



Same-quadrant tube exchange and multiple-layer closure for recurrent tube erosion: Surgical technique description and preliminary results

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ABSTRACT

Purpose: This report describes a surgical approach involving a 5-layer closure performed for a patient with uveitic glaucoma who had an Ahmed Glaucoma Valve placed 12 years prior to presentation, then erosions which were revised 2 and 4 years ago. Additionally, the patient had a Descemet Stripping Endothelial Keratoplasty (DSEK) completed 4 years prior to presentation. The patient presented with a tube that was eroded and a DSEK that had failed.

Observations: We describe the process of same-quadrant tube exchange for a new Baerveldt Glaucoma Implant-350 with repositioning of the tube tip from the anterior chamber to the ciliary sulcus with a 5-layer closure with Tutoplast pericardial patch graft, capsule autograft harvested from the Ahmed capsule, Tenon's transposition from a different quadrant, Tenon's advancement from the same quadrant, and conjunctival advancement. By post-operative month 16, the patient had undergone a repeat DSEK and had an improved visual acuity and well-controlled intraocular pressure on one IOP-lowering medication.

Conclusions: In complex tube revision surgeries with melted sclera, difficult closure under tension, and/or presence of significant tissue defect, pericardial patch graft, capsule autograft, tenon's transposition, tenon's advancement, or conjunctival advancement should be considered, as needed.

1. Introduction

Placement of aqueous shunts are an effective surgical intervention for controlling intraocular pressure (IOP) in glaucoma but have complications including tube erosion. Late tube erosion rates have been reported to be 2–7% and can be associated with infection, ranging from a mild anterior chamber reaction to severe and vision-threatening endophthalmitis.^{1,2} When evaluating an eye with a tube erosion, important characteristics to consider include the type of tube, the quadrant the plate is located in, the position of the tube tip, the location and size of the erosion, the angle status, and the presence and severity of an associated infection. Additional factors to consider include whether the position of the plate or tube may be contributing to the erosion risk, whether there are any other prior, ongoing, or anticipated future risk factors for tube erosion or erosion recurrence, whether there are other known complications from the tube that may impact whether this tube should be left in place versus repositioned/removed (e.g. diplopia,

anterior uveitis, or cystoid macular edema), the etiology and severity of glaucoma, prior glaucoma surgeries or revisions on this eye and the fellow eye, visual potential of this eye and the fellow eye, conjunctival mobility, known or anticipated possible future glaucoma or other surgeries needed on this eye and the fellow eye, and the patient's goals and concerns.^{3,4} (see Fig. 1)

Broadly speaking, a tube erosion can be addressed with one of the following surgical strategies: 1) leave the plate and tube in place and cover it, 2) leave the plate in place and reposition the tube tip more posteriorly and cover it, 3) exchange the entire implant for either a new one of the same type or a different type, position the tip in either the same location or more posteriorly, and cover it, 4) remove the tube but leave the plate in place, and plan for a concurrent or staged procedure to provide more IOP-lowering, or 5) remove the entire tube and plate, and plan for a concurrent or staged procedure to provide more IOP-lowering.^{5,6}

Tube erosions managed successfully can still develop early or late

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recurrent erosions. There are currently no standardized guidelines for the surgical management of tube erosion or re-erosion. Herein, we discuss surgical strategies for repairing tube erosions via an illustrative case of a recurrently eroded Ahmed Glaucoma Valve FP7 referred to us by an outside glaucoma specialist (MG) for further management.

2. Case report

The patient is a 44-year old woman with uveitic glaucoma in her pseudophakic right eye presenting with a baseline VA of 20/1000 and an IOP of 10 mmHg on 0 IOP-lowering medications. The right eye had an Ahmed Glaucoma Valve placed 12 years prior to presentation, tube revisions 2 and 4 years ago, and a Descemet Stripping Endothelial

Keratoplasty (DSEK) completed 4 years prior to presentation. Upon presentation, the tube had re-eroded and the DSEK had failed. A repeat DSEK was to be performed after the tube erosion was first addressed. The primary goal of our surgery was to address the erosion and prevent future re-erosion. A secondary goal was to achieve better long-term IOP lowering, since she would be at risk for steroid-induced IOP rise after her anticipated future DSEK.⁷ We performed a same-quadrant tube exchange for a new Baerveldt Glaucoma Implant-350 (BGI-350) (Johnson and Johnson Surgical Vision, Irvine, California) with repositioning of the tube tip from the anterior chamber to the ciliary sulcus and a 5-layer closure with pericardial tutoplast patch graft, autologous capsular patch graft harvested from the Ahmed capsule, Tenon's transposition graft from a different quadrant, Tenon's advancement from the same

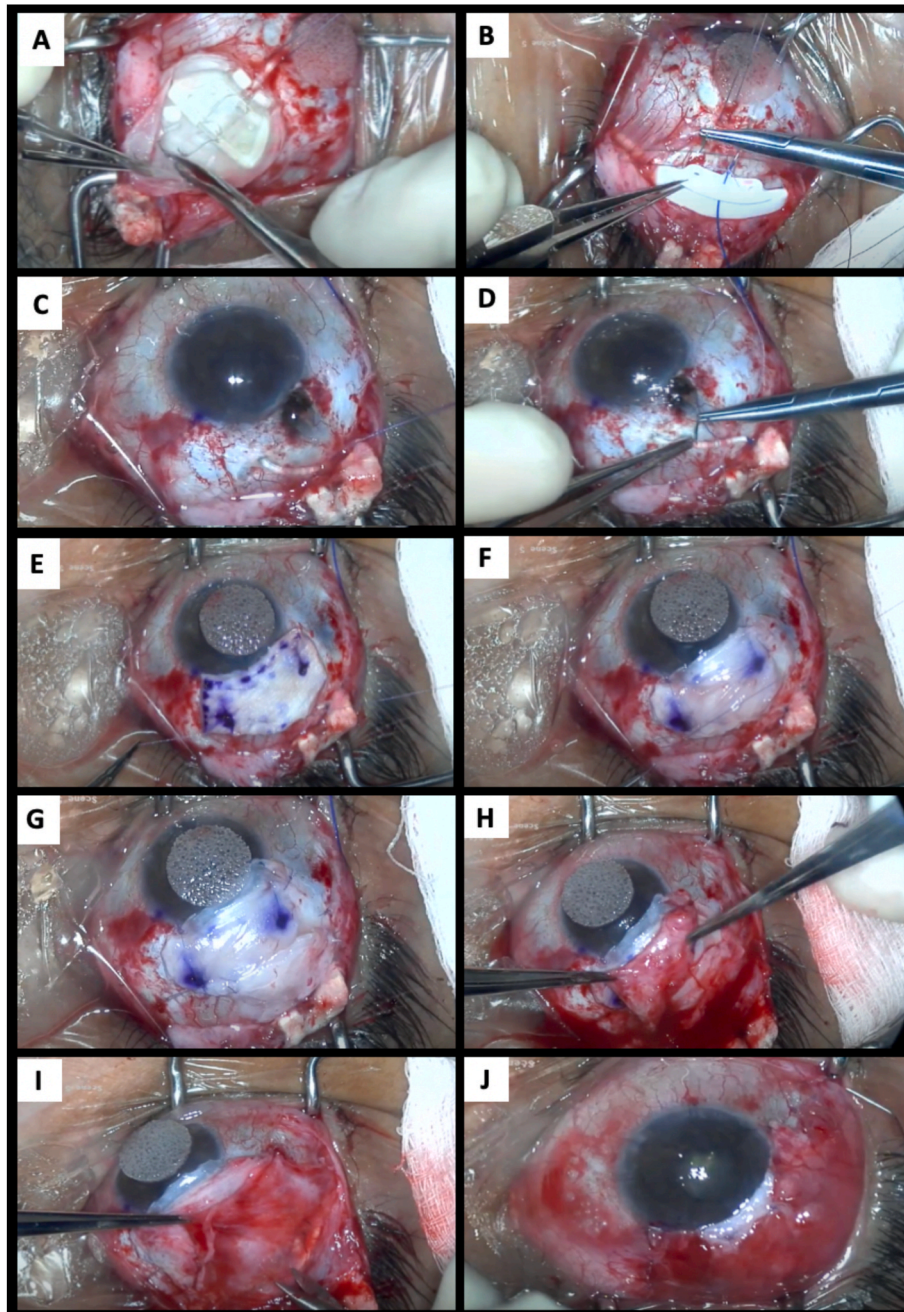


Fig. 1. (A) Capsule autograft harvested from prior Ahmed. (B) New Baerveldt-350 affixed to bare sclera in the same quadrant. (C) New tube inserted into ciliary sulcus. (D) Fenestrations for early IOP lowering. (E) Pericardial Tutoplast to reinforce sclera given extensive area of scleral thinning and melt at old tube entry site. (F) Capsule autograft covering pericardial Tutoplast. (G) Additional capsule autograft covering tube-plate junction. (H) Tenon's transposition. (I) Tenon's advancement. (J) Conjunctival advancement.

quadrant, and conjunctival advancement. (Video 1) By postoperative month 16, she had undergone a repeat DSEK, VA pinholed to 20/60, IOP was 12 mmHg on 1 IOP-lowering medication, and she was on Difluprednate Ophthalmic Emulsion 0.05 % twice per day for the DSEK, and the tube remained well covered without recurrent erosion.

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.ajoc.2024.102138>

Video 1. Surgical video demonstrating same-quadrant tube exchange and multiple-layer closure for recurrent tube erosion.

3. Discussion

There are well described strategies for covering tubes, including corneal, scleral, and pericardial allografts, and we have described our technique for harvesting a block of autologous capsule tissue from a preexisting tube's endplate for use as patch graft material.^{8,9} In this case, we used a large piece of pericardial tutoplast to reinforce the sclera and prevent leakage from the old tube site since the sclera at the old tube entry site was thin and melted, so there was no practical way to suture or plug the track shut. Since there was a large piece of Ahmed capsule tissue available, this was used as an additional layer of patch graft on top of the pericardial Tutoplast, and we hypothesize that capsular patch graft may incorporate into the surrounding tissues better than irradiated pericardium since it is autologous and still somewhat vascular. In primary and revision tube shunt surgery, the patch graft may be left bare but would typically be covered by conjunctiva, which may require a conjunctival advancement from the same quadrant, conjunctival rotation from a different quadrant, or a conjunctival free graft from the same or fellow eye. In between the patch graft layer and the conjunctiva layer, the Tenon's layer can either be left adherent to the underside of the conjunctiva or can be sharply separated from the conjunctiva and independently advanced, rotated, harvested as a free graft, left bare, or subsequently covered by conjunctiva, as needed. In addition to advancing the Tenon's and conjunctiva from this quadrant, a Tenon's transposition graft was also taken from an adjacent quadrant to provide an additional layer of coverage, which we hypothesize may reduce the risk of future recurrent erosion. If there is inadequate conjunctiva to achieve complete coverage even after considering a conjunctival free graft from the same or fellow eye, and the surgeon does not wish to leave any areas of bare sclera, bare patch graft, or bare Tenon's without additional coverage, then other materials (e.g. autologous buccal mucosa or processed allogenic amniotic membrane graft) can be used to bridge the gap in areas with a conjunctival defect.^{10,11}

4. Conclusion

When surgically managing an eye with a recurrent tube erosion, combining multiple methods of closure together maximizes the chances of a successful repair. When faced with melted sclera and/or a difficult closure under considerable tension and/or with a significant area of tissue defect, consider a pericardial patch graft, capsule autograft, Tenon's transposition, Tenon's advancement, or conjunctival advancement, as needed.

Patient consent

The University of Chicago IRB does not require written consent for

single case reports.

CRedit authorship contribution statement

Mikhayla Armstrong: Writing – original draft. **Jessie Wang:** Writing – review & editing, Writing – original draft. **Madhu Gorla:** Writing – review & editing. **Mary Qiu:** Writing – review & editing, Methodology, Conceptualization.

Declaration of competing interest

The authors have no conflict of interest.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.ajoc.2024.102138>.

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