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Case Report

Ab Interno Occlusion of Ahmed Glaucoma Valve Tube with a 4–0 Polypropylene Suture in a Patient with Hypotony

Ilkay Tugce Kara,[1] Enver Mirza,[1] Gunsu Deniz Mirza,[2] Refik Oltulu,[1] Mehmet Okka[1]

[1]Department of Ophthalmology, Necmettin Erbakan University, Faculty of Medicine, Konya, Türkiye
[2]Department of Ophthalmology, University of Health Sciences, Beyhekim Training and Research Hospital, Clinic of Ophthalmology, Konya, Türkiye

Abstract

The objective is to present the clinical improvement observed after ab interno intraluminal occlusion of Ahmed glaucoma valve (AGV) tube with a 4–0 polypropylene suture in a patient with secondary hypotony following AGV implantation. A 47-year-old male patient with a history of retinitis pigmentosa, congenital cataract, and glaucoma had undergone ex-press glaucoma filtration device implantation and cyclophotocoagulation treatments in his left eye previously. The intraocular pressure (IOP) was not regulated with these treatments, and an AGV implantation was performed in our clinic. Due to the development of hypotony at the postoperative 1st week, ab interno intraluminal occlusion of the AGV tube was planned with a 4–0 polypropylene suture. Before AGV tube implantation, the best-corrected visual acuity (BCVA) was 0.05, and IOP was 40 mmHg (with maximum antiglaucoma medication) in the left eye of the patient. At the postoperative 1st week, BCVA regressed to the level of hand motion, and IOP was <5 mmHg. Findings such as corneal fold, hypotony maculopathy, and choroidal effusion were also observed. Since there was no response to anti-inflammatory medical treatment initiated to reduce hypotony, ab interno intraluminal occlusion of the AGV tube was performed. After revision surgery, it was observed that IOP increased to 10 mmHg and BCVA increased to 0.1. In cases with postoperative hypotony due to excessive filtration after glaucoma drainage device implantation, ab interno occlusion of the tube lumen with a 4–0 polypropylene suture is an effective, safe, and inexpensive alternative surgical method that can be performed without causing conjunctival damage or subconjunctival scarring.

Keywords: Ab interno tube occlusion, Ahmed glaucoma valve, Choroidal effusion, Hypotony maculopathy, Polypropylene suture

Introduction

Ocular hypotony is a clinical condition in eyes with intraocular pressure (IOP) <5 mmHg (1-3). If it continues for a long time, it results in hypotony maculopathy (HM), choroidal effusion, optic disc edema, and eventually severe vision loss (1-3). Early detection of HM and rapid initiation of anti-inflammatory treatment or surgical interventions are important to prevent final visual acuity and permanent retinal damage.

Glaucoma drainage devices (GDD) are widely used in the surgical treatment of refractory glaucoma. With increasing frequency of GDD use, the incidence of HM has increased

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Address for correspondence: Enver Mirza, MD. Department of Ophthalmology, Necmettin Erbakan University, Faculty of Medicine, Konya, Türkiye
Phone: +90 505 226 62 92 **E-mail:** envermirza@gmail.com

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by 20% (4). There are many types of GDD with different plate designs, lumen sizes, and mechanisms. Ahmed glaucoma valve (AGV), one of GDD, has been shown to reduce the incidence of postoperative hypotony due to its valved structure. Even so, HM may be seen in some cases (5-7). In cases with no response to anti-inflammatory medical treatment, postoperative hypotony management becomes difficult. Various surgical options have been reported for the treatment of hypotony following GDD implantation, including ab externo tube ligation, ab externo intraluminal stents, and explantation of the tube or GDD (7,8). However, ab externo approaches cause conjunctival or subconjunctival complications in the postoperative period, and additional surgical interventions may be require to reduce IOP (9).

In this case report, we aimed to share the results of ab interno occlusion of the AGV tube with a 4–0 polypropylene suture, which is a minimally invasive surgical method in the management of postoperative hypotony after AGV implantation.

Case Report

A 47-year-old male patient with retinitis pigmentosa and glaucoma applied to our clinic in January 2024 with complaints of decreased vision and pain in the left eye. The patient underwent cataract extraction due to a congenital cataract at 6 months of age and bilateral secondary intraocular lens implantation in 2007 in other clinics. In addition, the patient declared that bilateral ex-Press glaucoma filtration device (Alcon Laboratories Inc., Fort Worth, TX, USA) implantation was performed in 2014, and bilateral cyclophotocoagulation was subsequently applied in another clinic.

At presentation, the patient's best corrected visual acuity (BCVA) was hand motion in the right eye and 0.05 in the left eye. The IOP was 15 mmHg in the right eye and 40 mmHg in the left eye (with maximum antiglaucoma medication: timolol 0.5%, dorzolamide 2%, brimonidine 0.2%, and latanoprost 0.005% eyedrops). Anterior segment examination of the left eye revealed that the cornea was transparent, the pupil was irregular, the anterior chamber depth (ACD) was deep, and he was pseudophakic. It was noticed that ex-press glaucoma filtration device had no function. Bilateral total cup-to-disc ratio, widespread bone spicule pigmentation, and arteriolar attenuation were determined with fundus examination.

Due to high IOP levels despite maximum antiglaucoma medication treatment and previous antiglaucoma interventions, ex-press glaucoma filtration device explantation and AGV implantation were performed on the patient's left eye in our clinic in March 2024. To summarize the surgery, the conjunctiva and Tenon tissues were dissected. After bleeding control, ex-press glaucoma filtration device was explanted. A tenon piece was inserted into the scleral gap after the explantation of ex-press glaucoma filtration device. The scleral gap was then closed tightly using a 7–0 vicryl suture (Ethicon, Johnson and Johnson Vision, New Jersey, United States). Sealing control was done, and it was ensured that there was no aqueous humor leakage. After that, AGV (New World Medical, Inc., Rancho Cucamonga, LA, USA) implantation was performed conventionally. Tenon was closed with a 7–0 vicryl suture, and conjunctiva was closed with a 10–0 vicryl suture, separately. At the end of the surgery, it was controlled and ensured that there was no leakage, again.

At the postoperative 1st day, the BCVA was hand motion, and IOP was 4 mmHg in the left eye. In the anterior segment examination of the left eye, it was seen that the conjunctiva was closed, the Seidel test was negative, the tip of the AGV tube was open, and ACD was deep. Fundus examination revealed that the retina was attached, but there was choroidal effusion in four quadrants. In addition to postoperative intensive topical anti-inflammatory eyedrops, oral prednisolone treatment was started at a dosage of 1 mg/kg for the patient. Due to increasing signs of hypotony such as loss of corneal transparency, increase in corneal folds, shallow of the ACD (Fig. 1), decrease in BCVA, development of HM and increase in choroidal effusion (Fig. 2), ab interno

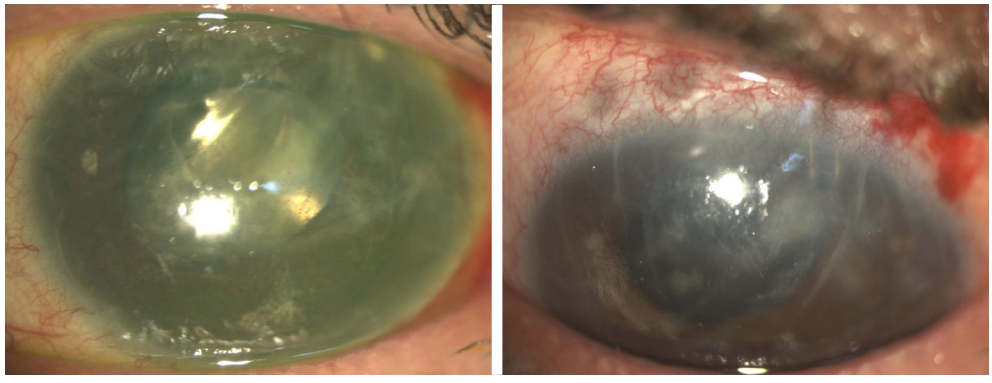

Figure 1. Due to hypotony before revision surgery, it is seen that the cornea has lost its transparency, corneal folds are present, and the anterior chamber depth has become shallow.

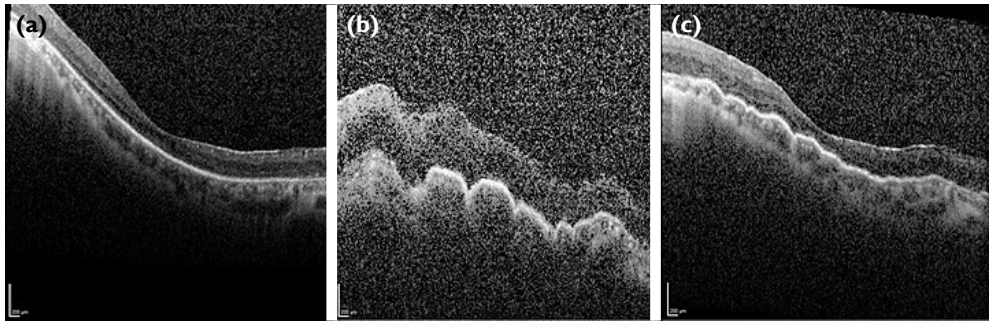

Figure 2. (a) Optical coherence tomography (OCT) section of the posterior pole before Ahmed glaucoma valve implantation. **(b)** OCT image of hypotony maculopathy at postoperative 1st week of Ahmed glaucoma valve implantation. **(c)** OCT section of the posterior pole at postoperative 2nd week of revision surgery.

intraluminal occlusion of the tube of AGV implant was performed with a 4–0 polypropylene suture at the postoperative 1st week of AGV implantation.

Surgery Technique

The written informed consent was obtained from the patient. Revision surgery was performed under local anesthesia. The patient had an FP7 model AGV implant placed in the superior temporal quadrant. For this reason, a 4–0 polypropylene (Prolene; Ethicon, Inc., Somerville, NJ, USA) suture was preferred for intraluminal occlusion in this case. Two clear corneal side port incisions were made with a 20 G MVR blade, approximately 180 and 90° away from the tube of AGV implant. The anterior chamber (AC) was filled with cohesive viscoelastic material. The tip of the 4–0 polypropylene suture was cauterized. The length of the suture was shortened to avoid affecting the valve mechanism of the AGV. The 4–0 polypropylene suture was inserted into the AC through the first side port incision. A vitreoretinal forceps was entered into the AC through the second side port incision, and the 4–0 polypropylene suture was inserted into the lumen of the AGV tube with the help of this instrument. The viscoelastic material in the AC was washed out. The corneal side port incisions were hydrated, and an intracameral antibiotic was injected into the AC (Fig. 3).

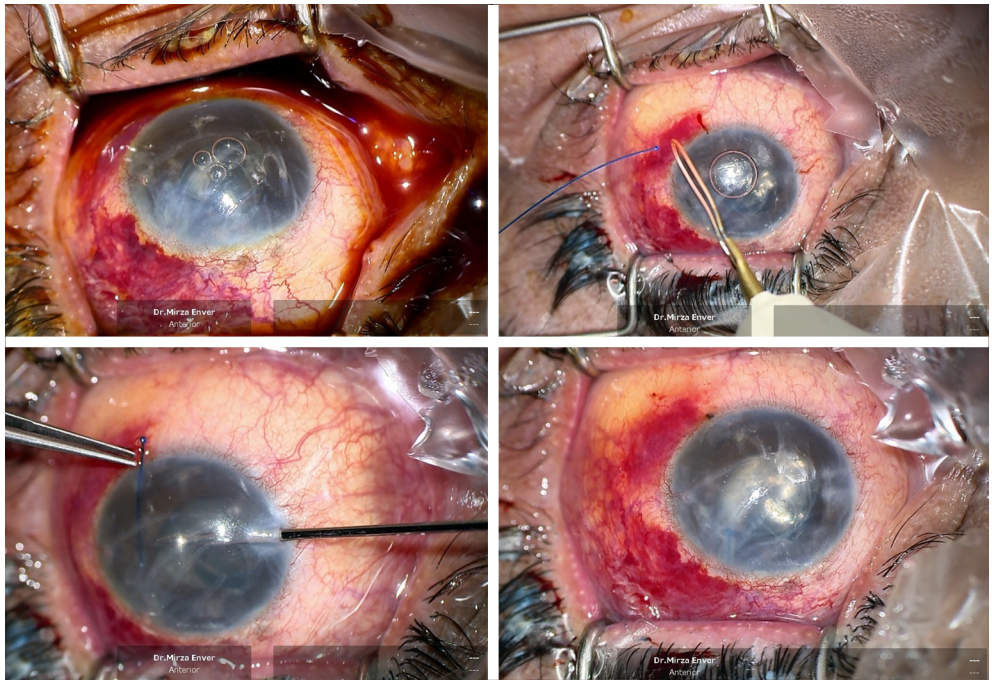

Figure 3. Ab interno occlusion of Ahmed glaucoma valve tube implant with a intraluminal 4.0 polypropylene suture.

Results

After revision surgery, BCVA was counting fingers at 2 ms, and IOP was 10 mmHg (without medication) in the left eye at the postoperative 2nd week. In the examination of the anterior segment of the left eye, it was observed that the cornea became more transparent, the corneal folds decreased, and the AC deepened. Fundus examination revealed that the retina was attached, HM, and choroidal effusion had regressed (Fig. 2). At the postoperative 6th month visit of revision surgery, it was observed that BCVA was 0.1 and IOP was 10 mmHg (without medication) in the left eye. In examination of the anterior segment of the left eye, it was observed that the corneal folds had disappeared, the cornea was transparent, the AC was deep, and the 4–0 polypropylene suture was in the lumen of the AGV tube (Fig. 4). Fundus examination revealed that the retina was attached and choroidal effusion had completely regressed.

Discussion

GDD implants are episcleral implants that provide drainage of aqueous humor into the sub-Tenon's space, usually applied to eyes with refractory glaucoma (10,11). There are GDD types with valved or valveless mechanisms. The risk of early postoperative hypotony is higher in valveless GDD implants (10,12). Although various modifications, such as narrowing the lumen of valveless tubes with external ligation, are made, the risk of early postoperative hypotony does not decrease compared to valved systems (5,6). AGV is a GDD implant containing a valve mechanism, and its clinical implantation is very common (5,13). AGV has been shown to be safe in terms of the risk of early postoperative hypotony, but it may still be seen after AGV implantation in some cases (5-7).

Medical and surgical treatments are used in the management of hypotony observed after GDD implantation. Local or systemic corticosteroids are the basis of medical treatment. As long as the ACD remains stable, most cases of hypotony can be managed with medical treatment and frequent follow-up (14). In cases with no response to medical treatment, surgical options should be considered (15). In cases with a large choroidal effusion accompanied by shallowing of the AC, viscoelastic material may need to be injected into the AC. Furthermore, large choroidal effusion and choroidal hemorrhage may require surgical drainage (15). Alternative interventions such as explantation of the tube or GDD are applied to treat postoperative hypotony, but conjunctival or subconjunctival damage may occur (8). Moreover, medical treatment and additional surgical approaches may be required to regulate IOP after the mentioned interventions (8,15).

Ab externo ligation of the tube is another surgical method that can be performed in the treatment of postoperative hypotony. However, in this method, the conjunctiva and Tenon's must be dissected again. In the literature, 6-0 polypropylene suture, 4-0 nylon suture, and 8–0 nylon suture has been reported to be used for Ab externo ligation of the tube of GDD implants(16-18). Although this method has been shown to give favorable outcomes in preventing postoperative hypotony, the study conducted by Stein et al.(19) concluded that failures varied depending on the suture material and resulted in the need for additional surgical interventions. Furthermore, external ligation with a 9–0 polypropylene suture or 10–0 nylon suture could be possible from the cornea above AGV with conjunctival preservation. Experience is essential for this technique. Otherwise, aqueous humor leaks may occur.

Intraluminal tube occlusion with polypropylene suture was first performed to stabilize the AC during phacoemulsification (20). In contrast to the ab externo ligation of the tube in GDD implants, the technique of ab interno intraluminal occlusion of the tube requires only small corneal side port incisions. The most important advantage of this technique is that it reserves the conjunctiva for future glaucoma surgeries. Moreover, this technique is reversible.

In addition, GDD have different intraluminal diameters, and different thickness sutures can be used to control postoperative hypotony with this technique (16-18,21). If the diameter of the implanted suture is thicker, less aqueous humor drain-

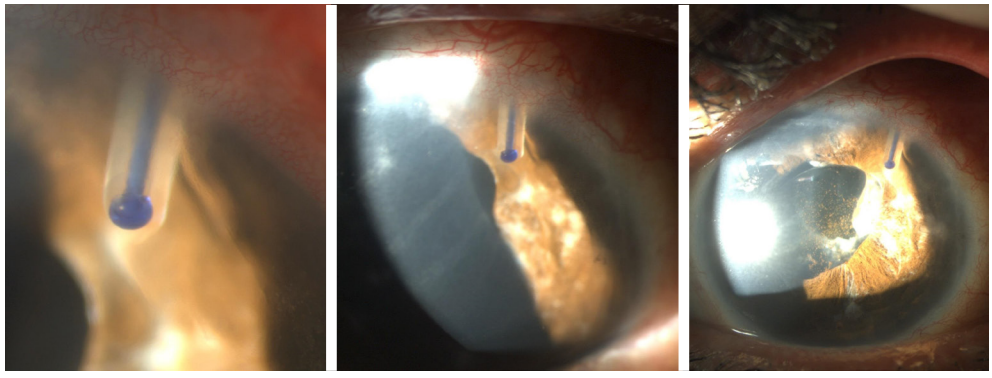

Figure 4. View of the intraluminal 4.0 polypropylene suture.

age may occur. Thus, higher levels of postoperative IOP can be achieved (9). In the study of Feinstein et al., (21) 4–0, 3–0, and 2–0 polypropylene sutures were used for intraluminal tube occlusion, and it was reported that tube occlusion rates were approximately 24–43%, 43–67%, and 97–124%, respectively. Furthermore, it was mentioned that approximately 75% of the cross-sectional area of the AGV tube remains open after intraluminal occlusion with a 4–0 polypropylene suture (21). For this reason, a 4–0 polypropylene suture was preferred in our case to ensure adequate aqueous humor drainage. Based on the study by Feinstein et al., (21) a 3–0 polypropylene suture can be used as an alternative choice in cases where sufficient IOP elevation cannot be achieved despite the application of a 4–0 polypropylene suture.

In summary, primarily, medical treatment was initiated for the management of hypotony observed after AGV implantation, in our case. However, it was detected that the signs of HM progressed. Subsequently, intraluminal occlusion of the AGV tube was performed with a 4–0 polypropylene suture. After revision surgery, it was observed that the patient's BCVA increased, IOP increased to a sufficient level, and clinical findings related to hypotony regressed.

Conclusion

The management of eyes that develop hypotony due to excessive filtration after GDD implantation can be quite challenging. Ab interno intraluminal occlusion of the GDD tube with a polypropylene suture is a conjunctiva-preserving, minimally invasive, effective, and reversible technique in the management of hypotony following GDD implantation.

Disclosures

Informed consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

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