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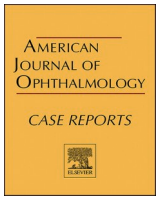

Unburied polytetrafluoroethylene scleral suture erosions and failure of pericardial graft revision

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ABSTRACT

Purpose: The purpose of this case series is to report three cases of exposed, unburied polytetrafluoroethylene (Gore-tex) sutures used for scleral fixated intraocular lenses and their management, including failure of pericardial patch and success of irradiated corneal patch. This series aims to inform management options for this uncommon adverse event.

Observations: A retrospective case series was conducted of three patients who presented at a tertiary care center with exposure of unburied Gore-tex sutures used for fixation of intraocular lens. All three patients underwent initial suture revision with pericardial graft patching. Chart review was conducted to assess past ocular history, operative technique for lens fixation surgery, time from this surgery to suture exposure, time to pericardial patch failure, and long-term outcome.

Results showed that pericardial patch grafting failed within several months in all three cases. One patient subsequently had an irradiated corneal graft placed and still had a successful outcome after 36 months of follow-up. Possible risk factors for suture erosion were identified as a surgical history of pterygium excision and loose or unburied suture knots.

Conclusions and importance: Pericardial patch grafting may not work well for unburied Gore-tex suture exposure. Eyes with prior complex histories are at risk for erosion of unburied Gore-tex sutures with surgical repair required.

1. Introduction

Polytetrafluoroethylene (Gore-tex, W L Gore and Associates, Flagstaff AZ) sutures can be used as sutures for intraocular lens (IOL) fixation.[1] Gore-tex is a nonabsorbable monofilament with greater tensile strength than polypropylene. Commonly used for heart valve and vascular procedures, the use of Gore-tex in ophthalmic procedures remains off-label with regards to FDA approval. Studies of clinical outcomes using Gore-tex indicate lower rates of suture-related complications.[2] One reported complication is exposure of the Gore-tex suture through erosion of the overlying conjunctiva at an incidence of 0–40 %.[1–4] Exposure of sutures can lead to severe adverse events including foreign body sensation or discomfort, scleritis, conjunctival granuloma formation, and endophthalmitis. Burying sutures under the sclera can help decrease these adverse effects by limiting the sutures' exposure to external ocular surfaces and environment, and decrease the risk of erosion.[5,6] Despite this potentially devastating outcome, there are no clear guidelines for the management of eroded sutures and few case reports sharing long-term outcomes. In general, it is recommended to explant the lens and place a new one in these instances, which is a complex intervention. The option of a more conservative treatment may be preferred depending on clinical context. Here, pericardial graft for patching was performed and subsequently failed. This tissue was selected because of its availability in the surgery center, affordability, and ease of suturing. It is a collagen matrix that has been commonly used as a tectonic support and to cover glaucoma shunts with favorable outcomes.[7] (see Table 1)

We report three consecutive cases which presented to our cornea service with conjunctival erosion of previously scleral-fixated Akreos lenses by Gore-tex CV-8 sutures. In each case the sutures were tied in 3-1-1 fashion and left loose. Knots were left unburied and covered by conjunctiva. The exposed sutures were initially managed with pericardial patch grafts and tightening of the sutures. Unfortunately, in each case the sutures eroded soon after the procedure. In one case, an

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Table 1
Cases summary.

Case number	Past ocular history	Time from IOL fixation surgery to suture erosion	Time from pericardial patch graft to second erosion	Outcome following pericardial patch graft failure
1	Pterygium excision w/MMC, complicated phacoemulsification cataract extraction	One month	Two months	Patient developed chronic, sterile endophthalmitis and progressive scleromalacia. IOL was explanted.
2	HSV keratitis, PKP, phacoemulsification with IOL, PKP dehiscence with IOL dislocation secondary to trauma	Nine months	Six months	Irradiated corneal patch graft was placed with conjunctivoplasty and remains stable after 36 months.
3	Complicated extra-capsular cataract extraction, IOL exchange for ACIOL, persistent CME and corneal edema	Thirteen months	Three months	Patient lost to follow-up.

irradiated corneal graft was then used for patching and maintained good coverage after one year. The average length of follow-up was 27.3 months following pericardial graft patching.

2. Case 1

A 75-year-old Ethiopian female presented with endophthalmitis and Gore-tex suture erosion through the sclera of her right eye eight months following 23 gauge pars plana vitrectomy (PPV) and Akreos AO60 (Bausch + Lomb, St Louis, MO) intraocular lens scleral fixation. She had a past ocular history in the same eye of pterygium excision with autograft and mitomycin C, as well as a complicated extracapsular cataract extraction after which she was left aphakic. At the time of the lens fixation, records did not show signs of scleral thinning or necrosis on exam, but the operative report noted significant conjunctival scarring. Eight months after the lens fixation, her vision had stabilized at 20/60, but she had returned to her initial surgeon for a foreign body complaint. Her nasal Gore-tex suture was found to have eroded through the conjunctiva. The patient was taken back to the operating room by the same surgeon for revision. The conjunctiva was too scarred to recover the suture and was subsequently rotated partially within the superior sclerotomy site. An amniotic membrane graft was applied over the suture and secured with Tisseal glue. Two weeks later, the patient presented to our walk-in clinic with severe eye pain and blurred vision. She was found to have corneal edema, 3+ anterior chamber cell and a small hypopyon. The nasal Gore-tex suture was re-exposed with granuloma formation. It was thought by her retina specialist that she had developed a rebound iritis, due to her abruptly stopping her postoperative prednisolone, rather than an infectious endophthalmitis. Nevertheless, she received an intravitreal injection of ceftazidime and vancomycin. Aqueous humor was sent for cultures but was negative for bacterial or fungal growth. She was started on frequent topical steroids and referred to our cornea service for further management. The patient's vision was 20/80 on presentation. The intraocular inflammation had responded quickly to steroids. The patient requested a conservative management given her age and multiple prior surgeries, but she agreed to be taken urgently to the operative room given risk of infectious endophthalmitis. A conjunctivoplasty and pericardial patch graft placement were planned. The conjunctiva in the area of exposure was atrophic, adherent to the sclera, and could not be completely dissected. Severe scleral thinning was found underlying the exposed nasal suture. A pericardial patch graft was placed on top of the eroded sutures and was secured using a combination of Tisseel Tissue glue and 8-0 vicryl sutures. A conjunctival autograft was harvested from the superior conjunctiva and used to cover the patch graft and sclera with assistance of Tisseel glue. On postoperative day one, the Gore-tex suture was well-covered. The patient's vision was 20/60 and she was comfortable. One week postoperatively, the conjunctival autograft started to retract, leaving a portion of the pericardial graft exposed, but not the Gore-tex sutures. Two months following the pericardial graft and conjunctivoplasty, the patient presented to clinic with recurrent complaints of foreign body sensation. Vision was slightly decreased to 20/80. It was noted that the Gore-tex sutures had eroded through the pericardial patch graft and was migrating into the corneal limbus. There was recurrent iritis. Given severe thinning of the patient's sclera adjacent to the limbus and concern for perforation, she underwent lens explantation. The surgeon's intention was to subsequently fixate a lens in another quadrant once the inflammation had resolved, but the patient was lost to follow-up.

3. Case 2

A 54-year-old Caucasian female presented with right scleral suture erosion twelve months after a 25 G PPV/Akreos lens was sutured to the sclera with Gore-tex CV-8 sutures. The patient had a complex ocular history in that eye including a penetrating keratoplasty over 20 years prior for corneal scarring from HSV keratitis, a phacoemulsification cataract extraction about 15 years prior, and an open globe rupture with graft dehiscence two years prior due to trauma. The patient's corneal graft was retained at the time, but her intraocular lens was dislocated. After her lens fixation surgery, she had an excellent outcome and regained vision of 20/40. At presentation, the patient complained of worsening vision, eye pain, and discomfort. Examination revealed an exposed temporal Gore-tex suture and knot with surrounding vascularization and conjunctival injection (Fig. 1A). No purulence or necrosis was visualized. The patient was taken back to the operating room for a conjunctivoplasty and pericardial graft placement. The exposed suture was noted to be loose and subsequently tightened by fixing it to the stroma with nylon sutures. The surgery was initially successful in providing coverage of the sutures and resolving symptoms (Fig. 1B). Five months later, however, the patient began to complain again of foreign body sensation and pain. Vision was decreased to 20/80. Examination demonstrated pericardial graft melt with a re-exposed remnant of the Gore-tex suture (Fig. 1. C). Given the patient's complex ocular history including HSV and a corneal graft that was in good health, the patient and surgeon opted to avoid IOL explantation and re-implantation and she instead underwent the a less invasive suture revision with placement of an irradiated half-thickness cornea patch, Visiongraft (CorneaGen), over the exposed sutures. Tisseel glue was placed under the graft to seal the suture to the sclera, and the anterior edges of the graft were anchored with nylon sutures. More than one year post-operatively, this graft had maintained good coverage of the sutures (Fig. 1. D).

4. Case 3

A 66-year-old African American male presented with suture erosion in his right eye fourteen months following 25 G PPV and Akreos lens sutured to the sclera by Gore-tex CV-8 sutures. The patient had a history of complicated extracapsular cataract extraction with anterior chamber IOL placement. The patient suffered from refractory cystoid macular edema (CME) and corneal edema leading to the lens exchange and 25 G PPV, which resulted in mild improvement of retinal and corneal edema. On presentation the patient complained of foreign body sensation and his vision was 20/200. Examination revealed an eroded Gore-tex suture and knot through the conjunctiva temporally. The decision was made to attempt a Descemet stripping endothelial keratoplasty (DSEK) and patching of the exposed sutures. The patient underwent combined DSEK and pericardial graft placement over the Gore-tex sutures with an

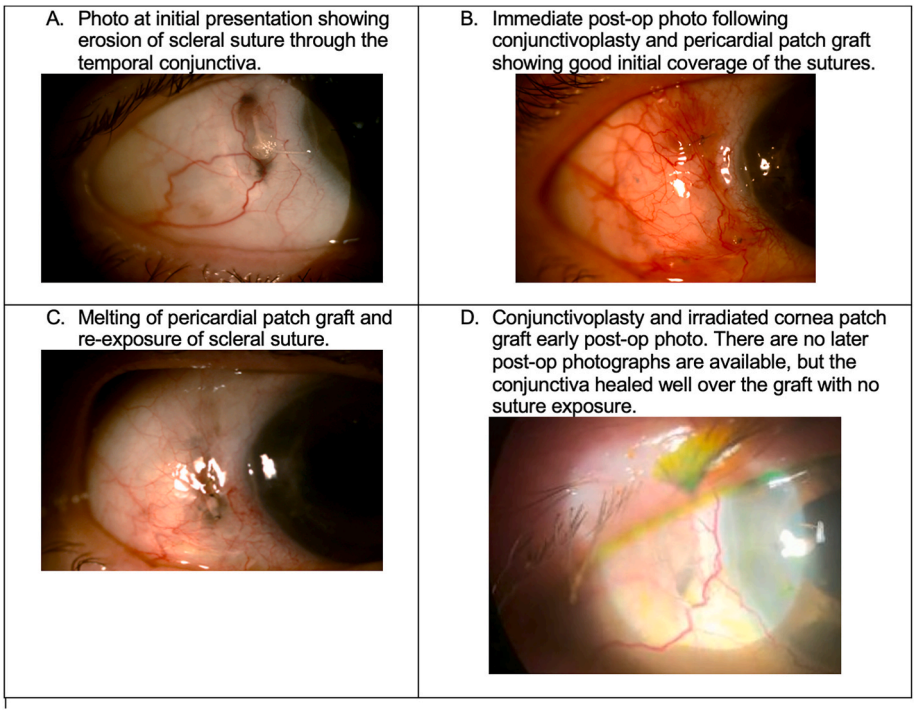

Fig. 1. Preoperative and postoperative slit lamp photographs of Case 2. A. Photo at initial presentation showing erosion of scleral suture through the temporal conjunctiva. B. Immediate post-op photo following conjunctivoplasty and pericardial patch graft showing good initial coverage of the sutures. C. Melting of pericardial patch graft and re-exposure of scleral suture. D. Conjunctivoplasty and irradiated cornea patch graft early post-op photo. There are no later post-op photographs are available, but the conjunctiva healed well over the graft with no suture exposure.

overlying conjunctivoplasty. During surgery, scleral thinning was noted adjacent to the sutures and suture knots were trimmed before pericardial graft placement. In the immediate postoperative period, the sutures were well-covered by a secure pericardial graft.

Two months following conjunctivoplasty and pericardial graft placement, the patient developed foreign body sensation and persistent pain. Vision was stable at 20/200; however, examination showed exposed temporal and nasal Gore-tex sutures. The cornea itself was healing appropriately with resolved corneal edema. The patient was planned for a revision procedure with an irradiated corneal patch graft, but was lost to follow-up.

5. Discussion

Outcome studies for polytetrafluoroethylene (Gore-tex) scleral sutures indicate mostly low rates of suture-related complications, though some estimate rates as high as 40 %.[1–4] The variability in the rate of suture erosions between studies may be related to surgical technique and length of follow-up. In our case series, the minimum time from surgery to exposure was eight months. In another series published by Junquiera et al.,[3] erosions occurred as early as several weeks after surgery. One factor leading to erosion is likely the surgical technique for tying Gore-tex suture, a technique that has evolved through surgeon experience. Currently many surgeons report rotating the knots or burying them under Hauffman scleral pockets. In the three cases we encountered, however, suture knots were not buried and the suture was left loose, similar to the technique used by Junquiera et al. While erosions can occur with a buried knot,[8] it is likely that some or all of these erosions could have been avoided by a different surgical technique. Another factor that can play a role in this complication is the health of the ocular tissue. The course of our patient with a history of pterygium excision was affected by severe thinning of the underlying sclera and scarring of the conjunctival tissue. With these cases in mind, it is important to take the patient's ocular history into consideration when planning scleral fixation surgery. The surgeon could consider fixating the lens away from the affected area or decide on a different implantation technique altogether.

As for the management of Gore-tex suture erosion, there is a paucity of published material. Junquiera et al. briefly mentions cutting the exposed tip of the suture in one case and suturing the conjunctiva in another case. These methods alone would have been unlikely to work in our cases as the sutures re-eroded despite shortening and good coverage with conjunctiva. Another series that reported suture erosion[8] managed it by lens explantation and cryotherapy as their patient developed scleral necrosis. Intraocular lens explantation and resuturing another lens in already scarred eyes is a risky and complex procedure and may not be preferred by patients who may have very good visual acuity with their current lens. On the other hand, there is more literature available regarding the management of polypropylene suture erosion. Techniques were described using scleral patch graft, allograft or autograft,[6] and corneal lamellar patch graft.[9] Scleral patches have been used for ages for covering glaucoma tubes and do well for that purpose although shrinkage has been reported in different publications.[10] It also does not provide a good cosmetic aspect. Similarly, partial thickness corneal tissue has also been using for glaucoma drainage device with good success.[11] There are not many studies of the use of these tissues for the repair of exposed suture for scleral IOL fixation. A technique was published where the corneal graft was fashioned during surgery by sectioning the patient's own cornea which was removed as they were undergoing concomitant penetrating keratoplasty. This technique was successful on eight patients with up to fifteen months follow-up but would obviously not be feasible in all erosion cases and would result in longer surgical times. Using a precut irradiated corneal patch may be a more convenient initial option to avoid IOL explantation in select cases of Gore-tex suture exposure. Although more costly than a pericardium or scleral patch, commercially available irradiated corneas are sterile, shelf stable at room temperature and available in different sizes and thickness (VisionGraft, Corneagen). We only used this tissue in one patient and did

not find other reports of its use for this indication in the literature, which is a limitation of our study. Nevertheless, it has been used successfully for long term in different applications like anterior or tectonic keratoplasties[12] and glaucoma shunt coverage.[13] On the other hand, our series shows that pericardium is apparently not an appropriate material for patching eroded Gore-tex suture. It melted rather quickly in all three cases. Its multidirectional collagen structure is different from the dense structure of the cornea's collagen, which may make it less resilient and would explain better outcomes with a corneal patch. Of note, a prerequisite for successful patch graft repair is adequate conjunctival tissue for covering the patch. In cases where the conjunctiva is too scared or atrophic due to previous surgeries, placement of a buccal mucosal graft on top of the corneal patch could be a good option as shown in one long-term series of exposed glaucoma tube repair.[14]

6. Conclusions

Management of unburied, exposed scleral sutures used for intraocular lens fixation remains a challenge for ophthalmologists and patients today. Patching the sutures may be appealing in specific cases, at least as a temporizing measure. In our series, grafting with pericardial patch seemed a convenient approach but failed rapidly in all three cases. Irradiated corneal patch grafting performed subsequently in one of those cases was successful over the long term. It is a promising option, but more studies are needed to assess its efficacy on a larger scale. Additionally, future studies could assess the use of alternative graft tissues such as donor sclera in these cases.

CRediT authorship contribution statement

Joseph Bechay: Supervision, Methodology, Investigation, Data curation, Conceptualization. **Sedona Rosenberg:** Writing – review & editing, Writing – original draft, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Erin Flynn:** Supervision, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Maya Bitar:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Patient consent

Written consent to publish this case has not been obtained. This report does not contain any personal identifying information.

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Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: This study was partially funded by the Richard A. Falls Virginia Lions Eye Institute Research Grant.

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