Objectives: To describe a microsurgical approach to a selective pedunculated conjunctival flap for the treatment of chronic corneal ulceration with or without corneal perforation, and to present the results of 50 consecutive cases.

Design: Retrospective, noncomparative case series and case reports.


Interventions: Partial pedunculated conjunctival flap surgery.

Methods: Review of the initial ocular diagnoses and characteristics as well as retrospective study of the postoperative course.

Main Outcome Measures: Resolution of the corneal ulcer and postoperative stability of the conjunctival flap.

Results: Sixty-two percent of the corneal ulcers treated were nonperforated, and 38% were perforated. The diagnoses included herpes simplex virus (14 patients), bacterial ulcer (11 patients), rheumatoid arthritis (8 patients), aphakic bullous keratopathy (6 patients), graft rejection (4 patients), herpes zoster virus (5 patients), and other (2 patients). Postoperatively, 94% of the conjunctival flaps were stable, and 3% had failed. The procedures were definitive in 64% of cases and temporary in 36%; 61% of patients received a corneal transplant 6 to 24 months postoperatively, and in 38% the flaps were removed 6 to 12 months after the original lesion had healed.

Conclusion: A selective pedunculated conjunctival flap is an effective and practical surgical approach to the treatment of perforated and nonperforated corneal ulcers that have not responded to other types of medical therapy.

Arch Ophthalmol. 2003;121:1189-1193

The technique of using a conjunctival flap for the treatment of chronic corneal ulceration was described by Gunderson1 in the late 1950s and became a standard surgical procedure. There are some drawbacks to this procedure, however.1,2 During the past 20 years, progress in microsurgical technique, aided by the microscope and fine surgical tools, has enabled us to use a selective pedunculated conjunctival flap secured in place by fine sutures and tailored to cover a desired area of the diseased cornea for the treatment of chronic corneal ulceration with or without corneal perforation. This microsurgical approach to the conjunctival flap provides a convenient alternative to the procedure developed by Gunderson without its drawbacks. The technique may be performed in an outpatient setting, and postoperative recovery is rapid. The purpose of this article is to describe the microsurgical approach to the conjunctival flap, highlight 2 case reports, and present the results of 50 consecutive cases.

METHODS

The microsurgical conjunctival flap technique may be performed in the minor surgical procedure room under a microscope. After the application of topical anesthetic solution, the eye is prepared with povidone iodine and draped in the usual sterile fashion. An eye speculum is inserted. A sponge (Weck-Cel; Medtronic Ophthalmics, Jacksonville, Fla) or cotton-tipped applicator is used to remove the loose epithelium over the diseased portion of the cornea and for 1 mm surrounding the lesion. A sponge (Weck-Cel; Medtronic Ophthalmics, Jacksonville, Fla) or cotton-tipped applicator is used to remove the loose epithelium over the diseased portion of the cornea and for 1 mm surrounding the lesion. The size and location of the denuded area are evaluated, and a deci-
sion is made regarding the most suitable site for obtaining a pedunculated bulbar conjunctival segment for covering the area (Figure 1A). The most suitable segment will typically be the one nearest the corneal lesion and with the best blood supply. Next, 0.5 to 1 mL of 1% to 2% lidocaine hydrochloride with epinephrine (dilution, 1:100,000) is injected subconjunctivally into the desired area. The initial needle puncture is kept away from the site where the conjunctiva is going to cover the diseased cornea. Rolling a cotton-tipped applicator over the inflated conjunctiva helps to spread the lidocaine and reduce the conjunctival stretching from the injection (Figure 1B).

A peritomy is performed from the 2-o’clock to 3-o’clock positions in the desired quadrant. A crescent-shaped incision peripheral to the peritomy is then made to isolate the appropriate size of the pedunculated conjunctival flap. The flap is undermined, and the incision is extended until the mobilized flap can stay over the corneal defect without traction (Figure 1C). If the conjunctival flap is being prepared for a perforated corneal ulcer, tissue from the Tenon capsule is mobilized along with the conjunctiva. Care is taken to preserve the vascular supply of the flap as much as possible.

The flap is then secured to the cornea using 10-0 monofilament nylon sutures. The suturing technique is one of the most crucial steps and the key to the success of this procedure. The first suture bite is passed through the conjunctival flap near the limbus. The needle is inserted at the edge of the diseased portion of the cornea, passed through the intact cornea, and pulled out just central to the edge of the intact corneal epithelium, being careful not to include any of the epithelium and to avoid infolding of the conjunctiva. The suture is tied snug. The second bite follows the tract of the first suture, pulling it. The initial knot passes into the suture tract, thus minimizing postoperative irritation from exposed knots. Each subsequent bite of the running suture includes 0.5 mm of the central conjunctiva and 0.5 to 1 mm of peripheral corneal tissue. Each bite passes through half the thickness of the cornea, enters about 0.5 mm central to the denuded edge of the corneal epithelium, and comes out just at the edge of the rolled epithelium. The last suture is tightened, tied, and rolled. The knot is buried under the conjunctiva or into the corneal tissue (Figure 1D).

The flap over the cornea should be neither too tight nor too loose. Sutures that are too tight may pull through a tight conjunctival flap, and a loose flap will not heal and may come off during the postoperative period. After completion of the running suture, edges of the corneal epithelium can be rolled over the suture and denuded area. Antibiotic ointment and a cycloplegic drug are administered, and the eye is patched. After 24 hours, the dressing is changed; by that time, there is usually no epithelial defect. The eye is treated with a topical antibiotic until it heals. The sutures may be removed 10 days to 2 weeks postoperatively if they become loose. Otherwise, they can be left in place for weeks or months.

**RESULTS**

We reviewed the records of all patients who had microsurgical conjunctival flap procedures for the
treatment of chronic corneal ulcers between 1982 and 1996. A total of 50 eyes of 50 patients were evaluated (Table). Patients were aged 15 to 85 years.

There were 21 male patients and 29 female patients. At the time of the initial diagnosis, 31 (62%) of the corneal ulcers were nonperforated. Nine (29%) of these were infected, and 22 (71%) were sterile (noninfected). The remaining 19 eyes (38%) had perforated ulcers. Eight (42%) of these were infected, and 11 (58%) were noninfected. The diagnoses for patients requiring a microsurgical conjunctival flap included herpes simplex virus (14), bacterial ulcer (11), rheumatoid arthritis (8), aphakic bullous keratopathy (6), graft rejection (4), herpes zoster virus (5), and other (2). The immediate postoperative outcome for 47 patients (97%) was successful, marked by a formed anterior chamber, healed ulcer, and quiet anterior segment of the eye. Three (6%) of the conjunctival flaps failed because of retraction or a nonhealing lesion. Thirty-two (64%) were performed as definitive procedures, 21 (42%) for peripheral ulcers and 11 (22%) on blind eyes. Eighteen (36%) of the conjunctival flap procedures were performed as a temporary measure. Eleven (61%) of these eyes received corneal transplants 6 to 24 months postoperatively. In 7 eyes (38%), the conjunctival flap was removed 6 to 12 months postoperatively after the original lesion had healed.

---

**REPORT OF CASES**

**CASE 1**

An 18-year-old female contact lens wearer developed redness and a white spot in the nasal corner of her right eye. Forty-eight hours later, the patient developed a large necrotic ulcer caused by *Pseudomonas aeruginosa* infection that perforated despite intensive topical antibiotic treatment (Figure 2A). Although tissue adhesive was applied, results of the Seidel test were positive for leaks, and the anterior chamber was shallow. She was seen at our office 1 week after her initial visit for a second opinion on a possible corneal transplant. The initial visual acuity was hand motions OD. Using microsurgical technique, a conjunctival flap was mobilized from the upper nasal quadrant and secured onto the area of the perforated cornea. The anterior chamber reformed within half an hour postoperatively. The eye was patched, and the patient was sent home. On postoperative day 1, results of the Seidel test were negative for leaks, and the anterior chamber was deep. The epithelium had healed. The patient was prescribed a topical antibiotic. At 6 weeks postoperatively, the sutures were removed. Her visual acuity was 20/60 OD. Five months after the procedure, the eye remained quiet with a corneal scar on the nasal side (Figure 2B).

**CASE 2**

A 78-year-old woman with rheumatoid arthritis came to our office 12 hours after developing watery eyes and decreased vision in the right eye. At examination, her visual acuity was 20/100 OD, the anterior chamber was flat, and a perforated sterile ulcer was seen at the 2-o’clock position in the midperiphery (Figure 3A). Using microsurgical technique, a conjunctival flap was secured into place over the perforated cornea. The anterior chamber reformed within half an hour postoperatively. The eye was

---

<table>
<thead>
<tr>
<th>Summary of Patient Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical Diagnosis</strong></td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Herpes simplex virus</td>
</tr>
<tr>
<td>Bacterial ulcer</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
</tr>
<tr>
<td>Aphakic bullous keratopathy</td>
</tr>
<tr>
<td>Graft rejection</td>
</tr>
<tr>
<td>Herpes zoster virus</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

*Three conjunctival flaps failed, 2 because of bacterial ulceration (1 patient received a graft, and 1 was blind and underwent evisceration) and 1 because of neurotrophic keratitis (patient underwent a second conjunctival flap procedure).*

---

Figure 2. A, Slitlamp photograph demonstrating the perforated necrotic ulcer, caused by *Pseudomonas aeruginosa* infection, covered with glue adhesive. B, Slitlamp photograph showing the cornea 5 months after the pedunculated conjunctival flap procedure.
patched, and the patient was sent home. At 6 weeks postoperatively, the sutures were removed (Figure 3B). Three months after the procedure, the patient’s visual acuity was 20/60 OD, and an immature cataract was seen.

**COMMENT**

In the past century, there have been many surgical approaches to the treatment of destructive corneal conditions. Among them was the use of conjunctival flaps, which could restore ocular surface integrity and provide metabolic and mechanical support for corneal healing. Described by Gunderson, the most accepted and popular technique involved making a 360° peritomy, mobilizing tissue from the upper bulbar conjunctiva, removing the corneal epithelium, and securing the flap to the lower limbal conjunctiva. Coverage of the entire cornea with the conjunctiva obstructed any view of the anterior chamber, precluded monitoring of corneal disease progression, and made it difficult to determine the presence and progress of secondary glaucoma. In addition, this procedure was challenging in patients with short fornices and had the potential to cause ptosis. It also required a more careful and extensive surgical procedure in the operating room. Any buttonholes or traction that could ultimately lead to flap failure had to be avoided. These limitations as well as advancements in modern corneal transplantation techniques and the use of tissue adhesives ultimately favored alternative approaches to treatment.

However, corneal transplantation is not always suitable; an inflamed, highly vascularized cornea, for example, carries a high risk of graft rejection. The use of tissue adhesives also has its drawbacks. It may result in a long, protracted course of recovery and has limited use in the setting of prolapsed uveal tissue through a corneal perforation.

The microsurgical technique of using a selective, pedunculated, partial conjunctival flap tailored to cover the desired part of the diseased cornea provides a convenient and logical alternative to the procedure developed by Gunderson in instances when only partial protection of the cornea is needed. It is an easily performed, highly effective solution for difficult-to-treat destructive corneal problems. It can be done in an outpatient setting, and postoperative recovery is rapid. Visualization of the anterior segment is not limited with this technique. Progression of corneal disease can be monitored, and intraocular pressure can be measured. It may be used in patients with short fornices, and we have seen no cases of ptosis in this series. We used a thin conjunctival flap for nonhealing superficial ulceration. For deeper corneal ulcers and perforation, we included the Tenon capsule with the conjunctival pedicle to provide stronger mechanical support for the cornea. In no instance of ulcer perforation did we notice bleb formation at the site of the conjunctival flap. The appeal of our selective pedunculated conjunctival flap technique is in its practicality for being performed as a minor surgical procedure and its versatility in being used as a temporizing measure. For peripheral ulceration or microperforation, this technique is meant as the definitive procedure. However, for central ulceration it can be used to temporize the inflamed eye until the ulcer heals and corneal transplantation can be performed. In this series, 18 (36%) of the flaps were later removed; 11 of these patients received a corneal transplant 6 to 24 months postoperatively once the eye was stable without any inflammation. Temporizing with a selective conjunctival flap has the advantage of reducing the risk of corneal graft rejection. The other 7 conjunctival flaps that were removed stabilized the original lesion and aided in the healing process of the corneal ulcer.

Of the 50 selective pedunculated conjunctival flap procedures performed in this case series, only 3 (6%) failed because of retraction of the flap or because the original lesion had not healed. The key to a successful pedunculated conjunctival flap includes selection of the appropriate site and size, mobilization of the flap without traction, preservation of the flap’s blood supply, avoidance of cautery, avoidance of conjunctival or corneal epithelial entrapment, debridement and application of povidone iodine to infected ulcers, securing the flap over the denuded area with running 10-0 monofilament nylon sutures, and avoidance of excessive traction on these sutures. In summary, a selec-
tive pedunculated conjunctival flap is an effective and practical surgical approach to the treatment of perforated and nonperforated corneal ulcers that have not responded to other types of medical therapy. This technique deserves a place in the repertoire of ophthalmic surgeons.

Submitted for publication November 6, 2002; final revision received March 21, 2003; accepted March 28, 2003.

Corresponding author and reprints: Ali Khodadoust, MD, Connecticut Eyecare Center, 46 Prince St, Suite 202, New Haven, CT 06519 (e-mail: CTeyecare@aol.com).

REFERENCES