

Optimizing MIGS Outcomes



Tips and tricks for improved surgical results.

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Microinvasive glaucoma surgery (MIGS) has carved out a niche in the glaucoma treatment algorithm, fulfilling a previously unmet need for safer glaucoma surgery that can be offered to patients with less severe disease. As the adoption rate grows and new devices come to market, many surgeons want to know how to optimize MIGS outcomes to provide a high level of safety and efficacy to patients.

PATIENT SELECTION

Appropriate patient selection is key to the success of any glaucoma surgery. Even trabeculectomy outcomes can look dire when performed in inappropriate cases, such as in aphakic eyes or patients with neovascular glaucoma.

In terms of safety and efficacy, not all MIGS devices are created equal. On one end of the spectrum, trabecular bypass devices and procedures have high safety profiles but are modest in their effects.¹ On the other end, subconjunctival devices are potentially as effective as trabeculectomy

but can result in more severe complications, such as bleb-related infections.² Hence, the MIGS surgeon must weigh the importance of safety versus efficacy in each patient and select the most suitable device.

TRABECULAR BYPASS PROCEDURES

The learning curve for certain trabecular bypass procedures is steeper than that for other MIGS devices, although it is certainly not insurmountable. The primary challenges for

the MIGS surgeon include (1) ensuring accurate access to Schlemm canal and (2) targeting areas of Schlemm canal with the highest concentration of collector channels. In eyes with raised episcleral venous pressure (eg, carotid-cavernous sinus fistula), trabecular bypass procedures invariably yield disappointing outcomes and should therefore be avoided.

Inadequate placement of the device in Schlemm canal is a common cause of poor surgical outcomes for

AT A GLANCE

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- ▶ The MIGS surgeon must weigh the importance of safety versus efficacy in each patient and select the most suitable device.



Figure 1. Gonioscope photograph of two iStents showing superficial placement of the inferior stent as evidenced by visible retention arches. The superior stent is well placed in Schlemm canal, and the retention arches are obscured by the pigmented trabecular meshwork.

trabecular bypass procedures (Figure 1). It is important to master gonioscopy to obtain good visualization of the angle structures during surgery and to select an appropriate gonioscopy lens to attain the desired high magnification. The surgeon must find the right combination of head and microscope tilt to optimize the view of the angle and master the ergonomics of hand positioning required to facilitate proper insertion of instruments for surgical manipulation.

It is important to avoid over-presurizing the eye with an ophthalmic viscosurgical device (OVD), as this can collapse Schlemm canal and result in superficial placement of the trabecular bypass device (Figure 1). Conversely, under-filling the eye with OVD predisposes the eye to corneal distortions during surgery. When the device is correctly placed, blood reflux from the canal can result in postoperative hyphema. Leaving the eye firm at the end of surgery with watertight corneal wound closure minimizes the risk of bleeding.

In some eyes, Schlemm canal is discontinuous and obstructed in

sections, with the collector channels draining to large aqueous veins concentrated only in certain sections of the canal.³ For the best surgical outcomes, it is crucial to target the MIGS device to these large aqueous veins. Trabecular bypass devices such as the iStent (Glaukos) access only a limited section of Schlemm canal; therefore, it is important to target these devices to the areas with the highest concentrations of collector channels.

Blood reflux in Schlemm canal is a useful tool to identify areas that correspond to aqueous vein drainage. Reflux can be elicited by decompressing the eye briefly. Trypan blue dye (Vision Blue, DORC International) can be injected in the anterior chamber at the end of surgery to verify correct implant placement and give the surgeon an opportunity to adjust the placement (Figure 2). In the near future, optical coherence tomography (OCT) technology may allow precise preoperative localization of collector channels and aqueous veins.⁴

The Hydrus implant (Ivantis) and Trabectome (NeoMedix) access wider

areas of Schlemm canal, increasing the likelihood of accessing an aqueous vein; therefore, targeted placement is not so crucial with these devices. To access more collector channels and aqueous veins with the Trabectome, use of a wider arc of ablation is recommended.

SUBCONJUNCTIVAL DEVICES

The basic principles of conjunctival surgery apply when implanting subconjunctival MIGS devices. The surgeon should select patients with healthy conjunctiva in the target quadrant and avoid using these devices in aphakic eyes, those with intraocular silicone oil, or those with previously failed filtering procedures.

In eyes with significant conjunctival toxicity from use of multiple glaucoma drops, consider substituting oral acetazolamide for topical medications 1 month before surgery to decrease ocular surface inflammation. Preoperative topical steroids for 1 week before surgery may also be beneficial in these patients.

Mitomycin C (MMC), although not licensed for use with these devices, is routinely used to minimize conjunctival scarring and increase the rate of surgical success. The concentration of MMC used should be balanced against the risk of developing avascular and cystic blebs that could be susceptible to infection.² In eyes with significant conjunctival inflammation, a higher concentration of MMC may be required; this has been shown to be associated with lower postoperative IOPs and reduced numbers of glaucoma medications compared with lower concentrations.⁵

Postoperative management is more complex with subconjunctival devices than with trabecular bypass or supraciliary devices. The frequency of topical steroid eye drops should be titrated according to the severity of conjunctival inflammation, with a higher frequency required in the immediate postoperative period. The

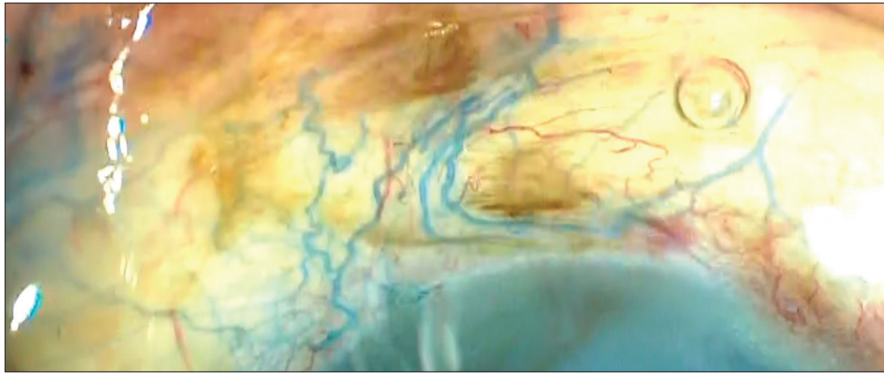


Figure 2. Anterior segment photograph of an eye with two well-placed iStents. Injection of trypan blue dye in the anterior chamber clearly delineates the aqueous veins.

frequency of topical steroids can subsequently be gradually tapered when inflammation decreases.

Patients of African or Asian descent and eyes with significant conjunctival inflammation are more prone to scarring.⁶ Hence, these eyes may require a prolonged duration of topical steroids, up to several months, and this may be augmented with periodic subconjunctival steroid injections. Bleb needling with concurrent antimetabolite injection should be performed judiciously when the IOP exceeds the target IOP as a consequence of conjunctival scarring. Approximately 40% of eyes require needling after Xen Gel Stent (Allergan) implantation (Figure 3).^{2,6} A significant proportion of these eyes require more than one needling procedure.² If the subconjunctival scarring around the implant is extensive, bleb revision with dissection of Tenon capsule is advisable. This procedure, performed in the OR, is more likely to be successful than needling done at the slit lamp.²

Xen. Before implantation of this device, intra-Tenon hydroexpansion should be performed, with MMC injected 5 to 8 mm posterior to the limbus. Ideally, injection of MMC under Tenon capsule limits its spread to the limbus anterior to the Tenon insertion, which would predispose to anterior blebs that are more likely to cause bleb dysesthesia. Gonioscopic guidance with an indirect gonioscopy

lens during Xen implantation allows precise placement of the implant just anterior to Schlemm canal, avoiding blood reflux and postoperative hyphema as well as damage to the iris and ciliary body.

Optimal Xen placement is 1 mm in the anterior chamber, 2 mm in the intrascleral space, and 3 mm in the subconjunctival space to facilitate the formation of a more posterior bleb. Because the Xen is implanted via an ab interno approach, the absence of conjunctival and Tenon dissection makes the implant susceptible to obstruction by Tenon capsule. Therefore, it is

crucial to ensure that the implant is fully mobile underneath the conjunctiva after insertion. Primary needling should be performed if the stent is noted to be immobile or curled.

In a small proportion of eyes, significant peritubular aqueous outflow may result in early postoperative hypotony. These eyes can be identified with intracameral injection of dye to visualize the speed of aqueous outflow. A small amount of a dispersive OVD (0.10 to 0.15 mL) may be injected into the anterior chamber at the end of surgery to reduce the occurrence of postoperative shallow anterior chamber in such eyes with significant peritubular aqueous outflow. Conversely, cohesive OVD should be completely removed from the eye to prevent an IOP spike.

InnFocus MicroShunt. The InnFocus MicroShunt (Santen) is implanted via an ab externo approach with conjunctival and Tenon dissection and is therefore associated with a lower rate of postoperative needling.⁷ The creation of a wide 6-to-8-mm peritomy with a deep sub-Tenon pocket and a large area of conjunctival dissection facilitates the formation of a large diffuse bleb that extends posteriorly. The surgeon should insert MMC-soaked

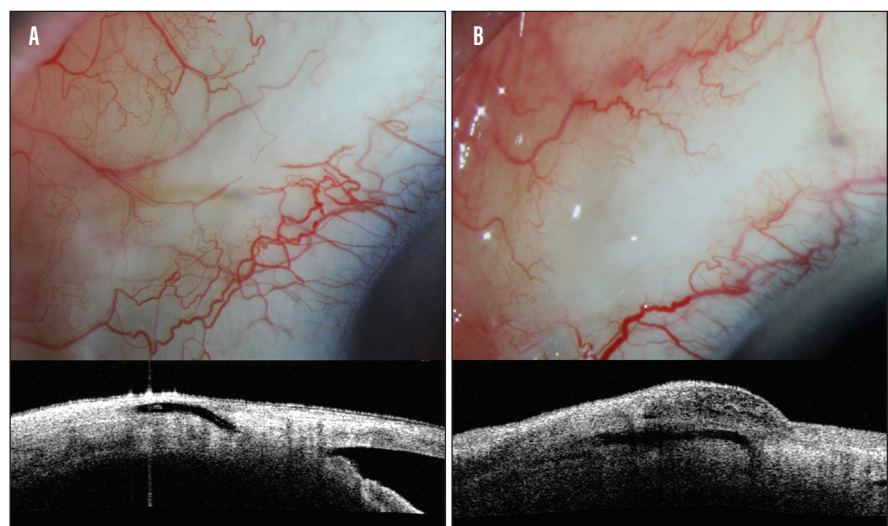


Figure 3. Anterior segment photograph of an eye 6 months after Xen implantation with a scarred bleb and an IOP of 26 mm Hg (top). The corresponding anterior segment OCT scan shows the cross-section of the implant with a flat bleb (bottom) (A). Anterior segment photograph of the same eye 1 month after bleb needling, with an IOP of 12 mm Hg (top). The corresponding anterior segment OCT scan shows an increase in bleb height with microcysts in the bleb wall (bottom) (B).

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sponges posteriorly into the sub-Tenon pocket over as wide an area as possible to optimize the surgical outcome.⁷ The InnFocus MicroShunt bleb is often diffuse and extends posteriorly, with a desirable bleb morphology that is more predictable than a trabeculectomy bleb. Inserting the fin of the device securely into the scleral pocket helps avoid peritubular flow and minimize the occurrence of postoperative hypotony.

It is important to ensure that the distal end of the InnFocus MicroShunt is not occluded by Tenon capsule when it is tucked underneath the capsule. This can be verified either by direct visualization or by confirming that the implant is freely mobile under the conjunctiva at the end of surgery. Finally, meticulous conjunctival closure is required to prevent postoperative bleb leaks, although the incidence of this complication is lower than with trabeculectomy.⁷

SUPRACILIARY DEVICES

Similar to trabecular bypass devices, supraciliary devices such as the CyPass Micro-Stent (Alcon) are more appropriate for patients with mild to moderate glaucoma, achieving postoperative IOPs in the midteens. However, supraciliary devices are associated with a higher incidence of complications compared with trabecular bypass devices. Significant IOP elevation after the implantation of the CyPass Micro-Stent has been reported in 4% to 11% of eyes, precluding its use in advanced glaucoma.^{8,9}

To decrease the incidence of early postoperative hypotony, consider stopping glaucoma medications 1 month before surgery in eyes with mild glaucoma. The frequency and duration of topical steroids after CyPass insertion is similar to that after cataract surgery. If IOP is elevated, prostaglandin analogues are preferred over aqueous suppressants so as to maintain the supraciliary aqueous lake.

Although supraciliary aqueous drainage has the potential to significantly reduce IOP, scarring around the device limits its efficacy. OCT imaging of the aqueous lake around the device may help predict subsequent IOP rise,¹⁰ although more data are required to verify this approach. Unlike subconjunctival drainage, which is amenable to needling procedures and antimetabolite treatment, scarring in the supraciliary space cannot currently be modulated. Future iterations of supraciliary MIGS devices should explore the safety and feasibility of delivering antiscarring or glaucoma medications to this region.¹¹

CONCLUSION

With emergence of more MIGS devices and the increasing rate of adoption worldwide, it is important to ensure that surgeon training keeps pace with the growth of this space. Although the surgical techniques for some MIGS devices may appear deceptively simple, awareness of these surgical nuances is crucial to ensuring best outcomes. ■

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