Modified conjunctival flap as a primary procedure for nontraumatic acute corneal perforation

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Abstract

Objective: Appropriate management of nontraumatic acute corneal perforation is always a challenge even with the many advances in surgical materials and techniques. We reported the outcomes of a case series of acute corneal perforation repair using a newly modified conjunctival flap with amniotic membrane transplant (AMT), fibrin glue, and a bandage soft contact lens (BCL). Materials and Methods: A total of 13 consecutive referral cases with nontraumatic acute corneal perforation at the University of Washington were reviewed. All open globes were repaired by a combined surgery with a modified conjunctival flap, AMT, fibrin glue, and BCL. Visual acuity, a slit lamp examination, and the patient-reported pain level were collected preoperatively and postoperatively. Subsequent corneal surgeries to improve visual function were also reviewed. Results: All ocular surfaces of the 13 eyes were stable at postoperative follow-up. Eleven of the 13 patients had the same or worse visual acuity 1 week postoperatively. Nine of the 13 patients achieved better vision 6 months postoperatively. None of the patients developed perioperative or postoperative complications. Five patients with good visual potential underwent further corneal surgeries, including Boston keratoprosthesis and penetrating keratoplasty. The average referral distance was 217 miles and the median number of follow-up visits within 6 months was 4. Conclusions: The combination of a modified conjunctival flap, AMT, fibrin glue, and a BCL could provide a temporary method to stabilize and secure the integrity of the globe as well as the ocular surface after a nontraumatic acute corneal perforation. This approach allows easy follow-up and preserves the eye for future corneal surgery under optimal conditions.

Keywords: Amniotic membrane transplant, Conjunctival flap, Corneal perforation, Fibrin glue, Gundersen flap

Introduction

 Conjunctiva is a well-vascularized ocular tissue. It recruits cells such as fibroblasts and leukocytes into the cornea to promote wound healing. Total conjunctival flaps (TCF) have been used widely for various ocular surface disorders since 1958 [1]. The indications for TCF have ranged from chronic corneal ulceration due to infection, inflammation, and trauma (from small wounds) to alleviation of pain from severe alkali burns or other painful and chronic ocular diseases. A TCF can always provide a good protective covering for the cornea.

The use of conjunctival flaps has decreased in the past 10 years due to great improvements in medications, biomaterials, surgical instruments, and techniques. Nonetheless, conjunctival flaps still have many advantages in treating ocular surface disorders [2,3], including better control of corneal inflammation and pain, no need for donor tissue, fewer follow-up visits, and use of a technically easy procedure. The goal of this treatment is to preserve the globe and rehabilitate the cornea for delayed definitive treatment.

Herein, we present a case series of patients with nontraumatic acute perforated corneas successfully treated with a combination of a modified conjunctival flap with amniotic membrane transplant (AMT), fibrin glue, and a bandage soft contact lens (BCL).

Materials and methods

Patient collection

Thirteen consecutive patients presenting with nontraumatic acute perforated corneas were included in this study from...
2008 to 2014 at Harborview Medical Center, University of
Washington, Seattle, WA, USA. Etiologies of acute corneal
perforation in those patients included neurotrophic corneal
ulceration, corneal ektasia, and descemetocele with impending
perforation. Nine of the 13 patients were diagnosed with
underlying systemic diseases, such as rheumatoid arthritis,
Fabry’s disease, Ehlers–Danlos syndrome, leukemia, chronic
graft-versus-host-disease, and trigeminal squamous carcinoma.
Perforation sizes varied from pinpoint to 4 mm. All perforations
were located around the center or the inferior part of the cornea.
Patients were considered eligible for modified conjunctival flap
placement if they had a chronically thin or perforated cornea
with poor visual potential or untenable regular follow-up. The
study was conducted in accordance with the Declaration of
Helsinki and was approved by the Institutional Review Board
of Harborview Medical Center. Informed written consent was
waived because the study was a retrospective data analysis.

Surgical techniques

Eleven of the 13 patients underwent general anesthesia.
Topical anesthesia was administered for the remaining two
surgical repairs. First, we surgically debrided the loose
epithelium surrounding the perforation and repositioned the
prolapsed iris or uveal tissue away from the wound. Then,
a 180° peritomy was performed from 3 to 9 o’clock. The
inferior conjunctiva was mobilized as much as possible. If the
perforation of the cornea was associated with severe tissue
melting, an amniotic membrane (Ambio5, IOP Ophthalmics,
Denville, NJ, USA) combined with fibrin glue (TISSEEL,
Baxter, Deerfield, IL, USA) was applied to stabilize the
perforation site. If there was no significant tissue loss, fibrin
glue alone was applied without the amniotic membrane. The
inferior mobilized conjunctiva was then positioned superiorly
to cover the area of corneal perforation accompanied by
fibrin glue application to stabilize the conjunctival tissue
over the corneal perforation. Three interrupted 10-0 nylon
sutures were used to secure the conjunctival flap onto the
corneoscleral bed at the 3, 6, and 9 o’clock positions. A large
BCL (20 mm) (Kontur Kontact, Hercules, CA, USA) was
placed, and a subconjunctival injection of antibiotic was given
at the end of the procedure. Photographs of this modified
conjunctival flap surgery are provided in Figure 1.

Postoperative observation

Postoperative visual acuity, intraocular pressure, and
slit-lamp examination were checked routinely in the clinic.
Grading of postoperative pain (0–3+) and globe stability
was also collected postoperatively. Globe stability was graded
as good, medium, or poor. Good globe stability was determined by
the presence of stable reepithelialization, no leakage, acceptable
healing of the flap, and an appropriate surface for a secondary
procedure. Medium globe stability was defined as variable
reepithelialization and/or surface condition and possibly able to
sustain a secondary procedure with further healing. Poor globe
stability was defined as poor reepithelialization, poor adherence
of the conjunctival flap with residual infection, ulceration, or
degradation of the ocular surface threatening the viability
of the eye. Surgical success was defined as a stable ocular
surface without flap retraction or dehiscence, and the absence
of persistent symptoms or pain. Complications were recorded,
including the progression of an infectious or inflammatory
process beneath the flap, flap loss from epithelial ingrowth,
and/or epithelial cyst formation.

RESULTS

The preoperative and postoperative characteristics of
the patients are presented in Table 1. Thirteen patients
(9 men and 4 women) received the procedure using a modified
corneal perforation combined with fibrin glue, and application
of a large BCL. Meanwhile, 11 of these 13 patients also
underwent AMT during the procedure. The average age
of the patients was 51 years old (range, 17–71 years old).
Most of the corneal perforations were located in the center
of the cornea (8 of 13) [Figure 2a and b]. Three paracentral
corneal perforations and two inferiorly peripheral corneal
perforations were included in this study. The average
perforation size was 2.5 mm (range, pinpoint to 4 mm). Two
to four months after the primary procedure, all corneas had
thin conjunctival flaps and intact globe integrity [Figure 2ce].
The follow-up period in this study was 6–48 months. Five of
the 13 patients underwent secondary procedures, including
penetrating keratoplasty (PKP) (three patients, 6 months
after the primary procedure) [Figure 2f and g] and Boston
keratoprosthesis (Kpro) (two patients, 1 year after the primary
procedure) [Figure 2h]. The patients who received PKP as
their secondary procedure recovered very well without marked
corneal neovascularization following the primary procedure.

The preoperative best-corrected visual acuity in these
13 patients ranged from light-perception to 20/40. Most
of the patients (11 out of 13) had the same or poorer visual
acuity right after their surgeries. However, most of them
achieved better vision 6 months postoperatively. All patients
with pain experienced almost immediate pain relief after the
primary procedure. Only 1 of the thirteen had complaints
of postoperative pain on the postoperative day 1. No wound
leakage was found postoperatively and globe stability was
graded “good” in all patients. There were no perioperative
or postoperative complications. The median number of follow-up
visits within 6 months was 4 (range, 1–8). The average referral
distance was 217 miles (range, 11–2100 miles).
<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>Underlying systemic diseases</th>
<th>Preoperative VA</th>
<th>Postoperative VA 1 week</th>
<th>Postoperative VA 6 months</th>
<th>Final Change in VA</th>
<th>Postoperative globe stability</th>
<th>Preoperative pain</th>
<th>Postoperative pain</th>
<th>Postoperative infection</th>
<th>Distance of referral (miles)</th>
<th>Follow-up visits within 6 months</th>
<th>Secondary procedure</th>
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<td>52</td>
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<td>Good</td>
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<td>0</td>
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<td>44</td>
<td>1</td>
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<td>20/80</td>
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<td>Good</td>
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<td>68</td>
<td>1</td>
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<td>200E@6’</td>
<td>HM</td>
<td>20/400</td>
<td>Improved</td>
<td>Good</td>
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<td>6</td>
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<td>44</td>
<td>None</td>
<td>200E@5’</td>
<td>CF</td>
<td>20/20</td>
<td>Improved</td>
<td>Good</td>
<td>1+</td>
<td>0</td>
<td>None</td>
<td>28</td>
<td>8</td>
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<td>AML</td>
<td>20/300</td>
<td>HM</td>
<td>20/200</td>
<td>Improved</td>
<td>Good</td>
<td>1+</td>
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<td>HM</td>
<td>HM</td>
<td>20/800</td>
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<td>Good</td>
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<td>CF@3’</td>
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<td>No change</td>
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<td>20/25</td>
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<td>20/200</td>
<td>20/70</td>
<td>Improved</td>
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<td>1+</td>
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<td>48</td>
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<td>HM</td>
<td>HM</td>
<td>HM@1.5’</td>
<td>Improved</td>
<td>Good</td>
<td>1+</td>
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<td>7</td>
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<tr>
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<td>ALL, GVHD</td>
<td>HM</td>
<td>LP</td>
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<td>Good</td>
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<td>0</td>
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of a Gundersen’s flap or modified Gundersen’s flap [9,10], we developed a newly modified conjunctival flap along with the use of an amniotic membrane patch and fibrin glue in this study. This modified flap was much easier to perform with only an inferior 180° peritomy and some dissection beyond the inferior Tenon’s capsule. We anchored the flap with three interrupted conjunctivo-scleral stitches (3, 6, and 9 o’clock) with additional fibrin glue application. These three stitches could counteract the force of conjunctival flap retraction in the early stage. In addition, the suture at 6 o’clock could reduce movement of the conjunctival flap postoperatively.

AMT is widely applied in a variety of ocular surface diseases [11-15]. It is indeed an effective treatment for most nontraumatic acute perforations. However, the outcome of treatment may nonetheless be compromised in patients with underlying systemic diseases which are often associated continuous corneal melting postoperatively or patients who cannot have regular checkups. We believe that the modified conjunctival flap likely provides better and longer protection, and it thereby contributed to satisfactory results for the 11 study patients who received this treatment. Notably, neovascularization was not observed among the three patients who subsequently received PKP as a secondary procedure. Indeed, it has been demonstrated that human amniotic membrane has an antiangiogenic effect on severely damaged corneas [16]. The modified conjunctival flap surgery was performed in conjunction with AMT in this study, and the satisfactory treatment outcome was appropriately attributed to the combination of both procedures.

Although our study mostly focused on nontraumatic acute corneal perforation, this modified conjunctival flap combined with AMT may also be considered as a treatment choice for severe noninfectious corneal ulceration or impending perforation. To the best of our knowledge, conjunctival resection has been primarily used for rheumatoid corneal ulceration management [17]; however, whether this treatment can be as effective when applied to rheumatoid corneal perforation is less reported. In this study, we used modified conjunctival flap on two rheumatoid patients, one with corneal perforation and the other with an impending perforation. With appropriate postoperative medications including topical steroids, antibiotics, and lubricants, patients generally recovered well after this primary procedure.

**CONCLUSIONS**

Patients with nontraumatic acute perforated corneas underwent a combination of a modified conjunctival flap, AMT, fibrin glue, and BCL application, and all had favorable outcomes in our study. With the advent of Kpro and other sight-saving procedures, salvage of the globe primarily for secondary procedures may help reestablish useful sight to the patient. Furthermore, the procedure we introduced here is safe and does not require intensive follow-up, making it a preferred procedure in populations where resources are scarce or compliance difficult.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES