

The rate of endophthalmitis after pars plana vitrectomy and its risk factors

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Abstract

Purpose To study the incidence of endophthalmitis after pars plana vitrectomy, its causative organisms, and visual acuity outcomes.

Patients and methods In this retrospective, comparative study, the medical records of patients with acute-onset postoperative endophthalmitis after pars plana vitrectomy at Farabi Eye Hospital, Tehran, Iran, during a 12-year period between January 2004 and November 2015 were reviewed. To compare the endophthalmitis patients with other cases who underwent pars plana vitrectomy at the same day and also the same operating room, a control group was developed by gathering the data from surgical records.

Results In the present study, the incidence rate of post-vitrectomy endophthalmitis was 0.04% (16/39783). The organisms identified in aqueous or vitreous cultures (culture positive 44%) included *Streptococcus pneumoniae* (two patients, 12.5%), *Pseudomonas aeruginosa* (two patients, 12.5%), fungi (two patients, 12.5%), and *Streptococcus viridans* (one patient, 6.25%). Visual acuity after treatment for endophthalmitis ranged from light perception (7 eyes)

to hand motion (1 eye), and evisceration was performed in 8 eyes (50%). When comparing the cases (patients developing endophthalmitis) and controls (patients with no complications operated in the same day and place of operation with the case group), only not using tamponade showed a statistically significant relation with the occurrence of endophthalmitis ($p = 0.034$).

Conclusion Our results indicated low incidence of endophthalmitis after pars plana vitrectomy comparable to previous studies which resulted in poor visual acuity. It seems that not using tamponade might increase the risk of endophthalmitis among these patients.

Keywords Vitrectomy · Endophthalmitis · Risk factor · Incidence · Iran

Introduction

Endophthalmitis causes severe inflammation of the ocular tissues and is one of the most devastating postsurgical complications [1]. The incidence of endophthalmitis is related to the surgical procedure and has been reported to be about 0.4% for cataract surgery, and 0.06% in intravitreal injections [2–7]. Post-pars plana vitrectomy (PPV) endophthalmitis is an uncommon cause of endophthalmitis with studies reporting incidences of between 0.01 and 0.86%

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[1, 2, 8–12]. However, normal postoperative pain and inflammation after PPV may mask endophthalmitis and lead to delayed diagnosis and grave visual consequences. We conducted a retrospective study of all vitrectomy patients and investigated the post-vitrectomy endophthalmitis that occurred in Farabi Eye Hospital, Tehran, Iran, and probable risk factors during a 12-year period between 2004 and 2015. Also, to compare the endophthalmitis patients with other cases who underwent PPV at the same day and the same operating room, a control group was developed.

Patients and methods

This retrospective study was approved by the ethics committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran, and was conducted in compliance with the guidelines of the Declaration of Helsinki. We conducted a retrospective study of all patients undergoing vitrectomy and investigated the rate of post-vitrectomy endophthalmitis in Farabi Eye Hospital, Tehran, Iran, during a 12-year period between 2004 and 2015. These cases were identified through a search of the hospital's surgical records. Endophthalmitis was diagnosed among patients entering the study based on clinical signs and symptoms including visual loss, eye pain and irritation, photophobia, ocular discharge, as well vitreous involvement, even in the absence of a positive culture. To compare the endophthalmitis patients with other cases who underwent PPV at the same day and the same operating room, a control group was developed with data from surgical records. We collected the following information for each patient: the cause of vitrectomy, age, sex, history of systemic disease or previous ocular surgery, procedure performed, drugs used at the time of vitrectomy, from the interval between vitrectomy and the appearance of endophthalmitis, type of tamponade, visual acuity after vitrectomy, microbiologic analysis, visual acuity on presentation with endophthalmitis, and final treatment outcomes. Cases that met the definition were included, regardless of the microbiological study findings, and patients with any simultaneous surgery other than vitrectomy or with postoperative corneal ulcer were excluded. In this study, endophthalmitis was defined by clinical criteria independent of microbiological results, using the following clinical features: visual acuity (VA)

changes, progressive eye pain, lid edema, redness, circumcorneal congestion, corneal edema anterior chamber cell with fibrin, hypopyon, and vitreous cell and fibrin occurring within 6 weeks after vitrectomy. All our patients had received povidone iodine 5% scrub for at least 3 min before the vitrectomy. We did not use any antibiotic drops or systemic antibiotics before the vitrectomy, but we applied a prophylactic topical antibiotic for 5–7 days after PPV.

The surgical management of endophthalmitis consisted of pars plana vitrectomy. All patients were then treated with systemic antibiotics including IV vancomycin 1 g/BD and ceftazidime 1 g/TDS, as well as topical antibiotics including fortified vancomycin 50 mg/cc and ceftazidime 50 mg/cc and intravitreal antibiotics including vancomycin 1 mg/0.01 mL plus and ceftazidime 2.25 mg/0.01 mL. Microscopic examination and culture of undiluted vitreous was performed in all patients undergoing vitrectomy. Also antimicrobial susceptibility testing of bacterial isolates was performed.

Statistical methods

To present data we used mean, standard deviation, median and range, frequency, and percent. To compare the results between the case and control group, we used Mann–Whitney test (in ordinal variables) and Chi-square or Fisher's exact test (in nominal variables). All statistical methods were performed by SPSS Version 24.0 (Armonk, NY: IBM Corp). *p* values less than 0.05 considered statistically significant.

Results

Table 1 shows the demographic data. In total 39783 pars plana vitrectomies were performed during the 12-year period from 2004 to 2015. In total sixteen cases of endophthalmitis including 10 males (62%) and 6 females (38%) were recorded with the incidence of endophthalmitis being 0.04% (95% CI: 0.024–0.064%). The age range among patients developing endophthalmitis was 8–78 years, with a mean age of 59.31 ± 17.46 years. The time of onset of the postoperative symptoms ranged from 2 to 13 days, with a mean of 5 ± 3.4 days. One case (6%) underwent the standard 20G pars plana vitrectomy, and 15 cases (94%) underwent 23G vitrectomy, 1 of 16 cases

Table 1 Demographic findings of patients with post-vitrectomy endophthalmitis

Parameter	Values
Age	
Mean ± SD	59 ± 17
Median (range)	66 (8–78)
≤ 18	1 (6.3%)
19–35	0 (0.0%)
36–50	2 (12.5%)
51–70	10 (62.5%)
71 +	3 (18.8%)
Sex	
M	10 (62.5%)
F	6 (37.5%)
Pre-surgical visual acuity	
Mean ± SD	2.61 ± 0.47
Median (range)	2.9 (1.7–3.0)
Gauge	
23	15 (93.8%)
20	1 (6.3%)
Incision	
Straight	16 (100.0%)
Beveled	0 (0.0%)
Diabetes mellitus	
Positive	7 (43.8%)
Negative	9 (56.3%)
Tamponade	
No tamponade	9 (56.3%)
Gas	4 (25.0%)
Silicone	3 (18.8%)
IVTA	
Positive	4 (25.0%)
Negative	12 (75.0%)
Lens	
Phakic	10 (62.5%)
PCIOL	6 (37.5%)
Aphakic	0 (0.0%)
Surgeon	
Attending	15 (93.8%)
Fellowship	1 (6.3%)
Indication for vitrectomy	
Epiretinal membrane	1 (6.3%)
IOL dislocation	1 (6.3%)
Macular hole	1 (6.3%)
Nucleolus drop	0 (0.0%)
Rhegmatogenous retinal detachment	1 (6.3%)
Non-rhegmatogenous retinal detachment	2 (12.5%)

Table 1 continued

Parameter	Values
Tractional retinal detachment	3 (18.8%)
Vitreous hemorrhage	7 (43.8%)

IVTA intravitreal injections of triamcinolone acetonide

was suture less and 15 (94%) had sutured sclerotomies. Seven patients with post-vitrectomy endophthalmitis (43.7%) had diabetes mellitus. In total 15 cases were operated on by retina faculty (94%) and 1 case by retina fellows-in-training (6%). Three patients (18.7%) had silicone oil tamponade, 4 cases (25%) had gas tamponade, and 9 cases (56.3%) had no tamponade [balanced salt solution (BSS)]. Intravitreal injections of triamcinolone acetonide during PPV were performed for 4 patients (25%) and intravitreal injections of bevacizumab in 4 patients (25%). Subconjunctival antibiotic injection was performed in 12 patients (75%). Cultures were positive in 7 (44%) cases and remained negative in 9 patients (56%). The organisms identified in aqueous or vitreous cultures (culture positive 44%) included *Streptococcus pneumoniae* (two patients, 12.5%), *Pseudomonas aeruginosa* (two patients, 12.5%), fungi (two patients, 12.5%), and *Streptococcus viridans* (one patient, 6.25%). Gram-positive organisms were found in 42.85% of the culture-positive cases. Visual acuity after treatment for endophthalmitis ranged from hand motion (1 eye) to light perception (7 eye), and evisceration was performed in 8 eyes (50%).

Table 2 shows a comparison of the case and control group (patients with no complications operated in the same day and place of operation). As it can be observed only tamponade usage showed a statistically significant relation with the occurrence of endophthalmitis ($p = 0.034$), indicating a relation between endophthalmitis and not using any tamponade.

Regarding the pars plana vitrectomy using 20G or 23G methods, we did not find a statistically significant difference between these two methods regarding the rate of postoperative endophthalmitis ($p = 0.595$) (Table 2).

Discussion

Endophthalmitis is a very severe complication that can be caused by various factors [1]. Endophthalmitis after

Table 2 Comparison of the case and control group to find the probable risk factors for endophthalmitis

Parameter	Group		<i>p</i>
	Control	Case	
Age			
Mean ± SD	54 ± 17	59 ± 17	0.097 ^a
Median (range)	57 (1–85)	66 (8–78)	
≤ 18	5 (4.2%)	1 (6.3%)	
19–35	11 (9.2%)	0 (0.0%)	
36–50	26 (21.8%)	2 (12.5%)	
51–70	60 (50.4%)	10 (62.5%)	
71+	17 (14.3%)	3 (18.8%)	
Sex			
M	67 (56.3%)	10 (62.5%)	0.638 ^b
F	52 (43.7%)	6 (37.5%)	
Pre-surgical visual acuity			
Mean ± SD	2.53 ± 0.54	2.61 ± 0.47	0.558 ^a
Median (range)	2.8 (1.7–3.0)	2.9 (1.7–3.0)	
Gauge			
23	113 (95.0%)	15 (93.8%)	0.595 ^c
20	6 (5.0%)	1 (6.3%)	
Incision			
Straight	116 (97.5%)	16 (100.0%)	> 0.99 ^c
Beveled	3 (2.5%)	0 (0.0%)	
Subconjunctival			
Positive	95 (79.8%)	12 (75.0%)	0.743 ^c
Negative	24 (20.2%)	4 (25.0%)	
Diabetes mellitus			
Positive	40 (33.6%)	7 (43.8%)	0.424 ^b
Negative	79 (66.4%)	9 (56.3%)	
Tamponade			
No tamponade	33 (27.7%)	9 (56.3%)	0.034 ^c
Gas	27 (22.7%)	4 (25.0%)	
Silicone	59 (49.6%)	3 (18.8%)	
IVTA			
Positive	25 (21.0%)	4 (25.0%)	0.748 ^c
Negative	94 (79.0%)	12 (75.0%)	
Lens			
Phakic	45 (37.8%)	10 (62.5%)	0.107 ^b
Posterior chamber IOL	60 (50.4%)	6 (37.5%)	
Aphakic	14 (11.8%)	0 (0.0%)	
Suture			
Positive	115 (96.6%)	15 (93.8%)	0.473 ^c
Negative	4 (3.4%)	1 (6.3%)	
Dye			
Positive	18 (15.1%)	4 (25.0%)	0.296 ^c

Table 2 continued

Parameter	Group		<i>p</i>
	Control	Case	
Negative	101 (84.9%)	12 (75.0%)	
IVB injection			
Positive	28 (23.5%)	4 (25.0%)	> 0.99 ^c
Negative	91 (76.5%)	12 (75.0%)	
Plasmin			
Positive	0 (0.0%)	0 (0.0%)	–
Negative	119 (100.0%)	16 (100.0%)	
Surgeon			
Attending	97 (81.5%)	15 (93.8%)	0.306 ^c
Fellowship	22 (18.5%)	1 (6.3%)	
Indication			
Epiretinal membrane	5 (4.2%)	1 (6.3%)	0.998 ^c
IOL dislocation	7 (5.9%)	1 (6.3%)	
Macular hole	9 (7.6%)	1 (6.3%)	
Nucleolus drop	2 (1.7%)	0 (0.0%)	
Rhegmatogenous retinal detachment	7 (5.9%)	1 (6.3%)	
Rhegmatogenous retinal detachment	17 (14.3%)	2 (12.5%)	
Tractional retinal detachment	21 (17.6%)	3 (18.8%)	
Vitreous hemorrhage	51 (42.9%)	7 (43.8%)	

IVTA intravitreal injections of triamcinolone acetate

^aBased on Mann–Whitney test

^bBased on Chi-square test

^cBased on Fisher exact test

pars plana vitrectomy is a rare occurrence [2]. According to studies published in recent decades, the incidence of post-pars plana vitrectomy endophthalmitis varies between 0.01 and 0.86% [1, 2, 8–12]. The incidence rate in the present study (0.04%) was lower compared with some previous reports by Kunimoto et al. [9] reporting a rate of 0.23% after 25-gauge vitrectomy, Wani et al. [13] who reported a rate of 0.20% among 2965 undergoing PPV and Abi-Ayad et al. [10] who reported a rate of 0.86% among 1632 posterior vitrectomies. Our results were comparable with Eifrig et al. [8] findings regarding 15,326 patients undergoing PPV at Bascom Palmer Eye Institute between January 1984 and December 2003 who reported a rate of 0.039%, a report by Bhende et al. [11] on 111,876 vitrectomies reporting a rate of 0.04%, a report by Oshima et al. [14] on 29,030 cases of 20-gauge vitrectomy who reported a rate of 0.034%, a report by Dave et al. who reported a clinical incidence of post-vitrectomy endophthalmitis of 0.052% [15] and another report by Shimada et al. [16] who reported a rate of 0.03% among patients undergoing PPV. But our rate was higher than a report by Wykoff et al. [12], indicating a rate of just 0.011

among 18,492 patients undergoing PPV and a report by Wu et al. [17] indicating a rate of about 0.02%. These wide differences in the rate of post-PPV endophthalmitis might be related to different factors such as underlying disease causing the need for PPV, surgical technique employed, or the surgery room sterile conditions.

Most studies have report that staphylococci is the most common organism causing post-PPV endophthalmitis [1, 2, 12]. In the present study, the organisms identified in aqueous or vitreous cultures among 7 culture-positive patients included *Streptococcus pneumoniae* (two patients, 12.5%), *Pseudomonas aeruginosa* (two patients, 12.5%), fungi (two patients, 12.5%) and *Streptococcus viridans* (one patient, 6.25%), and no case of coagulase-negative staphylococci were observed.

Historically, visual acuity outcomes in patients with endophthalmitis after vitrectomy are poor possibly because of coexisting advanced vitreoretinal diseases [2]. Further, patients who have undergone pars plana vitrectomy for advanced posterior segment disease (for example, diabetic retinopathy, retinal detachment with proliferative vitreoretinopathy) often

have conjunctival congestion, reduced vision, and discomfort postoperatively, which may delay the diagnosis of endophthalmitis resulting in worse visual outcomes. Visual acuity outcomes have been reported to be better with less virulent organisms [18]. In the current series, fifteen of sixteen eyes had a final visual acuity of light perception or worse with 8 eyes undergoing evisceration. In comparison, a study by Aaberg et al. [19] reported a median visual acuity of no light perception and Kunimoto et al. [9] reported a median final visual acuity of counting fingers or hand movements (range, 20/50-no light perception). In addition to organism virulence, poor visual outcomes in the current series may be related to advance posterior segment diseases.

In the present study, 44% of patients were culture positive. In comparison, Wani et al. [13] reported that 50% of their patients were culture positive and Park et al. [20] reported 60.7% positive culture. In this retrospective study of an uncommon disease (only 16 cases of post-vitrectomy endophthalmitis during the 12-year study interval), it was not possible to identify significant predictors of developing endophthalmitis except for the method of tamponade indicating a relation between endophthalmitis and not using a tamponade. Regarding the pars plana vitrectomy using 20G or 23G methods, we did not find a statistically significant difference between these two methods regarding the rate of postoperative endophthalmitis which was in line with previous studies. For example Shimada et al. [16] did not find a difference between vitrectomies conducted using 20G or 25G methods regarding the rate of postoperative endophthalmitis.

The significance of the current study is the low incidence of post-vitrectomy endophthalmitis and the poor visual outcomes of established cases. A limitation of our study was the relatively low number of patients with endophthalmitis, which might have caused our search for risk factors of this condition compared to the control group to be less reliable.

Conclusion

The incidence of endophthalmitis after pars plana vitrectomy is low but the visual acuity outcomes after treatment are generally poor. It seems that not using tamponade might increase the risk of endophthalmitis.

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Compliance with ethical standards

Conflict of interest All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript.

Ethical approval All procedures performed in our study were in accordance with the ethical standards of the institutional and/or national research committee (ethics committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran,) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent For this type of study, formal consent is not required.

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