Infectious endophthalmitis is a devastating vision-threatening condition that involves inflammation of the entire globe. The most common form of infectious endophthalmitis results from direct inoculation of an organism from outside the body (ie, exogenous, as opposed to endogenous), typically following cataract surgery, intravitreal injection, or glaucoma filtering surgery. It usually presents acutely within 3 to 21 days after the procedure.

We previously reviewed 10 years of endophthalmitis cases (n = 758) seen at a tertiary referral center and found gram-positive organisms to be the causative pathogens in 80% of cases, followed by gram-negative pathogens (11%) and fungi (9%). Specifically, coagulase-negative staphylococci was the most common class and Staphylococcus epidermidis the most common species.

With respect to endophthalmitis after intravitreal injections, the overall incidence rate is low (between 0.016% and 0.056%); however, the high volume of injections performed makes this an increasing cause of infectious exogenous endophthalmitis. In light of the increased use of intravitreal injections in recent years, this article reviews our approach to the surgical management of endophthalmitis, with the hope of imparting pearls for vitreoretinal surgeons.

The Endophthalmitis Vitrectomy Study (EVS), published in 1995, demonstrated that immediate pars plana vitrectomy (PPV) after endophthalmitis does not lead to a statistically significant difference in visual outcomes in patients with better than light perception vision at presentation. Correspondingly, over the ensuing decades, PPV for treatment of post–cataract surgery endophthalmitis has decreased in use from 26% to only 10% of cases.

ENDOPHTHALMITIS AFTER INJECTIONS

Recently, we analyzed patients developing endophthalmitis after intravitreal injection with VEGF inhibitors to compare the outcomes of immediate tap and injection (TAI) of intravitreal antibiotics versus initial surgical PPV. Reviewing 258,357 intravitreal injections performed over a 10-year period, we identified 40 patients (0.016%) who developed acute endophthalmitis. There was no statistically significant difference in visual outcomes at 6 months between initial treatment with TAI and PPV. Our study was designed to mirror the EVS, albeit in a retrospective fashion.

AT A GLANCE

► Infectious endophthalmitis is a devastating vision-threatening condition most often caused by an exogenous organism.

► Despite the low incidence of endophthalmitis after intravitreal injections, the high volume of these injections makes this an increasing cause of infectious exogenous endophthalmitis.

► The authors present their pearls for the surgical management of endophthalmitis.
Despite the importance of the EVS findings, it can be argued that the EVS data may reflect the use of older, large-gauge PPV techniques and may not be applicable to the smaller-gauge microincisional vitrectomy surgery (MIVS) techniques widely performed today. Similarly, our retrospective study of endophthalmitis after intravitreal injection may include selection bias of more severe pathology that proceeded directly to surgical intervention. Due to these confounding variables, it may be that early MIVS for endophthalmitis can be of significant benefit at removing infectious material and vitreous debris. In selected cases, surgery may improve infection clearance and optimize visual outcomes.

**Preferred Approach**

Our preferred management for infectious endophthalmitis is to, first, as soon as possible, perform a vitreous biopsy (tap) via a short 25-gauge needle on a 3-mL or 5-mL syringe. A smaller gauge needle, such as 27-gauge or 30-gauge, can be used in an eye that has already undergone vitrectomy surgery. We typically remove a vitreous sample as large as the vitreous liquefaction will allow, up to the volume of fluid that may be subsequently injected (ie, 0.2 to 0.3 mL).

This is followed by injection with intravitreal antibiotics at the pars plana in the clinic setting. The antibiotics we use most commonly are intravitreal ceftazidime 2.25 mg/0.10 mL and vancomycin 1.00 mg/0.10 mL. In patients with known serious penicillin allergy, intravitreal amikacin 400 µg/0.10 mL can be considered. Intravitreal dexamethasone 400 µg/0.10 mL is also sometimes considered when there is a significant inflammatory component and when the suspicion for atypical organisms is low.

If no clinical improvement is seen in symptoms, vision, and/or examination, we typically perform PPV within 48 to 72 hours of initial presentation with the idea that the vitreous acts as a culture medium for microorganisms to proliferate.

**Surgical Technique**

Our surgical technique for endophthalmitis includes a three- or five-trocar setup using three standard pars plana trocar-cannulas with or without two anterior corneal limbal trocar-cannulas (Figure 1). The latter two ports are typically necessary in eyes with severe endophthalmitis that have significant anterior segment inflammatory reaction and/or media opacity. The anterior infusion line is especially important when an anterior chamber washout is necessary. Similarly, a second anterior limbal cannula is useful for secondary instrumentation to remove fibrin and inflammatory membranes with the vitreous cutter and/or small gauge retinal
Inflammation of the anterior segment and media opacity can be barriers to an early safe and effective PPV due to poor visualization of the posterior pole. In this event, limbal vitrectomy is the preferred platform to perform anterior chamber membrocleotomy to remove membranes and improve visualization before vitreous removal (Figure 2). Care should be taken to avoid trauma to the iris, which may cause hyphema and lead to a suboptimal view of the posterior pole.

A small amount of hemorrhage may be seen from iris neovascularization after capsular membrane removal, making the view of the posterior pole increasingly challenging (Video). When the media clarity is improved and the posterior pole can be better visualized, the balanced saline solution infusion line can be reinserted to the conventional inferotemporal pars plana cannula, and a posterior vitrectomy can then be performed. In cases in which the pars plana infusion still cannot be optimally visualized, a posterior vitrectomy can be performed with the infusion line connected to the limbal anterior infusion cannula.

In aphakic eyes, posterior segment vitrectomy can be easily performed with only the limbal trocars in place, without the need for pars plana access. We recommend preoperative B-scan ultrasound imaging to confirm whether the retina and choroid are attached for 360° to ensure safe entry with the pars plana instrumentation.

After PPV, we typically leave the vitreous cavity fluid-filled; however, the choice of tamponade agent can also include air, nonexpansible gas, or silicone oil as needed. We typically avoid using air or gas because it often easily escapes into the anterior chamber, unless the case is complicated by retinal breaks or retinal detachment. Use of valved limbal cannulas in the anterior chamber can help to minimize any regurgitation of gas into the anterior chamber if this is necessary or anticipated.

A compressible medium such as air or gas in the anterior chamber can limit postoperative visualization or lead to elevated IOP due to pupillary block or, in some cases, angle closure.10 Moreover, in instances in which there is shallowing of the anterior chamber angle, unstable IOL–capsular bag complexes found in post–cataract surgery endophthalmitis may undergo significant displacement under air or gas. When atypical organisms are encountered, with severe progressive infection, inflammation, or hypotony, silicone oil can provide a stable, long-acting tamponade.

Endoscopic vitrectomy can facilitate visualization of the vitreous cavity in the setting of poor visibility due to significant inflammation or anterior segment opacification. Several studies have shown the utility of endoscopic techniques with favorable outcomes in recalcitrant cases.11–13 Although this requires additional endoscopic equipment and familiarity with the endoscopic technique, it may provide a useful alternative surgical option in eyes with inadequate anterior segment visualization or advanced anterior segment scarring.

**SHARING STRATEGIES**

PPV for acute infectious endophthalmitis can be challenging due to severe inflammation in the anterior chamber, which creates significant media opacity. The surgical pearls and surgical techniques presented here are meant to help retina surgeons manage acute infectious endophthalmitis in a safe and efficacious manner.

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**REFERENCES**


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