The "Pocket" Technique: A Novel Surgical Technique for Repair of Glaucoma Drainage Device Tube Exposure

Tomas M. Grippo, MD,† Naomi E. Gutkind, MD,‡*
Nicolas Monteros Alvi, MD,† Carla Salina Indovino, MD,†
Matias J. Lopez Tomasella, MD,† Justina C. Mutti,†
Agustina L. Mena, MD,† and Fernando Mayorga, MD†

Précis: Presented is a novel surgical technique, termed the "pocket" technique, of scleral patch graft placement into a subconjuntival pocket to cover exposed glaucoma tube shunts, which is particularly useful in cases of scarred and thinned conjunctiva and Tenons.

Abstract: Exposure of glaucoma tube shunts is an uncommon postoperative complication which poses a significant risk to the patient and may be difficult to repair. In this case series, the authors present 2 cases using a novel surgical technique, the "pocket" technique, to place a scleral patch graft to address tube exposure. Patient 1 remained free of tube exposure at most recent follow-up visit after 21 months, and patient 2 remained free of tube exposure at most recent follow-up visit after 4 months. This technique offers an elegant surgical option that has multiple benefits; it allows for stability of the scleral patch graft even in cases of scarred down, thinned conjunctiva with minimal Tenons, allows for repair along the entire length of the tube shunt including perilimbal exposures, and allows for secondary healing when there is not enough conjunctiva to cover both the opening and the patch. These advantages make the "pocket" technique a quick to perform, minimally invasive surgical approach that is useful for addressing both difficult and straightforward tube exposure cases.

Key Words: glaucoma, ahmed glaucoma drainage device, tube exposure, scleral patch graft, new technique, case series

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Glaucoma is a progressive optic neuropathy and represents the second leading cause of blindness worldwide and represents the primary cause of irreversible blindness, affecting approximately 76 million individuals worldwide.[1,2]

The only modifiable risk factor for progression of visual field defects from glaucomatous optic neuropathy is elevation in intraocular pressure (IOP).[2–7] There are many approaches to achieving reduction in IOP, including medical, laser, and surgical treatment.[2,8,9] One such surgical treatment is implantation of an aqueous tube shunt, which allows egress of aqueous from the eye to an external, subconjunctival reservoir where it can be resorbed.[10,11] Efficacy of primary tube shunts has been demonstrated, and tube shunts are the preferred surgical approach in certain clinical situations.[10,11]

Although effective, aqueous shunt surgery can be complicated postoperatively, including extrusion of the tube or plate through the conjunctiva.[2] The prevalence of tube exposure in the postoperative period following the implantation of glaucoma devices has been reported to range from 2% to 7%.[2] Tube exposure of Ahmed valved implants specifically has been reported to be between 5% and 14.3%.[2]

An exposed tube can increase the risk of endophthalmitis by providing a pathway for microorganisms to migrate from the ocular surface and conjunctiva into the eye, and thus, prompt management and repair are essential.[12] Management of tube exposure can be challenging. Many techniques with variable success rates have been described for revision including extensive lateral conjunctival dissection with the use of various grafts including cornea, sclera, buccal mucosa, tenon cyst, tragal perichondrium, and double layer amniotic membranes.[12–18] There are certain risk factors that are associated with worse outcomes following revisional surgery including black race, diabetes mellitus, high number of medications for glaucoma before the implantation of the drainage device, a history of multiple laser procedures for glaucoma, and combination of drainage device surgery with another surgery.[13]

This article presents a novel, minimally invasive, and easily adaptable technique to position a full-thickness scleral patch graft in the case of exposed glaucoma drainage device tubes. This technique may be a used to address any tube exposure, but it may be especially useful in cases of scarred down, thin conjunctiva with little to no Tenons capsule or with erosions near the limbus or plate that may be difficult to close completely.

CASES

Case 1

A 71-year-old woman with a history of arterial hypertension and severe primary open angle glaucoma presented for second opinion after undergoing complex cataract extraction resulting in an iris-fixated intraocular lens and a previous failed superior trabeculectomy in her left eye. Due to paucity of records from her previous provider, it is not clear if mitomycin C was used in her initial surgery. At the time of presentation, her IOP was 32 mm Hg, and she underwent successful implantation of an Ahmed valve with scleral patch placement supero-temporally in her left eye in 2019.

During successive examinations, the IOP remained under control, the drainage device was correctly positioned, and the conjunctiva was in good condition. After 13 months,

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From the *Ophthalmology Department, Grippo Glaucoma and Cataract Center; †Hospital Alemán, Servicio de Oftalmología, Buenos Aires, Argentina; and ‡Bascom Palmer Eye Institute, Miami, FL.
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Reprints: Tomas M. Grippo, MD, Grippo Glaucoma and Cataract Center, Buenos Aires, Buenos Aires 1426, Argentina (e-mail: tomasgrippo@yahoo.com).

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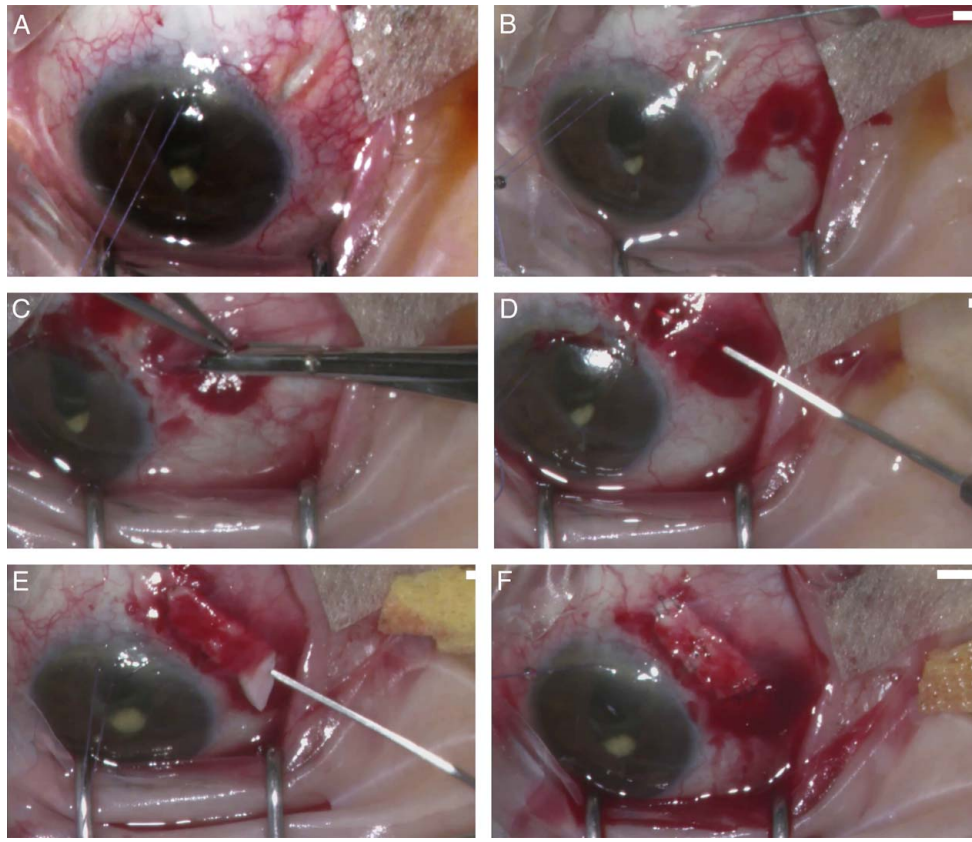

FIGURE 1. A, Surgical video footage of patient 1 after placement of traction suture to provide visualization of the exposed tube. B, Subconjunctival lidocaine with epinephrine is injected to provide anesthesia, hemostasis, and create dissection planes. C, Parallel conjunctival incisions are made on either side of the tube. D, Blunt dissection is used to mobilize conjunctiva around the exposed tube, and in each of the pockets to either side of the tube. E, The scleral patch is trimmed to the appropriate length and placed carefully in each pocket, appropriately covering the exposed tube. F, The conjunctiva is approximated with 10-0 nylon sutures. If the area overlying the patch graft is unable to be closed due to insufficient conjunctiva, it may be left to heal by secondary intention, as long as the tube is appropriately covered by the patch graft.

however, the tube was found to have eroded through thinned, scarred conjunctiva. The decision was made to perform revisional surgery, and the patient was placed on topical antibiotics in anticipation of surgical repair.

Case 2

A 73-year-old woman with a remote history of meningitis, with active exposure keratopathy and severe pseudoexfoliative glaucoma with prior cataract surgery and trabectome surgery had persistent elevation of IOP. She underwent implantation of an Ahmed valve with a native scleral flap supero-temporally in her right eye.

Six months after surgery, the tube was found to have eroded through thinned conjunctiva. The decision was made to perform revisional surgery, and the patient was placed on topical antibiotics in anticipation of surgical repair.

Surgical Technique

A sterile field is created with povidone iodine 5% and 10%. A 7-0 vicryl corneal traction suture is placed at the limbus proximal to the tube and the eye is rotated inferiorly to expose the extrusion site (Figures 1A and 2A). Dry and 70%-alcohol soaked Weck-cel sponges are used to clean the exposed tube to remove debris and epithelial cells. Preservative-free lidocaine 2% with epinephrine is administered subtenons (if tenons is present) and subconjunctivally around the tube erosion. This assists in anesthesia, hemostasis, creating dissection planes between the episclera and the fibrotic conjunctiva and tenons (Fig. 1B). Two parallel conjunctival incisions are made on either side of the tube exposure in areas of healthy conjunctiva a few millimeters away from the exposure (Fig. 1C). The length of these incisions is customized to each case in order to allow for easy positioning of the full-thickness scleral patch, and to create a margin of healthy conjunctiva. Blunt dissection is then performed approximately 2 mm in all directions from these incisions, including toward the exposed tube to mobilize the surrounding conjunctiva both below and above the tube to create a continuous pocket from incision to incision to place the sclera. (Fig. 1D). This margin should allow healthy conjunctiva to rest on top of the scleral patch graft in all directions to facilitate epithelialization above the graft. The edges of friable unorganized conjunctiva at the erosion site can be trimmed to facilitate epithelial growth if enough tissue is available. The size of the pocket is measured, and a scleral patch is trimmed to the appropriate size. It is then positioned over the extruded tube and below the surrounding conjunctiva (Fig. 1E). The donor patch graft is not secured to the recipient sclera as it is held in the "pocket" of conjunctiva and tenons. Finally, when possible, the conjunctiva is sutured with 10-0 nylon or

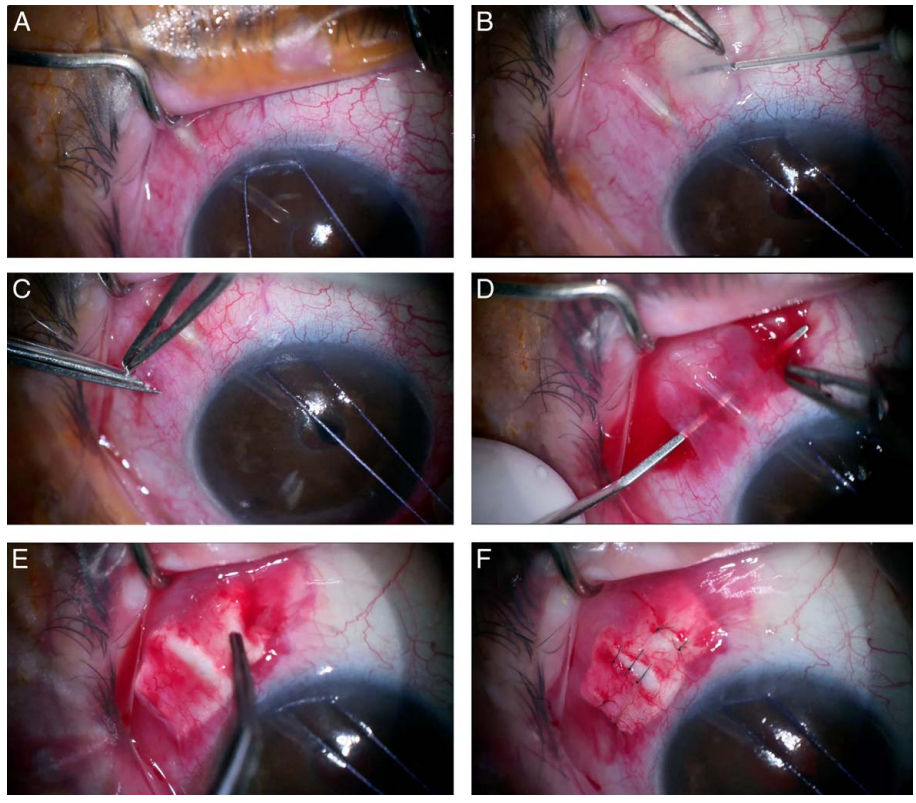

FIGURE 2. Surgical video footage of operative technique of patient 2. Image description from A to F corresponds to legend of Figure 1.

vicryl sutures to approximate the edges over the donor sclera, and to seal the new lateral conjunctival incisions (Fig. 1F). If conjunctiva is unable to be closed centrally, the authors place this few interrupted sutures to best-approximate the edges of conjunctiva and to secure these to the scleral patch graft.

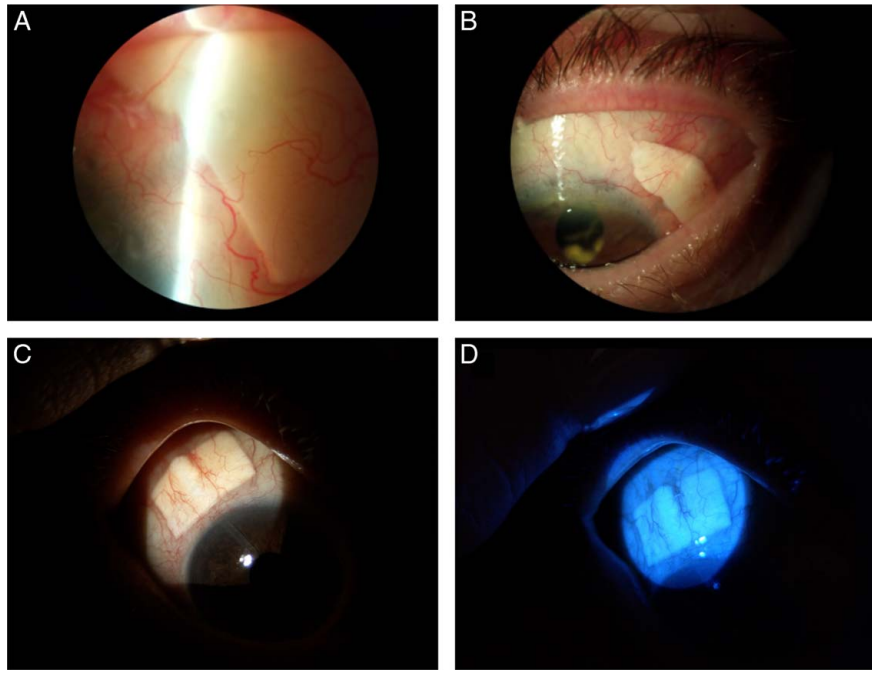

FIGURE 3. Slit lamp photography of patient 1 (A and B) and patient 2 (C and D) shows the previously exposed tube covered by a patch of sclera, which has well-healed conjunctiva overlying it.

RESULTS

Since revisional surgery, the patient in case 1 has been followed for 21 months, and the patient in case 2 has been followed for 4 months. During the postoperative period, the drainage device tubes have remained entirely covered by the scleral patch, with continuous epithelialized conjunctiva overlying in case 1 (Figs. 3A, B) and a more robust continuous conjunctiva in case 2 (Figs. 3C, D). There have been no clinical signs of infection, and the IOP has remained controlled.

DISCUSSION

The Ahmed valve implant is a good option for many glaucoma patients. However, tube exposure continues to represent a serious complication.[12]

It is the authors' experience that the "pocket" technique described offers significant benefits over previously described techniques. This method is minimally invasive, quick to be performed and learn, and is well suited for cases with insufficient conjunctiva, as the central defect overlying the scleral patch may be left to heal by secondary intention if unable to be closed. Additionally, this method may be used to address exposure along the entire length of the tube; in the authors' experience, it is a viable technique even for exposure near the limbus or the plate. When using this technique near the limbus, authors recommend tapering the edge of the scleral patch toward the limbus to reduce risk of dellen formation. In this clinical scenario it is important to, if not able to ovelay, at least aproximate remaining conjuntival tissue to at least be in contact with the donor sclera covering the tube to allow for the conjunctiva to grow over the graft. Given its minimally invasive nature and its ability to stabilize the scleral patch graft; it is also a suitable technique in cases of scarred down thin conjunctiva.

Several maneuvers must be performed to minimize the risk of inadvertent damage to the tube. When connecting the 2 sides of the pocket above and below the tube, dissection with a blunt cyclodialysis spatula, and blunt scissors is recommended to prevent the possibility of inadvertently nicking the tube. One must also pay special attention to avoid disinserting the tube from the eye while performing the dissection. The authors have not encountered complications from this procedure.

In this article, we present a useful technique to cover the exposed tube by creating pockets on the sides of the damaged conjunctiva, to house a scleral patch that will be placed. In our experience, this method is a quick minimally invasive procedure with a short learning curve, is well-tolerated by patients, and yields favorable postoperative outcomes.

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