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10.4103/meajo.
meajo_424_20

Endophthalmitis Post Pars Plana Vitrectomy Surgery: Incidence, Organisms' Profile, and Management Outcome in a Tertiary Eye Hospital in Saudi Arabia

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Abstract:

PURPOSE: To determine the incidence of endophthalmitis after pars plana vitrectomy (PPV), organisms' profile, and management outcomes at a tertiary eye hospital in a Middle East country.

METHODS: In this single-arm cohort study conducted in 2020, medical records of patients who underwent PPV not accompanied by any other intraocular surgery were reviewed; those with a diagnosis of acute endophthalmitis in the immediate postoperative period (within 6 weeks) during the past 6 years were analyzed.

RESULTS: A total of 8153 records of PPV surgeries were reviewed. Five cases had endophthalmitis post-PPV with an incidence of 0.061%. Three (0.037%) had positive cultures, all of them for *Staphylococcus epidermidis*. The interval between PPV and diagnosis of endophthalmitis ranged from 3 to 25 days (mean, 15.8 days). Final vision after treatment ranged from 20/400 to no light perception, and one eye was eviscerated.

CONCLUSION: The incidence of endophthalmitis post PPV is low. Despite prompt diagnosis and standard management, visual prognosis seems to be poor. The infective agents for endophthalmitis were commensals from the ocular surface.

Keywords:

Endophthalmitis, intraocular infection, pars plana vitrectomy

Introduction

Infectious endophthalmitis is characterized by severe inflammation of the intraocular tissues. It is an uncommon but devastating eye infection that can follow any intraocular surgery. It can lead to severe visual loss if not treated immediately and properly either by intravitreal antibiotics or pars plana vitrectomy (PPV) and can sometimes

result in evisceration.^[1] The rate of this infection varies according to the type of intraocular surgery. Phacoemulsification is the most common ophthalmic surgery and has a reported endophthalmitis incidence of 0.04%.^[2] The incidence of acute endophthalmitis after intravitreal injections and cataract surgery in our centers in the recent past were 0.004% and 0.12%, respectively.^[3,4] A recent meta-analysis addressing the incidence of endophthalmitis after microincision PPV was 0.092%.^[5]

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How to cite this article: AlBloushi B, Mura M, Khandekar R, AlMesfer S, AlYahya A, Alabduljabbar K, et al. Endophthalmitis post pars plana vitrectomy surgery: Incidence, organisms' profile, and management outcome in a tertiary eye hospital in Saudi Arabia. Middle East Afr J Ophthalmol 2021;28:1-5.

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Received: 22-09-2020

Revised: 15-03-2021

Accepted: 19-03-2021

Published: 30-04-2021

There are few studies on endophthalmitis after microincision PPV^[6-10] and to the best of our knowledge, none in the Middle East countries. Our center, being a tertiary teaching and referral eye center, employs many retinal surgeons and subspecialist trainees; we therefore receive various complicated cases.

The purpose of our study was to determine the incidence of endophthalmitis, organisms' profile, and management outcome in eyes that underwent PPV over a 6-year period at a tertiary eye center in a Middle East country.

Methods

Study design

A singlearm retrospective cohort study was conducted in 2020 at a tertiary eye center in a Middle East country. This study was approved by the Institutional Review Board and Ethics Committee (IRB 2061R). The consent was waived by the institutional review board as it was a retrospective review of data from medical records. All tenets of the Declaration of Helsinki were strictly adhered to while conducting this study.

Records of patients who underwent microincision (23 or 25-gauge) PPV between April 2014 and December 2019 were reviewed for postoperative diagnosis of endophthalmitis and subsequent management. The information was obtained through a search of electronic medical records, crossreferencing vitreoretinal surgical pathologies managed with vitrectomy alone, and data from the infection control committee.

Patients

After reviewing all files, we included patients reported by the infection control committee to have developed severe postoperative inflammation clinically suggestive of endophthalmitis post-PPV without secondary or combined intraocular surgery (phacoemulsification, intraocular lens [IOL] implantation or explantation, intraocular foreign body [IOFB] removal, glaucoma surgery, open globe injury repair, and endophthalmitis with limbal vitrectomy, phacoemulsification with dropped lens fragments) within 6 weeks of vitrectomy. Any patient with a diagnosis of endophthalmitis before PPV or endophthalmitis secondary to PPV combined with intraocular surgery (cataract extraction, glaucoma surgery, IOFB removal, IOL explantation, or implantation) and open globe injury was excluded. All suspected cases were reviewed to ensure that endophthalmitis was associated to the pars plana procedure and that collected data meets study objectives. As per our hospital protocol, before surgery, all cases were examined to rule out any risk factors for postoperative endophthalmitis.

The data recorded from clinical charts at first presentation included patient's age, sex, comorbidities, preoperative

visual acuity, involved eye, indication for PPV, operative notes, surgical instrumentation gauge, use and type of tamponade, use of sutures and size, use of postoperative subconjunctival antibiotics, immediate postoperative notes, postoperative visual acuity, intraocular pressure, use of topical antibiotics, emergency room notes, interval between the surgery and the initial symptoms, presenting symptoms, visual acuity, slitlamp examination, culture site and resulting management, and the final visual acuity.

Surgical procedures

All surgical procedures were performed under a rigorously aseptic method using preoperative 5% povidoneiodine wash and sterile drapes that isolated the lashes. We performed 23- or 25gauge sclerotomies, and tamponade agents were given according to the baseline pathology and surgeon's discretion. Sclerotomies are closed with 7/8–8/0 vicryl based on wound integrity. We regularly used subconjunctival antibiotics (cefazolin sodium 50 mg/0.5 ml) and steroids (dexamethasone 2 mg/0.5 ml) at the end of the procedure. Postoperative medication included topical antibiotics quarter in die (QID) for 2 weeks and prednisolone acetate 1% QID tapering over 1 month.

Endophthalmitis

Clinically, endophthalmitis was diagnosed if the patient developed any of the following signs or symptoms from the immediate postop until 6 weeks after surgery: decrease in visual acuity, redness, pain, conjunctival discharge and congestion, corneal edema, anterior chamber cells, hypopyon, fibrin, and vitritis.

Culture-positive endophthalmitis was labeled if the vitreous tap had microorganism growth. If the microbiological analysis (staining/culture) was negative, then the case was considered to be culture-negative endophthalmitis.

Statistical analysis

The data of the patients with endophthalmitis after PPV were collected using a pretested data collection form and transferred to the Statistical Package for the Social Sciences (SPSS 25) (IBM, NY, USA). Univariate analysis was conducted using the parametric method. Qualitative variables were presented as frequency (%). Quantitative variables were plotted to study the distribution; if normally distributed, we calculated the mean and standard deviation, and if it was skewed for a small sample, we presented the median and interquartile range. The number of PPVs performed was used as the denominator to calculate the annual incidence rate. Final visual acuity was compared to vision noted before endophthalmitis management.

Results

At the study site, 8153 microincision pars plana procedures met the inclusion criteria. Of these, 5 patients developed clinical picture of postvitrectomy endophthalmitis. There were three men and two women with a mean age at presentation of 35 years (range, 23 months–65 years). The mean followup period was 25.2 months after treatment for endophthalmitis (range, 6–48 months). Three patients had diabetes. Three patients received silicone oil tamponade, one case had gas, and one case had air tamponade. Mean duration of surgery was 125.2 min (range 30–240). Two out of the three cases with oil tamponade had positive cultures, and all 23-gauge sclerotomies had been sutured. The interval between vitrectomy and diagnosis of endophthalmitis ranged from 3 to 25 days (mean, 15.8 days). Their clinical characteristics and indication for surgery is summarized in Table 1.

Three patients had culture growth whereas one patient did not have growth; one patient was eviscerated before culture. During the 6-year study, the overall incidence of postvitrectomy endophthalmitis was 0.061% (95% confidence interval [CI] 0; 544/10,000) and the rate of culture-proven endophthalmitis after vitrectomy was 0.037% (95% CI 0.0; 420/10,000) [Table 2].

Cultured organisms were *Staphylococcus epidermidis* ($n = 3$). All patients were treated with a tap/inject procedure with injection of intravitreal antibiotics, except one patient who was eviscerated. Of the patients treated initially with tap and injection, three required a secondary vitrectomy. Visual acuity on presentation with endophthalmitis ranged from hand motion to no light perception, with final vision after treatment ranging from 20/400 to no light perception, and one eye was eviscerated [Table 3].

Discussion

Endophthalmitis post-PPV is uncommon. In our study, the incidence of clinically evident and culture-proven

endophthalmitis after microincision vitrectomy was 0.061% and 0.037%, respectively. The incidence rate in previous studies was reported to be 0.028%–0.075%,^[6–11] while a recent meta-analysis^[5] reviewed the microincision vitrectomy subgroup data, estimating an incidence of 0.092% (52/56581) in several studies performed between 2007 and 2016. Our inclusion criteria were very restrictive, where only patients who underwent vitrectomy without other secondary procedures (e.g., phacoemulsification, IOL implantation or explantation, IOFB removal, open globe injury repair, and endophthalmitis with limbal vitrectomy) were included. Other studies excluded only posttraumatic endophthalmitis and simultaneous cataract surgery cases.^[1,6–9] One particular multicenter study,^[7] excluded all endophthalmitis cases if the surgery had been performed by fellows, potentially leading to a lower overall incidence.

Usually, patients who have undergone PPV often have conjunctival congestion, reduced vision, and discomfort postoperatively, which may result in a delay in the diagnosis of endophthalmitis. Acute development of symptoms (2–4 days) has been described.^[5,9] We found that the mean time to presentation in ER and diagnosis of endophthalmitis was of 15.8 days; a significant proportion of patients (60%) presented during their third postoperative week. As tertiary referral center, patients are admitted for surgery as inpatients and discharged only after postoperative condition is stable. However, many of our patients reside distantly and it is difficult for them to attend ER immediately once symptoms have developed.

We found 75% culture positivity in our study, which is higher than the previously reported rates of 55%–66% [Table 4]; this is most likely due to the late presentation to ER which allows for bacterial colonies to become more detectable. In our experience, vitreous samples had a culture-positive yield higher than that of aqueous samples (66.6% vs. 33.3%). On the other hand, Bhende *et al.*^[11] found that the aqueous culture-positive yield was similar to that of vitreous samples (33.3%

Table 1: Clinical characteristics and vitrectomy features of patients with postvitrectomy endophthalmitis

Case number	Age (years)	Sex	Systemic disease	Study eye	Indication of vitrectomy	Gauge	Surgical time (min)	Tamponade	Sutured sclerotomy	Interval between surgery and endophthalmitis (days)
1	42	Female	DM	OS	TRD	23	101	SF6 20%	Yes	24
2	38	Male	BA	OS	RRD	23	240	SO 1000 cs	Yes	25
3	29	Male	DM	OD	CTRRD	23	120	SO 1000 cs	Yes	3
4	65	Female	DM, HTN, dyslipidemia	OS	VH	23	30	Air	Yes	4
5	2	Male	Knobloch syndrome	OD	RRD	23	135	SO 5000 cs	Yes	23

DM: Diabetes mellitus, HTN: Hypertension, BA: Bronchial asthma TRD: Tractional retinal detachment, RRD: Rhegmatogenous retinal detachment, VH: Vitreous hemorrhage, SF6: Sulfur hexafluoride, SO: Silicon oil, cs: Centistokes, CTRRD: Combined tractional/rhegmatogenous retinal detachment, OS: Oculus sinister, OD: Oculus dextrus

vs. 35.0%). Vitreous and aqueous samples are equally important to determine the culture status.

Reports from other studies have shown coagulase negative *Staphylococcus* as the most common organism in postoperative endophthalmitis.^[7,9,12] In agreement with these previous studies, coagulase negative *Staphylococcus* was also the most common organism isolated in our cases, which is normal flora found on the ocular surface. Proper preoperative examination, intraoperative draping, and postoperative care are essential to prevent this flora from entering the eye.

Two of the three cases with silicone oil tamponade had culture positivity. Steinmetz *et al.*^[13] reported two cases of endophthalmitis in silicone-filled eyes that were treated with antibiotic injection alone. However, it was uncertain if these cases were truly infectious or just a severe postoperative inflammatory reaction to the silicone oil, as one of their cases did not have vitreous or aqueous samples, and the other case did not have growth of the aqueous sample. The higher surface tension properties of air, gas, and silicone oil have been suggested previously to decrease the risk of infection.^[9,14] However, in our study, samples from one patient with air and two with silicon oil tamponade were culture positive, which is rarely reported.

Another factor previously associated with higher risk of developing endophthalmitis has been the use of transconjunctival sutureless vitrectomy. All of our cases had been properly sutured with 7/0 vicryl. One particular study,^[9] reported a risk 25 times higher of endophthalmitis development if the sclerotomies are not sutured and a 19.5-fold increase in risk if balanced saline solution is placed as tamponade agent. They have also described the possibility of a “cluster” theory, where cases present with similar infections agents and in a close period of time. Although the same microorganism was detected in all our cases, they presented during a span of 16 months.

Most of the time, the final visual acuity outcomes in patients diagnosed with endophthalmitis after PPV are poor,^[1,7,15] which might be due to the preoperative retinal pathology and associated poor visual potential. Our

Table 2: Culture growth

	Frequency (%)	Valid percent
Valid		
No growth	1 (20.0)	25.0
Growth	3 (60.0)	75.0
Total	4 (80.0)	100.0
Missing	1 (evisceration) (20.0)	
Total	100.0	

Table 3: Culture results, site of positive culture, visual acuity and anatomical outcomes

Case number	Organism	Culture site	Initial management	Dexamethasone	Surgery required	VA before initial vitrectomy VA	BCVA at presentation	BCVA final	Follow-up period (months)	Retina condition
1	.	.	.	.	Evisceration	4/200	NLP	Evisceration	48	Evisceration
2	<i>S. epidermidis</i>	Vitreous	V + C	No	PPV	20/100	HM	20/400	24	Attached
3	<i>S. epidermidis</i>	AC	V + C	No	None	20/40	HM	HM	36	Attached
4	<i>S. epidermidis</i>	Vitreous	V + C	No	PPV + PPL	HM	NLP	NLP	6	Attached
5	No growth	AC	V + C	Yes	PPV	FF	-	Phthisis	12	Detached

AC: Anterior chamber. PPV: Pars plana vitrectomy. PPL: Pars plana lensectomy. V + C: Vancomycin + ceftazidime. S. epidermidis: *Staphylococcus epidermidis*. VA: Visual acuity. HM: Hand motion, NLP: No light perception, BCVA: Best corrected visual acuity, CF: Counting finger

Table 4: Culture positivity of micro incision postvitrectomy endophthalmitis

Study (years)	Percentage with positive culture (%)
Oshima <i>et al.</i> (2010)	63
Scott <i>et al.</i> (2011)	66.6
Wu <i>et al.</i> (2011)	62.5
Dave <i>et al.</i> (2016)	55
Lin <i>et al.</i> (2018)	66.6
Current Study	75

study provides further evidence that the outcomes after PPV are generally poor; with visual acuity ranging from 20/400 to phthisis, and one eye had to be eviscerated.

This study has few limitations. These included the retrospective nature of the study, heterogeneous indications for surgery, varied age presentation, and different operating surgeons influencing outcomes, which could not be studied due to the small subsample.

Conclusion

Postvitrectomy endophthalmitis is a rare occurrence and can be difficult to differentiate from severe postoperative inflammation. Surgeons should be aware of this, and the patient should be managed accordingly. Ocular surface flora tends to be the most common pathogen involved. The patient should be counseled about guarded visual prognosis even after successful management.

Acknowledgments

We would like to thank Muneera Alfutais, the research coordinator, for data entry and data cleaning. We would also like to thank Mrs. Elvira Mabato from the infection control committee.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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