Advice on Glaucoma Drainage Devices

Technical pearls and advice on selecting a device for tube shunt surgery.

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Thanks to recent research such as the Tube Versus Trabeculectomy (TVT) Study, the popularity of glaucoma drainage devices (GDDs) as initial surgical therapy for glaucoma is rising even in eyes with strong visual potential and patients who are considered to be good candidates for trabeculectomy. All GDDs drain fluid through a silicone tube that is attached to a silicone or polypropylene explant or plate.1,2 The surface area of the plate, plate material, and presence of a valved mechanism are the main differences between GDDs.3

At present, surgeons use four main tube shunts: Ahmed Glaucoma Valve (New World Medical, Inc.), Baerveldt (Abbot Medical Optics Inc.), Krupin Eye Valve (Hood Laboratories), and Molteno (Molteno Ophthalmic Limited).3,4 Interest has been rising, however, in the newly introduced Molteno 3 (Molteno Ophthalmic Limited; see A New Glaucoma Drainage Device).

RESEARCH

Five-Year Results of the TVT Study

The TVT Study compared the results of a 350-mm² Baerveldt glaucoma implant to those of trabeculectomy using mitomycin C (0.4 mg/mL for 4 minutes) in 212 eyes with medically uncontrolled glaucoma.5 Five-year data show that the tube shunt group had a lower probability of failure than the trabeculectomy group (29.8% vs 46.9%). The IOP at 5 years was similar in both groups (14.4 mm Hg in the tube group and 12.6 mm Hg in the trabeculectomy group), and both treatment arms required a similar number of glaucoma medications postoperatively (1.4 and 1.2, respectively).

It had previously been suggested that the IOP after tube shunt surgery typically settles in the mid- to upper teens, but the results of the TVT Study suggest that this modality achieves a similar IOP to trabeculectomy. According to subgroup analysis, 63.9% of eyes in the tube shunt group had an IOP of 14 mm Hg or less 5 years postoperatively.

Studies Comparing the Ahmed and Baerveldt Implants

Two studies have compared the failure rates and safety of the Ahmed Glaucoma Valve model FP-7 and the Baerveldt 350-mm² glaucoma implant. The Ahmed Baerveldt Comparison (ABC) Study assessed 276 patients with refractory glaucoma who had previously

A NEW GLAUCOMA DRAINAGE DEVICE

The Molteno 3 (Molteno Ophthalmic Limited) is available as a 175- or 230-µm single plate. The thin profile of this polypropylene shunt makes it more flexible than the original Molteno tube shunt. The Molteno 3 is a dual-chamber implant, with a superior subsidiary ridge that restricts flow to the main chamber until the IOP is high enough to overcome the valved mechanism. It thus avoids early hypotony and promotes a thinner bleb. The secondary subsidiary ridge prevents glaucomatous proinflammatory aqueous from developing a thick encapsulated bleb over the plate, which leads to a lower IOP and reduces the need for postoperative hypotensive medication.
undergone a trabeculectomy for secondary glaucoma. One year after tube shunt surgery, the Baerveldt group had a lower IOP than the Ahmed group (13.2 vs 15.4 mm Hg), had a lesser need for additional surgery, and used a lower number of glaucoma medications (1.5 vs 1.8). The incidence of early and serious postoperative complications (hyphema, occlusion of the tube, corneal edema), however, was more common in the Baerveldt group.

The Ahmed Versus Baerveldt (AVB) Study evaluated 238 patients with uncontrolled refractory glaucoma. One year postoperatively, the Baerveldt group had a lower IOP than the Ahmed group (13.6 vs 16.5 mm Hg) and used fewer glaucoma medications (1.2 vs 1.6). The Baerveldt group required more postoperative interventions such as manipulation of the tube, paracentesis, and phacoemulsification.

**OUR APPROACH**

**Trabeculectomy or Tube Shunt?**

For patients with advanced open-angle glaucoma who have elevated IOP that is not controlled by maximal tolerated medical and laser therapy, our initial surgical procedure of choice is still a trabeculectomy with mitomycin C. In cases where one or two trabeculectomies have already failed or if the patient has neovascular or uveitic glaucoma, we consider a GDD with a scleral patch graft.

**How We Determine Which Shunt to Use**

In our practice, we use the Baerveldt 350-mm² glaucoma implant and the FP-7 model of the Ahmed Glaucoma Valve. In our experience, the valved shunt minimizes the risk of postoperative hypotony and choroidal effusion, and this GDD is highly effective for eyes that need a low IOP quickly, such as in cases of advanced open-angle glaucoma, uveitic glaucoma, and neovascular glaucoma. We have found that Baerveldt shunts can have a more complicated postoperative course, including a high initial IOP and hypotony after the Vicryl suture (Ethicon, Inc.) dissolves. If an eye can tolerate a high IOP for 4 to 6 weeks after surgery, however, a Baerveldt implant may be a better choice, based on the aforementioned studies. The Baerveldt may also be preferable if an Ahmed device has already failed in the eye.

For example, the figure shows the anterior chamber of a patient with an Ahmed Glaucoma Valve superotemporally and a Baerveldt implant inferonasally. We placed the former initially, but it failed to lower the IOP adequately. We implanted a Baerveldt device inferonasally a few months later, and the patient’s IOP is now well controlled.

**Technique**

Although it can be placed in any quadrant, we usually implant the GDD in the superotemporal quadrant using two interrupted 9–0 nylon sutures located 8 to 10 mm posterior to the limbus. Our usual choice for covering the tube is donor sclera, but many other materials may be used, including pericardium and donor cornea.

The Ahmed device requires priming before insertion to make sure the valve is functional. We use a 30-gauge needle for this purpose and apply just enough force to express balanced salt solution out of the valve. It...
is important not to be too vigorous during this test, because the valved mechanism can be destroyed.

We enter the anterior chamber with a 23-gauge needle positioned parallel to the iris. Ideally, the tube will not touch the iris or cornea.

Because Baerveldt implants have no resistance to outflow, to prevent immediate postoperative hypotony, we ligate the silicone tube intraoperatively with a Vicryl suture that dissolves in 4 to 6 weeks. Often, patients must use all of their preoperative glaucoma medications for this period.

CONCLUSION

Although trabeculectomy is still the most common surgical procedure to treat elevated IOP, tube shunts are slowly gaining popularity for the surgical management of glaucoma. New data from the TVT Study and the willingness of a growing number of glaucoma specialists to use tube shunts earlier in the course of the disease mean that GDDs have become a primary surgical option for some patients. We tend to use the Ahmed Glaucoma Valve more than the Baerveldt implant, because we have found that the former reduces the IOP more quickly, has a higher level of predictability, and is associated with fewer postoperative complications.

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