Tube retraction after Ahmed glaucoma valve (AGV) implantation is an infrequent but known complication. The management option includes the use of a commercially available AGV tube extender, 22 G angiocatheter, resisting the existing glaucoma drainage device (GDD), or insertion of a new GDD. Each of the methods described in the literature has its limitations. We describe the successful management of this complication by using a cost-effective technique of connecting the silicone tube segment to the existing tube to lengthen the tube, so that it could be inserted in the anterior chamber again. The silicone tubes used for the technique were the extra length of the GDD tube, which was cut short and leftover during other GDD implantation surgeries.

Clinical significance: During any GDD implantation, the tube is cut short before entering the anterior chamber. We retrieved the short segments of the tube immediately after the GDD was opened on the table and sterilized them again using plasma technology, available in our operating room. Hence, it provides a cost-effective alternative since the tube is usually trimmed to the desired length in all cases of GDD implantation (valved/non-valved), which can be subsequently sterilized and reused for lengthening the short tube in cases with tube retraction or inadvertently cut tube.

Keywords: Glaucoma drainage device complication, Glaucoma drainage implants, Glaucoma drainage surgery, Intraocular pressure, Postoperative complications, Surgical technique, Tube extension, Tube retraction.

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Background

Tube retraction after Ahmed glaucoma valve (AGV) implantation is a known complication that may require tube lengthening. Other situations that may require an extension of the tube are a kinked tube or an inadvertently cut tube. We describe the successful management of this complication by connecting the silicone tube segment to the existing tube to lengthen the tube so that it could be inserted in the anterior chamber again. The silicone drainage devices (GDD), especially the non-valved GDD’s have a long tube attached to the plate. We had cut short a small segment of the GDD tube, at the time of priming/opening of the GDD on the table, in our routine cases, and sterilized them using plasma technology, which was later employed for tube extension. To our best of knowledge, this cost-effective alternative of tube extension using sterilized residual GDD tubes has not been reported in the literature. The clinical technique adhered to the Tenets of the Declaration of Helsinki. The informed consent was obtained from the parents of the child and Institutional Ethics Committee approval was obtained.

Surgical Technique

Under adequate peribulbar anesthesia, a corneal traction suture was applied using 6-0 Vicryl suture (Braided coated polyglactin 910 violet, Ethicon, Johnson & Johnson Ltd., India) to have adequate exposure of the tube and plate. Using a minimally invasive approach, localized conjunctival peritomy was performed in 2 clock hours. The anterior edge of the corneal patch graft was dissected from surrounding fibrous and Tenon tissue. The tube was identified and localized conjunctival peritomy was performed in 2 clock hours. The anterior edge of the corneal patch graft was dissected from surrounding fibrous and Tenon tissue. The tube was identified and mobilized for 2–3 mm (Fig. 1A). Since the diameter of the silicone tube was marginally larger than the lumen of the AGV tube, so the end of the silicone tube was cut beveled. The lumen of the AGV tube was opened using Kelman–McPherson forceps, and the beveled end of the silicone tube was inserted into it (Figs 1B to D). Care was taken while removing the McPherson forceps so that the two connected tubes do not get dislodged. Another McPherson forceps were employed to hold the joint of the tubes while the first McPherson forceps were being removed (Fig. 1E). The tubes should snugly fit into each other (Fig. 1F). The joint of the two tubes were secured using a 10–0 nylon non-absorbable suture [Ethicon Nylon (Ethilon) Black monofilament 10–0 with TG160–4 needle] so that the tubes do not get dislodged while entry into the anterior chamber (Fig. 1G). The suture was passed through the wall (silicone material) of the tubes so that the suture does not enter the lumen of the silicone tube and does not occlude the lumen of the tube or interfere with aqueous drainage. The extra length of the tube was cut short and fashioned into the same track, which was created during the previous surgery. The tube was well visible in the anterior chamber (Fig. 1H). The Tenon tissue and conjunctiva were sutured using continuous 8-0 vicryl suture (Braided coated polyglactin 910 violet, Ethicon, Johnson & Johnson Ltd., India). The video of the technique has been uploaded as a supplementary file.

Case Description

An 11-year-old boy developed intractable glaucoma following right eye pars plana lensectomy and vitrectomy following firecracker injury. He underwent right eye AGV implantation to control the
intraocular pressure (IOP). The IOP was controlled immediately following surgery, but within 2 months of implantation, he presented with raised IOP of 44 mm Hg on Tab. acetazolamide 15 mg/kg body weight/day, Syp. glycerol 1 g/kg body weight orally in 50% solution, Syp. potassium chloride, G. travoprost 0.004%, G. brimonidine 0.2%, and G. timolol maleate 0.5% eye drops. On ocular examination, the child had the best-corrected visual acuity of perception of light in the right eye and 20/20 in the left eye. The cornea was clear, and there was minimal anterior segment inflammation. The child was aphakic, and the tube was not visible on the slit lamp as well as the gonioscopy (Fig. 2A). The posterior segment examination showed media grade I, choroidal rupture, and a macular scar on the posterior pole. The clinical impression was the retraction of the AGV tube in the sub-Tenon space. The patient was taken up for surgery.

**Postoperative Outcome**

The patient maintained reasonable IOP control (IOP-14 mm Hg on single topical antiglaucoma medication) and no tube retraction at a 2-year follow-up and a well-formed aqueous lake on ultrasound (Figs 2B and C).

**Discussion**

Glaucoma drainage devices form an important management option in refractory glaucoma. Due to their favorable success rate, they are being increasingly employed as either a primary or secondary procedure.1 All the surgeries are associated with some form of complications. The commonly encountered complications after GDD implantation are hyphema, postoperative hypotony, fibrosis, choroidal effusion, etc.2 Tube retraction is one of the complications encountered after GDD implantation. It is more frequently seen in children due to increasing globe size.3 The various management options described for managing a tube retraction or inadvertently cut tube are repositioning the whole AGV plate-tube complex,4 use of AGV tube extender,5 replacement with another GDD6 or 22 G Teflon angiocatheter.7 All the above-described methods have their drawbacks. Repositioning the whole GDD plate-tube complex is a cumbersome procedure. It involves the risks associated with a
new surgery and extensive surgical manipulation to clear out the fibrosis and adhesions, which may lead to postoperative hypotony and various complications. The commercially available AGV tube extender is expensive and bulky. The cost of an AGV tube extender is approximately 200 USD, which is much high compared with residual sterile GDD tubes, which can be saved free of cost. The 22 G angiocatheter is more rigid, has a larger outer diameter (0.8 mm) than the GDD tube (0.64 mm). It requires enlargement of the tunnel for insertion into the anterior chamber and thus has the potential for a leak. There are reports of anterior migration of the tube in the anterior chamber. Moreover, it is not approved for ocular use. Replacement with a newer GDD at the second site is another option. Still, it compromises the space for future surgery if required. Chiang et al. have successfully demonstrated the use of the “tube-in-tube” principle for tube extension in 3 patients at follow-up of 6 months to 3 years. This technique has multiple advantages. It is a minimally invasive procedure, with limited dissection, less learning curve, quick to perform, and does not add bulk to the globe, unlike the AGV tube extender. We have employed Kelman–McPherson forceps to stretch the diameter of the AGV tube. The end of the silicone tube was cut beveled so that it could be easily inserted into another tube. Abbott et al. also found the utility of this technique in their clinical experience and wet lab. They suggested making the extension as an outer tube so that it can be easily replaced in case of wear and tear. They had used Tennant tying forceps (curved, fine tip, stainless steel) to stretch the outer tube and advocated the use of viscoelastic to smoothen and facilitate entry of tubes into each other. We applied a fixation suture at tube-tube interface so that the joint does not get dislodged, but it has been reported that even in the absence of a fixation suture, the joint is well secure. Around 2 mm of overlap is enough to avoid leaks and hypotony.

The limitation with the technique employed by Chiang et al. was that they employed a newer GDD (Baerveldt) or tube extender every time to retrieve the tube for the procedure. Hence, it added to the cost of the procedure. We used a simplified and cost-effective alternative, i.e., the use of sterilized residual Aurolab aqueous drainage implant (Baerveldt prototype) silicone tubes, which were cut short and leftover during other glaucoma surgeries. It was connected in the above-described case to the existing tube to lengthen the tube so that it could be inserted in the anterior chamber again.

**Clinical Significance**

During any GDD implantation, the tube is cut short before entering the anterior chamber. We retrieved the short segments of the tube immediately after the GDD was opened on the table and sterilized them again using plasma technology, available in our operating room. Hence, it provides a cost-effective alternative since the tube is usually trimmed to the desired length in all cases of GDD implantation (valved/non-valved), which can be subsequently sterilized and reused for lengthening the short tube in cases with tube retraction or inadvertently cut tube.

**Conclusion**

We demonstrate a simple and cost-effective method of management of tube retraction post-GDD implantation.

**Meeting at a Presentation**

World Glaucoma Congress, Melbourne 2019, video film festival.

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