due to colonization of infectious microorganisms. Purulent inflammation caused by massive infiltration of the vitreous cavity with inflammatory cells is the hallmark of all types of endophthalmitis.[1] Considering an ophthalmic emergency, it is a potentially blinding condition that requires rapid diagnosis and treatment.[2] It is classified in two forms, endogenous and exogenous. The endogenous form is rare and usually seen in individuals with compromised immune systems. The pathogen microorganism reaches to the intraocular tissues through the blood circulation from a distant focus of infection. In the exogenous form, the infective microorganism reaches to the eye via direct inoculation during open globe trauma or intraocular interventions such as cataract surgery or intravitreal injections.[3] The incidence of exogenous endophthalmitis varies in the literature according to the type of surgery performed and the general condition of the patient.[4-6]

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The timing of pars plana vitrectomy (PPV) in the management of endophthalmitis has long been discussed in the literature.[7,8] A prospective, randomized study named the Endophthalmitis Vitrectomy Study (EVS) was published in 1995. EVS compared PPV surgery with intravitreal antibiotic injections in one arm and intravenous antibiotics with no antibiotics in the other arm in the management of acute postoperative endophthalmitis.[9,10] EVS concluded that only patients presenting with initial visual acuity of light perception would have the visual benefit of PPV while patients presenting with visual acuity of hand motion or better were suggested to have intravitreal antibiotic injections. In line with the results of this study, the vast majority of ophthalmologists and retina surgeons stopped performing PPV for endophthalmitis except for the worst eyes which present with a visual acuitiy of light perception.

In contrast with EVS, recent publications in the literature report that early intervention with PPV in patients with better visual acuity than light perception gives satisfactory results in endophthalmitis management.[11,12] Since the 90's when EVS was published, significant advances have been made in vitreoretinal surgery technology.[11-13] Smaller gauge surgical instrumentation allowing for transconjunctival surgery, new vitrectors capable of higher cutting rates, modern surgical microscopes, and their attachments allowing wide-field viewing have increased the success rates of PPV surgery and reduced surgical risks and complications.[14] As a result of all these developments in surgical technique and equipment, a re-evaluation of the EVS recommendations seems appropriate.

In this study, we aimed to share our clinical experience and results in patients who underwent primary PPV surgery with the diagnosis of endophthalmitis.

MATERIAL AND METHODS

Sixteen eyes of 16 patients presented with acute onset of endophthalmitis and had undergone PPV surgery between October 2017 and January 2023 were reviewed retrospectively. All procedures followed the Declaration of Helsinki rules, and written informed consent was obtained from all patients. Local ethics committee approval was obtained from Kahramanmaras Sutcu Imam University, approval date: 30.05.2023 and approval number:2023/05-06).

The diagnosis of endophthalmitis was made clinically after a complete ophthalmic examination detecting any of the signs such as reduced visual acuity, conjunctival injection, corneal edema, hypopyon, iritis, anterior chamber cells, vitritis, and poor red reflex in patients presenting with any of the symptoms such as ocular irritation, pain, red eye, photophobia, and reduced vision. The indication of early PPV surgery with the diagnosis of acute endophthalmitis was confirmed by a vitreoretinal specialist. Considering it was an emergency, surgeries were performed within 2-3 hours of admission. Clinical records of the patients including age, sex, best corrected visual acuity (BCVA) at presentation, BCVA achieved postoperatively, time from the onset of complaints to surgical intervention, type of endophthalmitis, microbiologic culture results, type of intraocular tamponade used after PPV surgery, presence of postoperative phthisis, retinal detachment, and other complications, the requirement of a second surgery, and follow-up time were scanned retrospectively.

All patients had undergone 23G, 4-port PPV surgery with standardized procedures. The PPV surgery aimed to reduce the bacterial load and remove toxins released into the vitreous cavity. At the beginning of the surgery, a 0.5 mL vitreous sample was collected with the infusion off, and the assistant was manually aspirating via a syringe while the surgeon was cutting with the vitrector. The vitreous sample obtained was sent for culture. A core vitrectomy was performed initially. After that, induction of posterior vitreous detachment was performed carefully not to create a retinal tear in all of the cases where the posterior hyaloid was intact. A delicate shaving of the vitreous base and cleaning of the peripheral vitreous were performed to minimize the number of residual bacteria colonies and toxins released. Most of the patients received silicone oil tamponade, while a few of them were treated with balanced salt solution (BSS) or air. At the end of the surgery, all patients received intravitreal injections of 1 mg vancomycin and 2.25 mg ceftazidime. Topical and systemic antibiotics and steroids were given to the patients, postoperatively. It was recommended that the patients rest prone position, on the right side and left side alternately to prevent macular toxicity of the injected antibiotic agents.

RESULTS

Sixteen eyes of 16 patients with clinically diagnosed exogenous acute endophthalmitis were included in the study. Of the 16 patients, 12 were men (75%) and 4 were women (25%). The mean age of the patients was 57.8 years (range: 4 to 84 years). Patients were treated between October 2017 and January 2023. Considering the etiological factors, 8 patients had phacoemulsification-cataract surgery, 3 patients had an ocular perforating injury, 2 patients had an ocular penetrating injury with intraocular foreign bodies, 2 patients had an intravitreal injection and a patient had vitreoretinal surgery due to IOL drop before the diagnosis of acute endophthalmitis. The mean time from the onset of symptoms to PPV surgery was 45.8 hours (range 27 to 75 hours). At the end of the surgery, all patients received silicon oil tamponade except three patients. Two of the remaining three patients received BSS, and one patient received air as tamponade. Sixteen samples from 16 patients were sent for microbiological analysis. Bacterial pathogens were reported in 7 cases (43.7%), and 9 of 16 samples (56.3%)were negative. Although gram-positive cocci were predominantly detected, gram-negative bacilli and gram-negative coccobacilli such as Pasteurella multocida were also reported. The visual acuities of the patients at the time of admission to the hospital were as follows: light perception in 2 cases, hand movement in 9 cases, finger count (CF) at 1 meter in 2 cases, CF at 2 meters in 2 cases, and CF at 3 meters in one case. The best visual acuities achieved postoperatively were as follows: light perception in 3 cases, CF at 1 meter in 2 cases, CF at 2 meters in 1 case, 0.05 in a case, 0.2 in a case, 0.3 in a case, 0.4 in 2 cases, 0.5 in 2 cases, 0.6 in a case, 0.7 in a case and 0.8 in a case using the Snellen chart. Complications after the PPV surgery were as follows: retinal detachment was reported in 3 cases (18.7%), glaucoma was reported in 3 cases (18.7%), cystoid macular edema was reported in a case (6.3%), and macular hole with choroidal neovascular membrane (CNVM) was reported in a case (6.3%). Two of the three patients who had retinal detachment developed phthisis bulbi. Eight patients out of 16 (50%) had no complications after the PPV surgery. The mean follow-up time was 10.3 months (range: 1 to 42 months). The characteristics of the patients are presented in Table 1.

DISCUSSION

Sixteen eyes of 16 patients with clinically diagnosed exogenous acute endophthalmitis who had undergone early PPV surgery in this study. Patients presented with various levels of vision. The vast majority of the cases were consisted of 8 patients with post-cataract surgery endophthalmitis (50%). The second most frequent etiological cause was ocular penetrating/perforating injuries in 5 cases (31.25%), including intraocular foreign body in 2 of them. Two cases had endophthalmitis following intravitreal anti-vegf injections (12.5%). Nowadays, with the increasing spectrum of indications for intravitreal injections, post-intravitreal injection endophthalmitis cases are increasing.[15] Although varying rates are reported in the literature, the incidence of endophthalmitis following cataract surgery has been reported to be 2-6 times higher than endophthalmitis cases following intravitreal injections.[15-17]

While performing PPV surgery, the primary goal was to remove infected vitreous as much as possible and to collect samples for microbiological analyses without inducing iatrogenic damage. In our study, after core vitrectomy, separation of the posterior hyaloid was achieved, and peripheral vitreous base shaving was performed in all cases. In the literature, it has been reported that PPV for the management of endophthalmitis has several benefits, such as removing the causative microorganisms, toxins, and infected material.[7,18] Recent studies have been reported that early PPV is the most promising option we have today to prevent further retinal damage.[19-22]

In the management of endophthalmitis, either surgical or medical intervention time is considered one of the most important parameters.[23] The average time required for an ordinary bacterial population to double is approximately 20 minutes, so the bacterial load increases logarithmically.[24] Further investigations that may delay surgical or medical intervention should be thought twice about. Early PPV surgery offers some benefits, such as the identification of the pathogen microorganism, removal of infected vitreous, toxins, and inflammatory mediators.[25] In our study, the mean time from the onset of symptoms to PPV surgery was 45.8 hours. In our opinion, this is a reasonable period. Poor diagnosis was reported in the literature if patients were not treated promptly on time. [26,27]

Table-1: *Characteristics of the patients*

	Sex	Age	Initial vision	Final vision	Etiology	Intraocular Tamponade	Postoperative complication	Microbiology
Case-1	Male	14	LP	CF at 1 meter	Penetrating trauma with IOFB	Silicone oil	Retinal Detachment	-
Case-2	Male	78	HM	0.7	vitreoretinal surgery due to IOL drop	BSS	-	-
Case-3	Male	16	CF at 3 meters	LP	Perforating-trauma	Silicone oil	-	-
Case-4	Male	71	CF at 1 meter	0.5	Post-cataract surgery	Air	Glaucoma	-
Case-5	Male	4	HM	LP	Perforating-trauma	Silicone oil	Retinal Detachment	Gram-positive cocci Gram-negative bacilli
Case-6	Female	68	CF at 2 meters	0.05	Perforating-trauma	Silicone oil	Glaucoma	Gram-positive cocci
Case-7	Male	67	HM	0.8	Post-cataract surgery	Silicone oil	-	Gram-negative coccobacilli
Case-8	Male	67	HM	0.4	Post-cataract surgery	Silicone oil	-	-
Case-9	Male	71	HM	0.4	Post-cataract surgery	Silicone oil	Cystoid macular edema	Gram-positive cocci
Case-10	Female	84	LP	LP	Post-cataract surgery	Silicone oil	-	Gram-positive cocci
Case-11	Female	73	HM	0.2	Post-cataract surgery	Silicone oil	Macular hole with choroidal neovascular membrane	Gram-positive cocci
Case-12	Male	71	CF at 1 meter	0.5	Post-intravitreal injection	Silicone oil	-	-
Case-13	Female	41	HM	CF at 2 meters	Penetrating trauma with IOFB	Silicone oil	Retinal Detachment	-
Case-14	Male	66	CF at 2 meters	0.6	Post-cataract surgery	BSS	Glaucoma	Gram-positive cocci
Case-15	Male	62	HM	CF at 1 meter	Post-intravitreal injection	Silicone oil	-	-
Case-16	Male	72	HM	0.3	Post-cataract surgery	Silicone oil	-	-

Abbreviations; Light Perception (LP), Hand movement (HM), Counting fingers (CF), Balanced salt solution (BSS), Intraocular foreign body (IOFB)

At the end of the surgery, except for 3 patients, all patients received silicon oil tamponades. Two of the remaining three patients received BSS, and one patient received air as tamponade. These three patients were diagnosed early and undergone to PPV surgery quickly. At the time of the surgery, signs and symptoms of endophthalmitis had not progressed yet. The best visual acuities achieved postoperatively in these patients were satisfactory (0.5, 0.6, and 0.7 using the snellen chart). There are many studies suggesting the use of silicone oil as an intraocular tamponade in endophthalmitis cases because of the antimicrobial effect of silicone oil.[19,22,28,29] We preferred silicone oil as the intraocular tamponade in most of the cases (81.25%).

Sixteen samples from 16 patients were sent for microbiological analysis. Bacterial pathogens were reported in 7 cases (43.7%), and 9 of 16 samples (56.3%) were negative. Although gram-positive cocci were predominantly detected, gram-negative bacilli and gram-negative coccobacilli such as Pasteurella multocida were also reported. Our results are in line with studies reporting that the most commonly detected microorganisms in culture-positive eyes are gram-positive organisms in endophthalmitis cases.[8] Some studies have reported that culture-negative cases tend to result with better final visual acuity because of a lower micro-organism load.[30]

Among 16 patients, 11 presented with a vision of light perception or hand movement. After PPV surgery, the visual acuity increased in 13 patients (81.2 %), and a patient who had no change in the vision presented with a vision of light perception and resulted in light perception due to phthisis bulbi. In two cases (12.5%), the final visual acuity was lower than the initial visual acuity. One of the two cases was a 4-year-old child who presented with a vision of hand movement which resulted in light perception due to retinal detachment with proliferative vitreoretinopathy (PVR). Although secondary PPV combined with scleral buckling surgery was performed, no improvement in vision was achieved. The other patient presented with a vision of CF at 2 meters which resulted in light perception due to phthisis bulbi.

The only approved surgical technique for removing the vitreous itself and materials in the vitreous cavity is pars plana vitrectomy. It has been widely reported in the literature that some complications can occur with PPV surgery. Common complications include cataract, macular edema, retinal detachment, suprachoroidal hemorrhage, intraocular pressure elevations, especially in patients with intraocular tamponade, and intraocular bleeding.[30] In our study, complications after the PPV surgery were as follows: retinal detachment was reported in 3 cases (18.7%), glaucoma was reported in 3 cases (18.7%), cystoid macular edema was reported in a case (6.3%), and macular hole with choroidal neovascular membrane (CNVM) was reported in a case (6.3%). Two of 3 patients who had retinal detachment developed phthisis bulbi. In EVS, the retinal detachment rate after PPV surgery was reported as 8 %.[10] It seems that our retinal detachment rate is much higher than EVS, but these 3 patients presented with retinal detachment due to perforating/penetrating ocular injury, and two of them had ocular foreign bodies that were removed by PPV surgery. The cause of retinal detachments due to endophthalmitis has been stated as retinal necrosis, not iatrogenic tears in the literature. Cleaning the infected material in the vitreous cavity may lower the risk of retinal detachment due to a tear in the necrotic retina.[20] In our study, no retinal detachment due to retinal necrosis or iatrogenic tear was observed. Eight patients out of 16 (50%) had no complications after the PPV surgery.

This study has some limitations. First of all, the patients included in the study did not show a homogeneous distribution in terms of age and etiology of endophthalmitis. While some patients included in the study had severe perforating-penetrating injuries and intra-ocular foreign bodies, some patients were cases whose signs and symptoms of endophthalmitis were recognized in the early period after intravitreal injection. Therefore, these factors may directly affect the results after PPV surgery. In addition, a 4-year-old child will have a much higher risk of PVR after PPV surgery than a 70-year-old patient. The major limitation of similar studies in the literature including our study is; the retrospective study design. The retrospective nature of the study limits the standardization of the surgical procedures and patient profiles. Prospective studies including patients with similar etiologies, initial visual acuities, and age groups will provide better contributions to the literature on the success of early vitrectomy.

In conclusion, the present study was conducted to share the results of early vitrectomy surgery of a single center for endophthalmitis management. The number of cases in our study is not sufficient to claim the generalization of the results. However, the authors planned to share their experiences with early PPV surgery and create an opinion and an idea in the readers. It is not the purpose of this study to criticize the results of the EVS study or the criteria for inclusion in PPV surgery. The authors state that EVS is a valuable and reliable study that has guided us all for years. The main inspiration for PPV surgery in the management of endophthalmitis has been the EVS. The point that the authors want to draw attention to is that the decision to perform PPV surgery in endophthalmitis management should not be limited to the patient's vision only. Based on our results, we can suggest that performing early PPV surgery may be an option for the management of endophthalmitis patients whose initial vision is better than light perception.

STATEMENTS AND DECLARATIONS

DATA AVAILABILITY STATEMENT

The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

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CONSENT FOR PUBLICATION

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his/her images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published, and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

COMPETING INTERESTS

The authors declare that they have no competing interests

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