

PEDIATRIC MIGS

Can microinvasive glaucoma procedures mitigate complications in children?

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The primary pathology in pediatric glaucoma differs from that of most types of adult-onset primary open-angle glaucoma. For this reason, the treatment algorithm used to manage adults with primary open-angle glaucoma

is not always appropriate for the care of children with the disease. In pediatric patients, the primary pathology is at the trabecular meshwork, whereas the downstream collector channels more often contribute to increasing outflow resistance in adults. Schlemm canal-based surgery is the treatment of choice for most children with congenital glaucoma because of its high success rate and low risk of complications (Figures 1 and 2).

WHEN ANGLE SURGERY FAILS

When angle surgery fails in pediatric patients, glaucoma drainage device (GDD) surgery and trabeculectomy with mitomycin C may be considered. Although they have reasonable success rates in children, these procedures carry greater risks and are more challenging to perform in this population.

Trabeculectomy success rates range from 50% to 87% in patients with congenital glaucoma and juvenile open-angle glaucoma.¹⁻⁵ The wide variability in outcomes is likely a result of challenges with postoperative care, including suture lysis/removal as well as the robust healing response that is typical in children. Another major concern with performing trabeculectomy on pediatric patients is the higher rates of bleb-related infection and hypotony.¹⁻⁵

GDD placement has reported success rates between 33% and 93% beyond 1 year of follow-up in children.⁶ Tube malposition and migration/retraction are more common in pediatric than adult patients, because children's eyes are often buphthalmic and have reduced scleral rigidity. Pars plana tube placement may be preferred in cases where anterior chamber placement is not ideal. Even when a complete pars plana vitrectomy with shaving of the vitreous base is performed, there is still the risk of tube obstruction (occlusion after hyaloid detachment), retinal detachment, and anterior membrane formation. In addition, strabismus/diplopia with GDD surgery is always a concern, as is progressive capsular fibrosis necessitating additional GDD placement.⁶

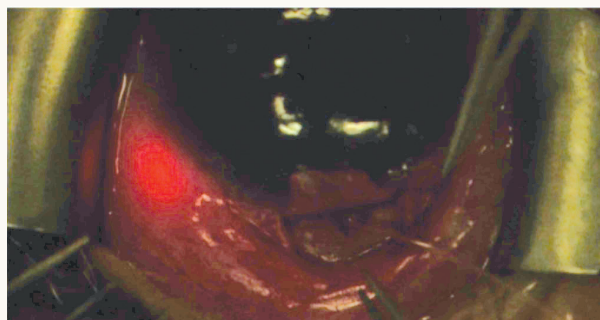


Figure 1. Microcatheter being passed within Schlemm canal. The illuminated tip helps to ensure that the microcatheter is in the correct location as it is passed circumferentially.



Figure 2. A nylon suture is used initially to locate the entrance to the canal. This is often the most challenging part of the case, because the canal has a diameter of only 200 to 300 μm .

AN ALTERNATIVE APPROACH TO THE ANGLE

The development of microinvasive glaucoma surgery (MIGS) is a response to the risks of traditional glaucoma surgeries in the adult population. These procedures are minimally traumatic to the targeted tissue, have a high safety profile, and can be performed through a microinvasive approach. Many of the approved devices are designed to treat ocular hypertension and mild glaucoma by enhancing physiologic outflow.

Children with glaucoma often have advanced disease, and their distorted anterior segment anatomy may make stent placement of any kind (Schlemm canal or supraciliary space) unfeasible. For these reasons, the adoption of devices and new

surgical techniques that complement traditional angle-based procedures (goniotomy and trabeculotomy) is more likely to increase in the near future. If the view permits, surgeons can use the Trabectome (NeoMedix) and the Kahook Dual Blade (New World Medical) in the same way that they use a 23-gauge needle to perform a goniotomy, and the Trab360 (Sight Sciences) functions as a more efficient trabeculotome. Gonioscopy-assisted transluminal trabeculotomy is another MIGS procedure that can be effective in treating childhood glaucoma.⁷ After performing a goniotomy, the surgeon pulls the illuminated microcatheter through Schlemm canal to create a 360° cleft. As with the Trab360, gonioscopy-assisted transluminal trabeculotomy is performed via an ab interno approach and spares the conjunctiva.

CREATING A BETTER BLEB WITH LESS RISK?

Other new devices such as the InnFocus MicroShunt (Santen; not FDA approved) and the Xen45 Gel Stent (Allergan) may have a role in pediatric glaucoma surgery, but further evaluation is required. The implants are small: the MicroShunt is 8.5 mm with a 70- μ m lumen, and the Xen is 6 mm with a 45- μ m lumen. Both devices shunt fluid directly from the anterior chamber to the subconjunctival space and are potentially a safer option than traditional glaucoma surgery when angle surgery fails (Figure 3).



AT A GLANCE

- The treatment algorithm used to manage adults with primary open-angle glaucoma is not always appropriate for the management of pediatric glaucoma, because there are differences in disease pathology.
- When angle surgery fails, glaucoma drainage devices and trabeculectomy with mitomycin C may be considered. Although they have reasonable success rates in children, these procedures carry greater risks and are more challenging to perform in this population.
- Children with glaucoma often have advanced disease, and their distorted anterior segment anatomy may make stent placement of any kind (Schlemm canal or suprachoroidal space) unfeasible. For these reasons, the adoption of devices and new surgical techniques that complement traditional angle-based procedures (goniotomy and trabeculotomy) is more likely to increase in the near future.
- Microinvasive implants may have a role in pediatric glaucoma surgery, but they require further evaluation. One of the biggest challenges in pediatric glaucoma surgery is dealing with children's robust healing response.

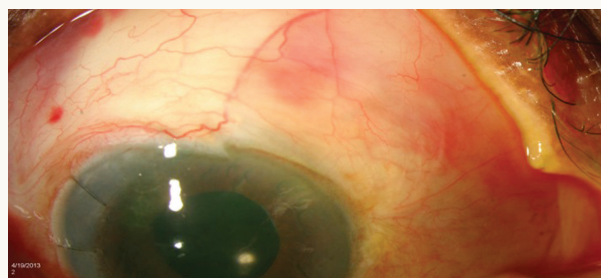


Figure 3. Bleb in an eye with a Xen45 Gel Stent. These blebs tend to be more diffuse and posteriorly directed. Although this device is currently used in adults, it could possibly be used in place of traditional glaucoma surgery in children.

Although these procedures require the use of mitomycin C, they offer several advantages over GDD surgery and trabeculectomy, including a lower potential risk of hypotony due to the implants' small luminal diameter, shorter implantation time, and relatively little postoperative management. Both devices are constructed from a material that is well tolerated by the body, but this does not guarantee that they will be effective in children, given their vigorous healing response.

CONCLUSION

Although glaucoma surgeries have evolved over the past few decades, many are still challenging to perform in the pediatric population and are associated with great risk. Ophthalmologists therefore continue to look for better options. Some of the MIGS procedures that are available or in development may be suitable for use in children, now and in the years to come. ■

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