Trabeculectomy With the Use of Amniotic Membrane for Uncontrollable Glaucoma

Hiroshi Fujishima, MD
Jun Shimazaki, MD
Naoshi Shinozaki
Kazuo Tsubota, MD

Abstract. Although trabeculectomy is an established surgical technique for glaucoma, in some cases it does not achieve a good filtering effect despite the use of mitomycin-C (MMC). The authors have developed a new surgical technique for uncontrollable glaucoma that uses amniotic membrane to prevent postoperative adhesion of conjunctiva and sclera. They performed trabeculectomy with a limbal-based conjunctival flap using 0.4 mg/ml of MMC for 2 minutes. Amniotic membrane was then placed under the scleral flap and sutured using 10-0 nylon. Among 14 eyes of 13 patients who underwent this procedure, intraocular pressure was controlled to less than 20 mm Hg after surgery in 13 eyes, including 3 eyes that underwent a second surgery with the same technique and 2 eyes that underwent laser trabeculoplasty. The authors' results suggest that this technique is efficacious for the reduction of intraocular pressure in high-risk glaucoma patients. [Ophthamlc Surg Lasers 1998;29: 428–431.]

Glaucoma that cannot be controlled despite maximum medical therapy, especially after penetrating keratoplasty (PKP), and secondary glaucoma are treatment-resistant diseases. Although mitomycin-C (MMC) and 5-fluorouracil have been used with trabeculectomy, some cases of uncontrollable glaucoma have persisted.¹

Amniotic membrane exists in the uterus during pregnancy, working to maintain an unborn baby. It is known to produce some growth factors that decrease inflammation, and it provides a stable and quiet epithelium.²,³ The regulatory mechanism of human intrauterine milieu is the effect of various substances on the production of endothelin⁴ and brain neurotropic peptide by amnion cells. This production is stimulated by epidermal growth factor,⁵ transforming growth factor-β, basic fibroblast growth factor,⁶ or interleukin-1, which are detected in human amniotic fluid. The use of amniotic membrane for reconstruction of the ocular surface somehow prevents symblepharon formation. The presence of amniotic membrane itself or some cytokine release may keep fibroblasts from forming an adhesion.³ We think that the prevention of fibroblast stimulation is beneficial for maintaining a functional bleb after surgery. Thus, we used amniotic membrane for trabeculectomy in patients with uncontrollable glaucoma to prevent postoperative adhesion under the scleral flap.

PATIENTS AND METHODS

We reviewed the records of 13 patients (9 men and 4 women, mean age 56.2 ± 15.0 years, 14 eyes) with treatment-resistant glaucoma who underwent surgery between June 1994 and July 1995 (see the table). The indications for surgery were uncontrolled intraocular pressure (IOP) with conventional trabeculectomy and MMC, after PKP, or secondary glaucoma. Each patient received topical and oral antiglaucomatous therapy, but the IOP remained uncontrolled. Informed consent was obtained for this treatment.

Before surgery, we determined which part of the conjunctiva was the most mobile and whether it had undergone previous filtering surgery. We removed 10 mm of the graft from patients who had limbal
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allografts. Sub-Tenon's anesthesia, a local anesthesia consisting of 2% lidocaine diluted with 1:80,000 epinephrine (Xylocaine E, Fujisawa Pharmaceutical Co., Ltd., Tokyo, Japan), was administered. We performed the limbal-based trabeculectomy with application of 0.4 mg/ml of MMC for 120 seconds using a methy cellulose sponge. A scleral block (4 × 1 mm) and a scleral flap (5 × 5 mm) were fashioned.

Sterilized fetal membrane was obtained from cesarean section. The serum of the mother contained no HIV, or hepatitis B or C antigens. The fetal membrane was cut into 5 × 5-cm pieces and stored at -80°C with dimethyl sulfoxide for 2 weeks prior to surgery. After washing and defrosting the tissue in 20 ml of sterilized water with 50 mg of dibekacin sulfate (Panimycin injection, Meiji Seika, Ltd., Tokyo, Japan), we removed the amniotic membrane from the fetal membrane. We placed the amniotic membrane (7 × 2 mm) on the eye, with the epithelial side up, next to the site of MMC treatment. We used 10-0 nylon to suture it between the sclera and the scleral flap, 2 mm posterior to the scleral block. We used 10-0 nylon to suture the scleral flap (Figs. 1 and 2).

Postoperatively, each patient received a subconjunctival injection of 2 mg of corticosteroid (Rinderon injection, Shionogi Co., Osaka, Japan) and 50 mg of dibekacin sulfate on the other part of the conjunctiva. Each patient received topical 0.1% betamethasone sodium phosphate (Sanbatazone; Santen Pharmaceutical Co., Osaka, Japan) and a topical antibiotic (Tarivid, Santen Pharmaceutical Co.) applied 5 times daily for 4 weeks. All antiglucomatous treatments were stopped.

Figure 1. Amniotic membrane (arrow) was sutured under the scleral flap using 10-0 nylon.

Figure 2. Schema of sutured amniotic membrane (white arrow = 10-0 nylon suture; black arrow = amniotic membrane). Patients 5 and 9 achieved success after two surgeries and patients 2 and 13 after laser trabeculoplasty.

STATISTICAL METHODS

Data were reported as mean ± SD. The IOP was analyzed using a paired Student's t test, with a level of .05 accepted as statistically significant. Glaucoma was considered to be controlled when the IOP was less than 20 mm Hg with medical treatment.

RESULTS

The mean follow-up period after surgery was 29.6 ± 3.2 months (range 26 to 36 months). Five eyes had undergone trabeculectomy with MMC and still had uncontrolled IOPs. Nine eyes had had PKP and corneal limbal transplantation for conjunctival disorders.

Trabeculectomies had been performed on 14 eyes: 8 on the superior sclera, 2 nasally, 3 temporally, and 1 inferiorly. At 3 and 12 months after surgery, the IOPs of 13 eyes were better controlled than before treatment (IOP less than 20 mm Hg; P = .0001, paired Student's t test) and these eyes had deep or wide bleb formations. One eye (patient 3) had a retinal detachment. Eight eyes retained their visual acuities, 4 had graft rejection (patients 2, 4, 9, and 13), and 1 had visual field loss (patient 7). Two patients (patients 5 and 9) underwent the same second surgery, and 2 patients (patients 2 and 13) underwent laser trabeculoplasty. After the mean follow-up period, 9 eyes were con-
trolled with no medication, 2 eyes were controlled with additional topical antiglaucomatous therapy (patients 8 and 12), 2 eyes were controlled with additional topical and oral antiglaucomatous therapy (patients 2 and 7), and 1 eye was null due to retinal detachment. A patient with graft rejection (patient 13) required further treatment. Other complications, such as infection or hypotonous maculopathy, were not seen, but eight cases of a flat anterior chamber without corneolenticular touch remained 2 weeks after surgery.

**DISCUSSION**

Glaucoma with ocular surface disorders such as ocular cicatricial pemphigoid (OCP), Stevens–Johnson syndrome, or alkali burn of the ocular surface also has conjunctival disorders. It is difficult to maintain a deep or wide bleb formation in glaucoma because of easy adhesion of conjunctiva and sclera. MMC has been used with trabeculectomy, but uncontrollable glaucoma still exists. Therefore, more effective treatment is necessary.

Because they had corneal and conjunctival disorders, 9 of the 14 eyes in our study underwent limbal transplantation (LT) to support the corneal and conjunctival stem cell population. LT is a transplantation technique that uses allograft–limbal tissue. Corneal stem cells are found in the limbal area. LT can help to reestablish a new ocular surface epithelium. Severe ocular disorders exist in eyes that need LT.

Recently, transplantation of amniotic membrane has been introduced for use in the surface reconstruction or treatment of severely damaged corneas. The use of amniotic membrane substrate for the bulbar conjunctiva has been proposed by Kim and Tseng and Tsai and Tseng. The amniotic membrane is made of a strong and stable collagen and is known to produce some growth factors and cytokines that decrease inflammation and prevent fibrosis and adhesion. Vessels never invade the amniotic membrane during gestation.

We used this new treatment for patients with severe glaucoma and ocular surface disorders to decrease the inflammation around the bleb and to decrease scleral flap adhesion. This adhesion is decreased by reducing inflammation or the space between the amniotic membrane and the scleral flap. Amniotic membrane is abundant and easily prepared. Although few patients were studied, this treatment should be considered. It is possible that MMC itself affects the scleral flap adhesion. Our results suggest that this surgery is efficacious in the reduction of IOP in patients with severe glaucoma and that it causes no adverse effects.

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**REFERENCES**