INTRODUCTION

The pars plana model of the Ahmed Glaucoma Valve (AGV) implant (New World Medical, Rancho Cucamonga, CA) is so designed that it is inserted into the vitreous cavity through a sclerostomy, and has a specially designed clip anchors that it in place and avoids tube kinking. The tube deliver aqueous from within the eye to the episcleral plate covered by Tenon’s capsule and conjunctiva, which stimulates fibrovascular encapsulation around the plate. This article elucidates the technique of its implantation, and critically evaluates its efficacy in refractory glaucomas.

Keywords: Pars plana Ahmed glaucoma valve, vitrectomy, triamcinolone, refractory glaucomas.

Surgical Technique: Pars Plana Ahmed Glaucoma Valve Implantation

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Abstract: The pars plana model of the Ahmed Glaucoma Valve (AGV) is inserted into the vitreous cavity through a sclerostomy, and has a specially designed clip anchors that it in place and avoids tube kinking. The tube deliver aqueous from within the eye to the episcleral plate covered by Tenon’s capsule and conjunctiva, which stimulates fibrovascular encapsulation around the plate. This article elucidates the technique of its implantation, and critically evaluates its efficacy in refractory glaucomas.

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INTRODUCTION

The pars plana model of the Ahmed Glaucoma Valve (AGV) implant (New World Medical, Rancho Cucamonga, CA) is so designed that it is inserted into the vitreous cavity through a sclerostomy, with an intravitreal length of 6 mm. A specially designed clip anchors it in place and avoids tube kinking. The tube deliver aqueous from within the eye to the episcleral plate covered by Tenon’s capsule and conjunctiva, which stimulates fibrovascular encapsulation around the plate. Intraocular pressure reduction is dependent on the resistance of aqueous flow across the fibrovascular capsule.

The pars plana AGV is indicated in all kinds of refractory glaucomas with a compromised endothelial count as it reduces the risk of corneal decompensation due to tube cornea touch. These include aphakic, neovascular, post-penetrating keratoplasty, postvitrectomy, inflammatory and post-traumatic glaucomas.1-3

SURGICAL TECHNIQUE

Quadrant Selection

The preferred quadrant for implantation of the AGV is the superotemporal quadrant, since it is the safest and easiest.

If not available for some reason, the descending order of preference is inferotemporal, superonasal and inferonasal. In the nasal quadrants, the implant plate should be fixed to a maximum of 6 to 8 mm from the limbus to avoid the optic nerve. In patients with intraocular silicon oil, the preferred quadrant is inferotemporal to avoid tube occlusion.

CORNEAL TRACTION SUTURE

Following appropriate anesthesia, under strict asepsis, a corneal traction suture is passed. The vector force of the corneal traction suture is far superior to that of the SR traction suture, and provides adequate exposure without the risk of superior rectus hematoma and the consequent Growth Factor release and fibrosis. There is risk of AC penetration (specially in buphthalmic eyes) and cheesewiring if the suture is placed too superficially. The recommended suture is 7’0 silk on a semicircular needle (Fig. 1).
CONJUNCTIVAL FLAP
A fornix based conjunctival flap is dissected in the superotemporal quadrant between two adjacent recti. The recommended length of the incision is 5 to 10 mm, with extensive peripheral blunt dissection so as to enable the formation of a large, diffuse bleb. The dissection is carried posteriorly to make a pocket for the AGV about 10 to 15 mm wide, taking care to avoid conjunctival buttonholing. The Tenons capsule and the conjunctiva are entered in separate layers to prevent injury to the SR. Relaxing incisions are best avoided as they increase the tissue trauma and the risk of wound leak (Fig. 2).

PRIMING THE AGV
The AGV is irrigated with BSS to prime the valve mechanism: A 26 G cannula on a 3 ml syringe filled with isotonic saline is introduced for 3 to 4 mm into the tube. The pressure required to prime the valve ranges from 80 to 100 mm of Hg. An immediate decrease in resistance of the implant is noted, together with a jet of saline as the valve is primed (Fig. 3).

SUTURING THE AGV
The explant plate is sutured to the sclera 8 mm from the limbus with 9’0/10’0 monofilament nylon using the sutures preplaced through the eyelets, while the pars plana clip is anchored at 4 mm from the limbus (Figs 4 and 5).
TRIMMING THE TUBE
The tube is then trimmed with the bevel up, to an intravitreal length of 6 mm (Fig. 6).

TUBE INSERTION
A sclerostomy is made at 4 mm from the corneoscleral limbus using either a 23 G needle or a MVR knife. This track is the guide for the insertion of the tube. The tube with the bevel up is gently inserted into the vitreous ensuring that the track fits snugly around the tube, and the length within the vitreous cavity is up to 6 mm (Figs 7 to 10).

PATCH GRAFT
A donor patch graft (Sclera or pericardial) is then placed on the tube and sutured. Alternatively, a partial thickness rectangular scleral flap may be raised before tube insertion (Fig. 11).

A partial thickness scleral flap may be made using a crescent knife before the sclerostomy. This obviates the need for a patch graft.

SUTURING THE FLAP
The conjunctiva is then sutured to the limbus, ACM removed, and subconjunctival injections of steroid and antibiotic are administered (Fig. 12).

AC PARACENTESIS
AC is entered at the corneoscleral limbus via a MVR Knife, its track being anterior and parallel to the iris plane in the inferonasal and inferotemporal quadrants. An oblique self-sealing, inferior paracentesis should be made parallel to the limbus to minimize damage to the lens. This can be used to reform the chamber intra- or postoperatively, if required. It also provides a controlled decompression of the AC and its reformation without manipulation of the sclerostomy site.

INFUSION
Anterior segment infusion through a AC maintainer through the paracentesis maintains the pressure and rigidity of the globe minimizing serious complications like choroidal effusion, etc. specially in high-risk eyes with myopia and buphthalmos. The intraocular pressure can be controlled using bottle height increasing the accuracy of wound closure, further reducing the chances of postoperative hypotony.

Alternatively, a three way tap may be used with the same effect (Fig. 13).

TRIAMCINOLONE ASSISTED VITRECTOMY
(AUTHOR’S TECHNIQUE)
The anterior vitreous is first stained by injecting 0.1 ml of preservative free triamcinolone acetonide to ensure complete clearing in the area of the tube. An automated limited anterior vitrectomy is then performed with high cut rate and low vacuum. (Figs 14 and 15).

ADVANTAGES OF TRIAMCINOLONE ASSISTED VITRECTOMY
- Better visualization of vitreous, therefore better vitrectomy, thus minimizing tube tip occlusion
- Visualization of drainage outflow through the valve, as the suspended triamcinolone particles can be seen to pass through the valve into the subconjunctival space.
- Anti-inflammatory effect of triamcinolone helps control the postoperative inflammation.

REVIEW OF LITERATURE
Schlote et al evaluated the safety and efficacy of pars plana-modified Ahmed Glaucoma Valve PS2 in advanced secondary glaucoma and found that one year after surgery, IOP was controlled (21 mm Hg or less) in ten of 11 eyes (91%), seven (64%) did not need medical antiglaucoma therapy. Average IOP decreased from 32.2 +/− 8.3 mm Hg before surgery to 15.7 +/− 7.7 mm Hg postoperatively (P < 0.0001). The average number of topically used medications used decreased from 2.9 +/− 1.2 to 0.545 +/− 0.78 (P < 0.0001). Complications included transient hypotony (three eyes-two of them without tube ligature), transient choroidal effusion (three eyes) and an intermediate increase in IOP (seven eyes).1

They concluded that pars plana-modified Ahmed Valve implantation is effective and safe in advanced glaucoma. Partial ligature of the tube is necessary to prevent early hypotony, and close follow-up of patients is needed to monitor variations of IOP within the first year.

Faghihi et al evaluated the efficacy and safety of the pars plana Ahmed glaucoma valve implant combined with PPV and panretinal photocoagulation for neovascular glaucoma in 18 patients with vitreous hemorrhage and concluded that pars plana vitrectomy and Ahmed valve...
Fig. 6: Trimming of the tube to an intravitreal length of 6 mm

Fig. 7: Sclerostomy being made at 4 mm from the surgical limbus

Fig. 8: Tube insertion

Fig. 9: UBM picture showing tube insertion 3.5 mm from limbus

Fig. 10: UBM picture of pars plana tube in situ

Fig. 11: Scleral patch graft over the tube

Fig. 12: Suturing the conjunctival flap
implantation seems to be a viable surgical modality in the management of neovascular glaucoma and coexisting posterior segment pathology with a relatively low rate of serious permanent postoperative complications.²

They reported that the mean preoperative IOP with oral and two or three topical antiglaucoma medications was 53.3 ± 10 mm Hg, and mean postoperative IOP without oral antiglaucoma medications was 16.3 ± 7.1 mm Hg (P < 0.0001) at the final visit. A postoperative hypertensive phase occurred in 7 patients (38.8%), of which all but one responded to medical therapy. There was one case of each of: mild vitreous cavity hemorrhage, hypotony, choroidal effusion, epiretinal membrane, corneal edema, and corneal ulcer.

Kim et al reported that the mean percentage decrease in corneal endothelial cell density in subject eyes following AGV implantation was 3.5% at 1 month, 7.6% at 6 months and 10.5% at 12 months after surgery. The superotemporal area, which was closest to the tube, showed the greatest decrease in endothelial cell density at 1 year after surgery.⁴

To determine the efficacy and associated complications of glaucoma drainage implant (GDI) surgery with pars plana tube insertion and penetrating keratoplasty (PK) in eyes with glaucoma and corneal disease, Sidoti et al retrospectively analyzed 34 eyes undergoing pars plana GDD insertion before, concurrent with, or after PK. Mean follow-up after completion of both GDI surgery and PK was 12.1 ± 8.4 months (range, 0 to 31.8 months). Twelve- and 24-month life-table rates for complete success after both GDI and PK were 63% and 33%, respectively. Twelve- and 24-month life-table success rates for IOP control and corneal graft clarity were 85%, 62%, 64% and 41%, respectively. Final postoperative visual acuity was the same as or better than (≥ 2 Snellen lines) the preoperative level in 29 patients (85%). One or more posterior segment complications occurred in 15 (44%) patients. They concluded that Pars plana tube insertion of GDD is a reasonable option for patients who have undergone PK or in whom PK is anticipated, despite the need for a complete pars plana vitrectomy.⁷

Lee et al reported a statistically significant corneal endothelial cell loss in the operated eye after AGV implant surgery, in spite of excluding those cases which required a second surgical procedure, or developed a tube corneal touch. The corneal endothelial cell loss increased with time: 15.3% at 12 months and 18.6% at 24 months after surgery, on average, in all measured areas.⁸

Although movement of the tube shunt device is uncommon after the implantation, a retraction of the tube,⁹,¹⁰
as well as its dynamic movement has been reported as a late complication. Law et al have reported that because the amount of tube movement was around 3 to 4 mm in all 3 eyes, it is possible that eyes with AGVs with less movement have not been identified clinically. Although the movement of tube in this small case series was not associated with any intraocular reaction or damage of intraocular tissue, especially the cornea long-term complications cannot be excluded.

Also, shallow or flat AC in a pseudophakic eye is a serious complication as this may permit the tube or the intraocular lens implant to touch the corneal endothelium leading to late corneal endothelial failure. The pars plana tube reduces the incidence of this potentially devastating complication.

CONCLUSION

Although complications related to limbal tube placement are avoided, the incidence of posterior segment complications may be higher for pars plana insertion. The potential for enhanced corneal graft survival with pars plana versus anterior segment tube placement warrants further investigation.

REFERENCES


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“True religion is real living; living with all one’s soul, with all one’s goodness and righteousness.”

—Albert Einstein