Implantation of Glaucoma Drainage Implant Tube Into the Ciliary Sulcus in Patients With Corneal Transplants

Shimon Rumelt, MD; Uri Rehany, MD

The placement of glaucoma drainage implants may be complicated by tube-corneal touch and endothelial decompensation, particularly after corneal transplantation. We describe an innovative surgical approach to glaucoma drainage implant procedures that may decrease such complications. The approach involves placement of the shunt tube into the ciliary sulcus. This approach may serve as an alternative to anterior chamber angle or pars plana implant placement in pseudophakic or aphakic eyes with refractory glaucoma and a high risk for corneal decompensation.

SURGICAL PROCEDURE

Limbal peritomy is performed in the upper nasal or temporal quadrants, exposing the scleral bed. An Ahmed or a Molteno implant is secured to the sclera with 6-0 polyester sutures 8 and 10 mm posterior to the limbus, respectively, between the superior rectus and the horizontal recti muscles. A 3- to 5-mm-long scleral tunnel is made with an angled crescent knife to secure the drainage tube and prevent late exposure. The sclerostomy into the ciliary sulcus is performed under a 3x3-mm, half-thickness, limbal-based scleral flap (Figure 1) with a myringotomy blade, approximately 1 mm posterior to the limbus at the 11- or 1-o’clock position. The blade is inserted with its shaft perpendicular to the limbus and beveled parallel to the iris plane. The position of the ciliary sulcus relative to the limbus was previously described for scleral fixation of posterior chamber intraocular lenses. The position of the blade tip is viewed during the procedure through the dilated pupil to confirm its location and avoid ciliary body separation. Iris retractors may be used to improve the view. The tube is introduced into the posterior chamber through the scleral tunnel and the sclerostomy under the limbal-based scleral flap. The edge of the tube protrudes approximately 3 mm into the posterior chamber. The shunt tube may not exceed the dilated pupillary margin, to avoid interference with vision. It should not be too short, to avoid possible closure by ciliary processes. The shunt tube is thus covered by scleral tissue except for 1 to 2 mm between the drainage implant and the posterior entrance of the scleral tunnel and 1 to 2 mm between the anterior opening of the scleral tunnel and the posterior lip of the limbal-based scleral flap (Figure 2). The fornix-based conjunctival flap is sec-
cured to the limbus with 7-0 poly-
glactin sutures.

At the conclusion of the proce-
dure, betamethasone acetate (3 mg) 
and gentamicin sulfate (20 mg) are 
injected subconjunctivally 180° away 
from the implant site. Postoperative 
topical treatment includes 0.3% gen-
tamicin sulfate, 4 times a day, 1% cy-
clopentolate hydrochloride, three 
times a day, and 0.1% dexametha-
zone sodium phosphate, 4 times a day 
and tapered gradually to once a day.

PATIENTS AND RESULTS

This procedure was performed in 3 
patients. The personal data, indica-
tions, preoperative treatments, and 
preoperative and postoperative vi-
sual acuities and intraocular pres-
sures are summarized in the Table.

The patients for this procedure 
were selected carefully. All had re-
fractory glaucoma and a high risk of 
corneal decompensation; all had un-
dergone other surgical procedures 
that failed to control their intraocu-
lar pressure; and there was potential 
to improve the vision in all cases. The 
insertion of the tube through the cili-
ary sulcus was selected as the proce-
dure of choice, owing to the combi-
nation of pseudophakia or aphakia, 
corneal graft, and moderate shallow-
ing of the anterior chamber. Ocular 
pain was alleviated following the pro-
cedure in all 3 patients.

The mean preoperative intra-
ocular pressure was 36.2 mm Hg 
(range, 32-41 mm Hg) with full an-
tiglaucoma medical treatment. The 
pressure decreased by approximately 
25 mm Hg to 11.3 mm Hg (range, 8-14 mm Hg) postopera-
tively without any antiglaucoma 
medication. Visual acuity remained 
stable during a mean follow-up of 18 
months (range, 16-20 months). The 
corneal grafts remained unchanged 
without complications. Figure 3 
demonstrates the tube in the poste-
ier chamber 13 months after sur-
gery in patient 3.

COMMENT

A glaucoma drainage implant is an al-
ternative to increase the success rate 
of filtration surgery in certain second-
ary glaucomas after failure of trabecu-
lectomy with adjunctive antimetabo-
lites. Introducing the shunt tube into 
the anterior chamber may be compli-
cated by tube-corneal touch in 8% to 
20% of patients and endothelial de-
compensation in 17% to 19% of pa-
tients.3 The risk of endothelial decom-
penion due to tube-corneal touch 
is further increased to 42%5 in eyes 
with corneal transplants.

Glaucoma develops in up to 53% 
of patients who have had penetrat-
ing keratoplasty.6 It is usually man-
aged by cyclodestruction, which is 
associated with postoperative inflam-
mation and may result in decreased 
visual acuity and phthisis bulbi. Im-
proved surgical results have been re-
ported after placement of the glau-
coma drainage implant through the 
pars plana.1 However, this proce-
dure requires pars plana vitrectomy 
to allow free access of aqueous hu-
mor into the tube. Our approach com-
bines several potential advantages, 
namely, avoidance of pars plana vitrec-
tomy and posterior segment complica-
tions, and a decreased risk for corneal 
decompensation. In the presence of a posterior chamber in-
traocular lens and intact posterior cap-
sule, the optic of the intraocular lens 
may prevent incarceration of the cap-
sule into the tube and vitrectomy may
be avoided. In aphakia, anterior vitrectomy may be sufficient. This procedure is simple and easy to perform by the anterior segment surgeon and, potentially, it may be used as an alternative for cyclodestruction, which has a less predictable result.

Ciliary sulcus placement of a shunt tube may be indicated in pseudophakic or aphakic eyes for refractory glaucoma in primary corneal diseases such as Fuchs endothelial dystrophy, in corneal transplantation, in shallow anterior chamber, or in extensive synchial angle closure. The procedure may be particularly advantageous in the presence of an anterior intraocular lens, since the tube would not disturb the lens. It is contraindicated in phakic eyes, since it may endanger the integrity of the crystalline lens.

We did not encounter major potential intraoperative complications such as ciliary body separation or suprachoroidal hemorrhage in these procedures. We operated on a limited number of patients owing to strict enrollment criteria. A larger series and a longer follow-up are required to establish the efficacy and safety of this procedure and to support its use as an alternative to other techniques.

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REFERENCES


Figure 3. A slitlamp photograph of patient 3 taken 13 months after the ciliary sulcus implantation of a glaucoma drainage implant combined with penetrating keratoplasty and scleral fixated intraocular lens. The corneal graft is clear and the tube is located between the intraocular lens and the dilated iris.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patient 1</th>
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<th>Patient 3</th>
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<td>General data</td>
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<td>32</td>
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<td>Indication for PK</td>
<td>PBK</td>
<td>Penetrating eye injury and PBK</td>
<td>ABK</td>
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<td>Initial treatment</td>
<td>Nd:YAG laser and cyclophotocoagulation</td>
<td>Trabeculectomy with mitomycin, Nd:YAG laser, cyclophotocoagulation, and cyclocryoablation</td>
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<td>Preoperative data</td>
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<td>Visual acuity</td>
<td>CF at 6 ft</td>
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<td>Antiglaucoma treatment</td>
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<td>0.5% Timolol maleate, bid</td>
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<td>Postoperative data</td>
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<tr>
<td>Visual acuity</td>
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<td>20/80 (graft replacement)</td>
<td>20/40</td>
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<td>IOP, mm Hg, range†</td>
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<tr>
<td>Follow-up, mo</td>
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<td>20</td>
<td>18</td>
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*PK indicates penetrating keratoplasty; PBK, pseudophakic bullous keratopathy; ABK, aphakic bullous keratopathy; CF, counting fingers; IOP, intraocular pressure; bid, twice daily; tid, 3 times daily; qid, 4 times daily; and CME, cystoid macular edema.

†There was no treatment with antiglaucoma medication for these measurements of postoperative IOP.