Aurolab aqueous drainage implant: My surgical technique

ABSTRACT
Aurolab aqueous drainage implant is a nonvalved tube implant used to treat refractory glaucoma. Although implanting the device could be surgically more demanding than certain other drainage devices, the author aims to describe the techniques which enable him to perform the surgery safely and efficiently.

Keywords: Aurolab aqueous drainage implant, scleral sleeve, surgical technique

INTRODUCTION
Aurolab aqueous drainage implant (AADI) is a nonvalved device useful in refractory glaucoma to achieve low intraocular pressure (IOP) when other methods have failed. It is made of NuSil permanent implant silicone elastomer which has passed tissue culture cytotoxicity testing. Its surface area is 350 mm²; its lateral wings are designed to be positioned under the rectus muscle. It has fixation holes to facilitate anchoring of the end plate about 10 mm posterior to the limbus. The device has been commercially available in India since 2013 and is similar to the Baerveldt glaucoma implant in design and function. Dr. Paul Palmberg was instrumental in the development of the AADI device.

There are various techniques of performing the glaucoma valve surgery, and over a period I have minimized the steps of the surgery in a manner which helps me do the procedure safely, efficiently and in very little time.

CONJUNCTIVAL DISSECTION
Adequate exposure is ensured by passing a 7-0 polyglactin suture through the peripheral cornea at around 12 o'clock position. Since the device implantation is invariably the second surgery for the eye in question, I prefer a limbus-based flap. The main concern is limbal stem cell deficiency which may occur in predisposed eyes with recurrent dissection of the conjunctiva at the limbus.[1] The conjunctival incision is made about 8–9 mm away from the limbus in the superotemporal site approximately between the lateral and superior rectus muscles [Figures 1 and 2].

SECURING THE PLATE TO THE SCLERA
After the conjunctival incision, the bare sclera is approached between the superior rectus and the lateral rectus. Novice surgeons attempting implant surgery usually underestimate the extent of the fan of the insertion of the tendon of the lateral and superior rectus muscles, and in their eagerness to hook the muscle may split the muscle fibers and induce trauma, which may later manifest as diplopia.[2] Another mistake surgeons make is to isolate muscle belly from all sides (e.g., in case of superior rectus from the temporal and nasal border), which is not warranted since one side exposure allows the implant to be slipped beneath the temporal part of superior rectus and superior aspect of the lateral rectus [Figures 3 and 4].

PREPARATION OF THE IMPLANT
The tube of the implant is tested for patency. Then the tube is ligated with 7-0 vicryl suture. The tube occlusion is...
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tested using a hydrating cannula (28-gauge) and serrated forceps[Figures 5-8].

The plate is anchored using nylon (8-0/9-0) sutures. I prefer to use the 9-0 nylon suture and make the needle pass through the sclera out through the eyelet of the implant on

Figure 1: Marking the conjunctiva 8 mm behind the limbus to fashion a limbus based conjunctival flap

Figure 2: Relaxing cuts given in the conjunctiva after conjunctival dissection for adequate exposure of the surgical field

Figure 3: Two muscle hooks under the superior rectus muscle after isolation and dissection of the lateral border of the muscle (right eye of the patient). Note the medial border of the muscle is barely dissected or exposed

Figure 4: Two muscle hooks under the dissected lateral rectus muscle

Figure 5: The patency of the tube is tested

Figure 6: The tube is completely occluded by ligature with 7-0 polyglactin suture close to the plate
the temporal aspect and then take the same needle through the nasal eyelet of the implant (without cutting the suture) and out through the sclera. After assessing the length of suture required to tie the implant, the suture between the eyelets is cut and the sutures are tied, anchoring the plate to the sclera. By this method, the plate is secured about 10–12 mm away from the limbus quite effortlessly. This leaves sufficient sclera ahead of the plate for dissecting the scleral tunnel through which the tube is placed into the anterior chamber (AC).

**SCLERAL TUNNEL**

I have avoided using scleral patch grafts\(^3\) and instead use the sclera of the patient to create a scleral tunnel.\(^4\) The tunnel will start about 3–4 mm in front of the plate and extend about 4 mm short of the limbus. From 4 mm away from the limbus, a needle (23-gauge) track is made into the AC almost in the same plane as the scleral tunnel. One could also use a donor patch graft (corneal/scleral) to cover the tube at the point of entry into the sclera [Figures 9-12].

The tip of the intact tube is first cut with bevel up fashion, and an attempt is made to insert the tube into the AC. This is done because most of the eyes which undergo tube shunt surgeries have distorted limbal anatomy. Hence, it is wise to confirm entry of the tube before finally trimming the tube to the desired length. Once a comfortable entry is confirmed the tube is trimmed to requisite length and is inserted into the AC [Figure 13].

Any tube track which is made and not used should be secured using an infiniti suture to prevent leak. In case of shallowing of the AC during insertion or accidental iris touch a paracentesis can be made to reform the chamber.

The tube is secured using nylon (9-0) sutures close to the plate. The tube is also secured to the sclera at the point of

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**Figure 7:** The plate is tucked underneath the superior rectus muscle

**Figure 8:** The plate being tucked underneath the lateral rectus muscle

**Figure 9:** Usage of corneal patch graft to cover the exposed part of tube before anterior chamber entry

**Figure 10:** The scleral groove being created with a Bard Parker knife
entry into the scleral tunnel. The incision on the sclera 4 mm behind the limbus is also secured with (9-0) nylon using an infiniti suture. The aim is to prevent wriggling of the tube and subsequent extrusion from the AC. Venting slits can be made if immediate IOP control is warranted. They are

Figure 11: The scleral tunnel dissected by a 23G needle

Figure 12: The tube is made to pass through the scleral tunnel and into the anterior chamber

Figure 13: Trimming the end of the tube with bevel up after confirming its entry tract and assessing its optimal length

Figure 14: Conjunctival closure with polyglactin (8-0) running suture

Figure 15: Tube passed into the vitreous cavity through a stab incision made with a 23-gauge needle 5 mm from the limbus

Figure 16: Tube in vitreous cavity secured to the sclera with 10-0 nylon purse string suture
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made distal to the ligature with 1–2 small punctures with a spatulated (10-0 nylon) needle.

CLOSURE

The conjunctiva is closed in running fashion using a polyglactin (8-0) suture, without tension. In many situations, the AC is not entered, and a subconjunctival injection of a combination of steroid and antibiotic is administered [Figure 14].

We have also used AADI implant for glaucoma following vitreo-retinal surgeries. In eyes which have undergone complete vitrectomy,[7,8] All other steps of the surgery are performed as mentioned above. Once the plate is secured and the tube ligated, a 23-gauge needle is used to make the stab incision into the vitreous cavity 5 mm–5.5 mm away from the limbus. The stab incision using the 23-gauge needle is made in a rotating fashion and while exiting the needle is used to slightly extend the opening so that the tube can be easily slid into the sclerostomy. The tube is then trimmed and then slid into the sclerostomy wound. Approximately, 5–6 mm length of the tube is left in situ. A nylon 10-0 suture is used in a purse string fashion to secure the tube to the sclera. A sclera or corneal patch graft is used to cover the entry of the tube into the sclera, and it is anchored with nylon 10-0 sutures. The remaining length of the tube is anchored to the sclera with 10-0 nylon sutures [Figures 15 and 16].

ADVANTAGES OF THE AUROLAB AQUEOUS DRAINAGE IMPLANT DEVICE

Due to the larger surface area it provides achieves lower IOP in the long-term as compared to valved devices. There is less chance of bleb encapsulation as it is not exposed to the inflammatory mediators from the AC until the tube opens up, which is typically after 4–6 weeks. Hence, there is no typical hypertensive phase[9] as in the case of valved devices, although during the initial few weeks there is a bout of raised IOP till the ligature gives way. During this period, the patient has to be on maximal medical therapy.

The most significant advantage is the cost. It is much more economical compared to the other commonly used devices like the Baerveldt or the Ahmed valve without a compromise on the efficacy.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES