

Corneal integrity in ahmed valve implantation: pars plana vs ciliary sulcus vs anterior chamber

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Introduction

Complex and refractory glaucoma cases, non-responsive to maximal management, require surgical intervention. The Ahmed Valve, a Glaucoma Drainage Device, is widely used in these scenarios. It may be implanted into the anterior chamber, ciliary sulcus and pars plana. However, there is no general consensus in the literature on which location is best when corneal protection is considered. This paper aimed to review all these studies, including ours, to determine which may be best, while still not compromising on valve efficacy in intraocular pressure reduction.

Review

Glaucoma can be somewhat of a challenge at times to the ophthalmologist, in cases where intraocular pressures (IOPs) remain sustained at high levels despite medical management. These refractory cases aren't always plain Primary Open Angle Glaucoma cases, rather, inclusive of more complexities such as Neovascular Glaucoma, Uveitic Glaucoma, Steroid-Induced Glaucoma etc. At these points of maximal medical management, surgical modalities are often resorted to. Within this category, several options are widely used, namely Glaucoma Drainage Devices (GDDs), Trabeculectomy with or without Augmentation, iStents, ExPress Mini Shunts, and Cyclodestruction. Each method of course, carries with it its own set of advantages, disadvantages and degree of efficacy in reducing IOPs. Of interest to us in this review are the GDDs, particularly the Ahmed Valve, because of its advantageous valve system which allows for self-regulatory prevention of post-operative hypotony.

Implantation sites options include the anterior chamber (AC), ciliary sulcus (CS) or pars plana (PP). There is well-known debate into which poses the safest profile with regards to corneal harm. The conjecture is such that posterior placement in the PP can denote some degree of edge over AC placement, due to decreased crowding spatially, as follows. PP access steers away from risks of AC access, such as corneal oedema, corneal decompensation, corneal endothelial touch, hyphaema, refractive change, iris injury inter alia.^{1,2} The reasons AC siting may ensue a higher risk of corneal decompensation include the increased flow of aqueous proximal to the endothelium, AC inflammation, occasions of tube-corneal/angle touch and the innate foreign body reaction to the tube itself [2]. However, the exact frequency of corneal issues in patients implanted with the Ahmed Valve is not known, but is reported as 9%–27% in the long-term.² Notably, our study on PPAV in refractory glaucoma patients produced no post-operative corneal complications.³ demonstrated significant differences such that post-PP GDD implantation endothelial cell damage was lower than in post-AC GDD implantation.⁴ “Preservation of Corneal Endothelium after PP Tube Insertion of the Ahmed Glaucoma Valve” also supported this.⁵

Several studies in our literature search served to demonstrate that AC Ahmed Valve implantation does reduce endothelial cell density over time, in approximately 10.5%–16.6%.^{6–9} When AC Ahmed

Valves were compared to CC siting in other studies, they all concluded that CC siting may be more corneal-protective as compared with AC siting.^{10–13} No Endothelial Cell Density studies in PPAV Ahmed Valve Implantation were found in our literature search. Overall and generally speaking, however, it appears that the majority of the literature therefore advocates for more posterior siting of the tube, rather than AC placement. This can be further demonstrated in two studies which looked at tube-cornea proximity and its correlation with corneal damage.^{14,15} Both deduced that more posterior positioning of the tube could be more favourable in averting corneal endothelial loss. The majority of endothelial cellular population was lost within the superotemporal quadrant, (that is, the location of the tube's beveled tip,) as opposed to the central region, endorsing the hypothesis that increased tube-corneal proximity was related to the endothelial changes seen. It was further recommended that the tube-corneal angle (TCA) should be roughly 30 degrees to allow more corneal protection. Amidst all this debate, a 2018 meta-analysis comparing AC GDDs vs PP GDDs showed that there was no statistically significant difference between the two groups, as pertaining to corneal complications, exclusive.¹⁶

It must be borne in mind that not all cases of corneal decompensation are necessarily due to the valve. Prolonged high IOPs, drop preservatives, variable aqueous humour compositions, long/complicated surgeries, may also play a role.² Furthermore, uveitic settings, pre-existing endothelial dystrophies and age variability (by extension, precursory endothelial cell population variability,) within studied populations may skew data due to their effects on corneal structural integrity. Other limitations which may skew data within the literature are short follow-up periods with patient drop-out gaps, population variability, glaucoma types, ocular hypotensive brand variability, relatively small study groups and omission of corneal complication reporting in some of the studies. Overall, on retrospective review of the literature, this means there is still appreciable controversy surrounding the Ahmed Valve and corneal interface complications. Therefore, more largescale studies higher up on the Evidence Based Medicine hierarchy pyramid, on endothelial cellular effects of PP vs CS vs AC Ahmed Valve siting, with baseline patient controls, are required to deduce which site of implantation is safest. However, our view currently stands in favour of the most posterior placement of the Ahmed valve via pars plana access. We

support this not only because as evidenced in our own personal research and clinical experiences, but also because of the purported logical and feasible mechanisms and ergonomics reasoned in all the supportive literature aforementioned. We furthermore advocate for this location for added concurrent surgical benefit of posterior cavity washout of vitreous haemorrhage or inflammatory vitreous debris, allowing view for diagnostics, delamination, epiretinal membrane peels, endolaser, etc.

Conclusion

It is recommended that Ahmed valves should be surgically implanted more posteriorly within the eye to avoid corneal complications. Pars plana access appears to be most corneo-protective when compared with ciliary sulcus and anterior chamber implantation.

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Conflicts of interest

The author declares no conflicts of interest.

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