

Reducing Endophthalmitis in Vitrectomy

Recommendations from the Microsurgical Safety Task Force

BY RICHARD S. KAISER, MD

The trend in ophthalmic surgery in recent decades has been toward smaller instrumentation used through smaller incisions. The goal is to enhance patient safety by inducing less trauma to the eye, while at the same time resulting in faster postoperative healing and decreased patient discomfort because of the reduced size of the wound. This trend has been seen in cataract surgery, with the progression from intracapsular to extracapsular cataract extraction and then to phacoemulsification through a sutureless wound. Similarly, retina surgeons have recently begun to adopt smaller instrumentation that can be used through smaller, sutureless incisions.

Traditionally, vitrectomy procedures were performed with 20-gauge instrumentation. The surgeon created three sclerotomies at the pars plana, and sutures were used to close each entry point at the conclusion of surgery. In the past several years, however, microincisional vitrectomy has gained wide acceptance by retinal surgeons. In microincisional surgery, either 23- or 25-gauge instrumentation is used to perform the vitrectomy procedure. Instead of sclerotomies, three cannulae are inserted through the sclera, conjunctiva, and pars plana, through which the surgeon has access to the vitreous cavity. At the close of a microincisional surgical procedure, the cannulae are removed, and the wounds are typically massaged to enhance self sealing, but no sutures are used.

The sutureless techniques in vitrectomy have undoubtedly introduced benefits, including a more comfortable operative experience for the patient and the surgeon and faster recovery and wound healing postoperatively for the patient. With increased experience with the instrumentation, the indications for its use have grown, and the spectrum of diseases that can be addressed has expanded.¹⁻³

COMPLICATIONS CONCERNS

As the use of smaller-gauge vitrectomy techniques has grown, however, concerns have begun to emerge that sutureless vitrectomy may be associated with an increased incidence of postoperative complications. Reported compli-

cations have included hypotony, choroidal detachment, and endophthalmitis.⁴⁻⁷ Endophthalmitis is such a rare event, however, that, even when it is occurring more frequently, this might not be noticed in small numbers of cases; one must look at a large series of cases to appreciate the increase.

In a review of 2 years' worth of medical records at several U.S. and European institutions, Scott and coworkers⁶ identified 11 cases of endophthalmitis among 1,307 patients who underwent 25-gauge vitrectomy (0.84%), compared with two cases among 6,375 patients who underwent 20-gauge vitrectomy (0.03%; $P < .0001$).

We performed a review of 8,601 consecutive pars plana vitrectomy cases performed at Wills Eye Hospital from January 2004 through August 2006.⁷ Twenty-gauge instrumentation was used in 5,498 cases, and 25-gauge in 3,103 cases. The overall incidence of postoperative endophthalmitis in the series was 0.09%. In the 20-gauge surgeries, one case of endophthalmitis (0.018%) was identified, compared with seven (0.23%) in the 25-gauge surgeries ($P = .004$).

This amounted to a 12.4 times greater risk of endophthalmitis in the sutureless 25-gauge cases than in the 20-gauge cases. The difference was statistically significant and clinically very relevant.

MICROSURGICAL SAFETY TASK FORCE

In response to the concerns raised by these studies, the Microsurgical Safety Task Force (MIST), a group of thought leaders in the field of posterior segment ophthalmic surgery, was convened. The MIST members, all with extensive experience in small-gauge vitrectomy surgery, were brought together for round-table discussions regarding the best approaches to sutureless surgery. Topics of discussion included preoperative, perioperative, and postoperative procedures, all with the goal of potentially minimizing the risk of postoperative endophthalmitis. The findings of the MIST panel were presented last year at the Retina Subspecialty Day preceding the Annual Meeting of the American Academy of Ophthalmology.⁸

Endophthalmitis and Sutureless Vitrectomy

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Postoperative endophthalmitis following ophthalmic surgery remains rare with an incidence of approximately 0.1%.¹ Scott et al² and Kunimoto et al³ both reported an increased rate of endophthalmitis following 25-gauge pars plana vitrectomy (PPV) compared with 20-gauge PPV. We retrospectively reviewed a total of 1,906 consecutive eyes that underwent 25-gauge PPV, and 2642 consecutive eyes that underwent 20-gauge PPV between January 1, 2004 and September 1, 2007.⁴ During the 46 month study interval the incident rate of 25-gauge post-PPV endophthalmitis was 0.053% (1/1906), whereas the rate of 20-gauge post-PPV endophthalmitis was 0.076% (2/2642) ($P=1$, Fisher exact test, 2-tailed).

The possibility of increased risk for intraocular infection has been suggested due to the sutureless nature of the conjunctival and scleral entry sites, which may allow for persistent fluid egress across the wound and potential influx of bacteria pathogens into the vitreous cavity. Scott et al² and Kunimoto et al³ did report an increased rate of endophthalmitis following 25-gauge PPV. However, the authors noted that leaking sclerotomies were a potential predisposing factor, and that the majority of 25-gauge cases were performed with non-beveled wounds. Non-sutured cataract wounds may allow entry of organisms predisposing to endophthalmitis. It has been shown in human cadaveric eyes that fluctuations of intraocular pressure following sutureless cataract surgery may allow surface fluid to enter the anterior chamber during initial postoperative period.⁵ The same may be true for sutureless PPV sclerotomies and the vitreous cavity as well.

The majority of 25-gauge PPV cases in our study had 30° incision angle, which increases the length of the scleral tunnel, allowing for a more water-tight wound. To overcome the potential complication of postoperative hypotony and wound leakage, the conjunctiva was displaced while introducing the 25-gauge trocar and canula in an angled plane at the initiation of surgery. We believe that the main factor responsible for postoperative endophthalmitis in sutureless PPV is a leaking sclerotomy

with or without hypotony. It is of paramount importance that an angled incision be performed to prevent postoperative leak and hypotony. We recently reviewed 290 consecutive eyes undergoing macular surgery with sutureless PPV and found our rate of postoperative intraocular pressure (IOP) less than 6 mm Hg to be only 2%, with normalization of IOP in all cases within 1 week. We believe proper wound sclerotomy construction is the primary reason for a low rate of endophthalmitis following sutureless PPV.

This study demonstrated that acute postoperative endophthalmitis is a rare complication after 25-gauge sutureless PPV, and found no statistical difference between 20-gauge and 25-gauge endophthalmitis rates in the study population. Potential explanations for our study's low rate of endophthalmitis following 25-gauge PPV may relate to the following: meticulous wound construction using 30° angled entry, examining and removing vitreous wicks from sclerotomies, and closely inspecting for a water-tight sclerotomy following canula removal with utilization of suture closure if needed.

In summary, we believe endophthalmitis following sutureless PPV is comparable to 20-gauge PPV. Proper wound construction may be the primary factor involved in preventing postoperative endophthalmitis in sutureless PPV.

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The MIST findings were not scientific, although they were evidence-based where possible. Mostly, however, they were recommendations based on years of experience among recognized and accomplished surgeons. The goal of MIST was to disseminate these guidelines and suggestions in the hope that they may help to lower the incidence of endophthalmitis.

A summary of some of our recommendations follows.

Preoperative: Eye preparation. It has long been known that topical application of povidone-iodine to the conjunctiva is the most effective method of eliminating bacteria from the surgical field. The value of povidone-iodine prep was demonstrated in cataract surgery almost 20 years ago.⁹ However, there was no consensus among the panel members on when or how povidone-iodine should be applied in vitrectomy surgery.

Wound Construction: Conjunctival Displacement. The panel agreed that the conjunctiva should be displaced at the wound sites before insertion of the trocars. When the conjunctiva is moved slightly to the side, the holes in the conjunctiva and sclera are not juxtaposed postoperatively, so there is no direct route from the surface into the vitreous cavity. A cotton-tipped swab can be used to displace the conjunctiva without tearing the tissue and can also serve to stabilize the eye during trocar insertion. Sharp instruments may puncture or make microholes in the conjunctiva.

Wound Construction: Beveled Incision. The panel agreed that trocar insertion should ideally be on an angle so that the wound forms a tighter seal postoperatively. Angled incisions in cataract surgery have been shown to have advantages over perpendicular incisions in regard to preventing ingress and egress from the wound.^{10,11} Angled incisions can help maintain intraocular pressure (IOP) in the early postoperative period, preventing hypotony and entry of infectious agents into the eye from the ocular surface.

Case completion: Tamponade. In the Wills series, all eyes that developed endophthalmitis were left with a fluid-filled vitreous cavity at the end of surgery. That is, no tamponade of air, gas, or silicone oil was used. It was felt that this trend might indicate an increased risk of endophthalmitis in eyes left fluid-filled at the conclusion of the case. Air and gas tamponade are traditionally used for particular types of procedures, not universally for all vitrectomies. Some panel members felt that filling the eye with air routinely at the end of surgery would help to maintain IOP in the early postop period, possibly limiting the entry of fluid into the eye. Whether an air fill is used or not, all cases should end with a tight wound and normal IOP.

Case Completion: Avoiding Vitreous Incarceration. The panel agreed that it is important to minimize vitreous incarceration in the wound at the end of the case. Vitreous can act as a wick for infection, allowing surface bacteria through the wound into the intraocular environment. Trocar

removal is a crucial step when vitreous strands can be pulled out through the wound. Mechanically pushing the vitreous back into the eye, for instance with a light pipe inserted through the lumen of the trocar while the trocar is extracted, can help minimize the incarceration of vitreous. This can be followed by massage of the incision with a cotton-tipped swab or a muscle hook to help the vitreous contract back into the eye.

Postoperative: Antibiotics. The panel's general consensus was that postoperative subconjunctival and topical antibiotics should be used. Retinotoxic antibiotics such as gentamycin should be avoided because they can potentially enter the eye through the wound.

CONCLUSION

Large retrospective series suggest that there is a statistically significant difference in endophthalmitis rates between sutured and sutureless vitrectomy. Until a large prospective trial to test this hypothesis is designed and carried out, surgeons must use their best judgment when employing the evolving techniques of 23- and 25-gauge sutureless surgery. The MIST members do not suggest that 25-gauge sutureless surgery is unsafe or has no advantages over 20-gauge surgery. Rather, the panel hopes that its suggestions will spur surgeons to innovate and find ways to make this increasingly common mode of vitreoretinal surgery safer and more effective. ■

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