Management of Acute Corneal Hydrops Using Compression Sutures and Intracameral Air Injection

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Patient: Female, 35-year-old
Final Diagnosis: Acute corneal hydrops
Symptoms: Diminished visual acuity • painful eye • photophobia
Clinical Procedure: Full-thickness compression sutures and intracameral air injection
Specialty: Ophthalmology
Objective: Unusual or unexpected effect of treatment

Background: Acute corneal hydrops, a rare complication of keratoconus, is characterized by sudden onset of corneal stroma edema. It typically manifests as an acute decrease in visual acuity, accompanied by pain and photophobia. Prompt recognition and interventions are critical for effective resolution of hydrops and prevention of corneal vascularization. Herein, we present a case of a patient with keratoconus who developed corneal hydrops, successfully managed using full-thickness compression sutures and intracameral air injection.

Case Report: A woman in her early 30s, with a history of keratoconus, presented with symptoms of acute hydrops in her left eye. On presentation, best corrected visual acuity was hand motion. Slit-lamp examination revealed marked corneal edema with multiple stromal clefts. The decision was made to perform full-thickness compression sutures combined with intracameral air injection to expedite edema resolution and prevent neovascularization. Three full-thickness sutures were placed across Descemet membrane breaks, and an air bubble was left, filling 50% of the anterior chamber. At 3-month follow-up, a clear, compact cornea was noted, with no evidence of vascularization. The patient was scheduled for penetrating keratoplasty for visual rehabilitation.

Conclusions: The combination of full-thickness compression sutures and intracameral air seems to be an effective and safe method for preventing corneal angiogenesis following hydrops. As corneal scaring is often an inevitable complication of acute corneal hydrops, keratoplasty is necessary for improving visual acuity. Hence, the prevention of corneal vascularization should be the major aim in the management of corneal hydrops to ensure successful keratoplasty.

Keywords: Corneal Edema • Corneal Neovascularization • Corneal Stroma • Keratoconus

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Introduction

Acute corneal hydrops is a sudden corneal edema secondary to rupture of the Descemet membrane (DM), resulting in infiltration of aqueous humor into the corneal stroma. Although it most commonly occurs as a rare complication of keratoconus, it can occur with other corneal ectasias such as kerato-globus and pellucid marginal degeneration [1]. Acute corneal hydrops presents as acute onset of severe visual impairment, photosensitivity, and pain. Corneal hydrops is diagnosed clinically by history and slit-lamp examination (SLE), usually showing extensive corneal edema leading to opacification of the stroma, which can be accompanied by intrastromal clefts and epithelial edema and bullae [2,3]. The diagnosis is confirmed by anterior segment optical coherence tomography (ASOCT) demonstrating a break in the DM [4]. Although it is usually a self-limiting condition that resolves spontaneously, the duration of the resolution of edema varies from 2 to 6 months. In cases of a large DM break and the presence of intrastromal clefts, prolonged inflammation and edema can promote corneal vascularization that precludes successful future keratoplasty [5].

Multiple approaches have been proposed for managing corneal hydrops to hasten the resolution of edema. In mild cases, conservative treatment may be attempted initially. This includes the use of topical cycloplegics, hyperosmotics, aqueous suppressants, and steroids, in an attempt to reduce the inflammatory response [6]. Although conventional treatment can expedite the resolution of edema and minimize inflammation, the presence of intrastromal clefts significantly delays corneal edema healing and predisposes to corneal neovascularization [5]. Descemetopexy using air or gases such as sulfur hexafluoride (SF6) and perfluoropropane (C3F8) accelerate the resolution of edema, but repeated injections are often required [7,8]. Recently, studies have proposed that the use of compressive corneal sutures, including full-thickness or pre-DM, with or without intracameral gas/air injection allows for approximation of the DM and multiple intrastromal fluid-filled pockets, confirming the diagnosis of acute corneal hydrops (Figure 1). Given the large DM tear and the presence of stromal clefts demonstrated on ASOCT, the decision was made to proceed with a surgical intervention using compression sutures and intracameral air injection. Our main aim was to accelerate the resolution of edema to prevent corneal vascularization.

The patient was admitted and signed an informed consent for the procedure. The left eye was prepped and draped in the usual sterile manner, and a lid speculum was placed for maximum globe exposure. Under general anesthesia, a prophylactic iridectomy was performed at 6 o’clock, and an air bubble was injected into the anterior chamber to delineate DM breaks. A total of 3 full-thickness interrupted 10-0 Prolene sutures were applied, with 2 parallel sutures and 1 transverse suture applied in areas of proposed DM breaks. At the end of the procedure, an air bubble was left filling 50% of the anterior chamber, and a bandage contact lens (BCL) was placed. She was instructed to maintain a supine position for 24 h postoperatively. Postoperatively, she was prescribed topical 0.15% bromonidine tartrate twice daily, 1% cyclopentolate 3 times daily, 0.5% moxifloxacin 4 times daily, 1% prednisolone acetate, 5% sodium chloride once daily at bedtime, and 0.3% polyethylene glycol 4 times daily. She tolerated the procedure well and was shifted to the recovery room in good condition.

On the first postoperative day, the patient reported an improvement in pain and photophobia. Uncorrected visual acuity OS was hand motion at least. SLE disclosed a marked reduction in corneal edema, intact sutures, and the BCL in place. On the second postoperative day, corneal edema had further resolved by 50%. Visual acuity OS was 20/200-1. Corneal examination before discharge indicated completely attached DM edges and resolution of intrastromal clefts. Upon discharge, the patient was instructed to avoid bending, heavy lifting, swimming, eye rubbing, travel by plane or going to high altitude, and a follow-up was scheduled for 2 weeks.

In the first follow-up visit, SLE indicated complete resolution of corneal edema and clefts and a moderate central scar. In the third postoperative month, corneal sutures were removed under aseptic conditions in the operating room. A clear compact cornea with moderate central scar was noted on SLE and there was no evidence of corneal neovascularization (Figure 1). At the 5-month follow-up, best corrected contact lens-assisted visual acuity had improved from 2/200-1 to 20/50. ASOCT

Case Report

A woman in her 30s with keratoconus presented to the Emergency Department with a sudden onset of markedly decreased vision in her left eye, accompanied by pain, photophobia, and a whitish discoloration of the cornea. She used bilateral contact lens for refractive correction. Upon presentation, the best corrected visual acuity (BCVA) was limited to hand motion OS and 20/20 OD with contact lenses in place. SLE OS indicated severe near limbus-to-limbus corneal edema with multiple intrastromal clefts. ASOCT revealed a wide separation of the DM and multiple intrastromal fluid-filled pockets, demonstrating prompt resolution with full-thickness compression sutures combined with intracameral air injection.
illustrated decreased corneal thickness and a marked central scar involving the visual axis (Figure 1). The patient was scheduled for penetrating keratoplasty 3 months after suture removal for visual rehabilitation due to the significant corneal scar.

**Discussion**

Acute corneal hydrops is a self-limiting condition that resolves spontaneously, even in the presence of extensive intrastromal clefts, over a period of 2-6 months [2]. The main aim of both conventional and surgical interventions is to hasten resolution of edema. Multiple surgical interventions have demonstrated a statistically significant reduction in the time to resolve edema, promising improvement in visual acuity, and a decline in the need for keratoplasty. However, few studies have assessed the safety and efficacy of full-thickness compression sutures combined with intracameral air injection in severe acute corneal hydrops and its role in the prevention of corneal vascularization [12,15-17]. Because patients with advanced keratoconus are likely to undergo keratoplasty even in the absence of corneal hydrops, it is important to ensure a successful cornea graft. Despite its favorable long-term outcomes in the treatment of keratoconus with and without prior acute hydrops, penetrating keratoplasty carries a substantial risk of graft rejection if performed during an episode of acute hydrops, due to the inflammation and edema. Furthermore, the risk of graft rejection is higher in keratoconus cases with prior resolved acute hydrops [18].

Several studies have concluded that descemetopexy with air or gas is not effective as a sole measure, especially in the presence of multiple stromal clefts, as in our case [19]. In a retrospective case series, Rajaraman et al [9] studied the difference between using intracameral C3F8 alone versus a combination procedure...
with compression sutures. They concluded that the combination of intracameral C3F8 and full-thickness compression sutures resulted in faster resolution of edema than intracameral C3F8 alone. Additionally, Sharma et al [20] reported a case of failed resolution of corneal hydrops despite intracameral C3F8 injections due to migration of gas into stromal clefts, impeding closure. Furthermore, 2 randomized trials by Zhao et al [21] and Liu et al [12] compared the use of full-thickness compression sutures combined with intracameral air injection with thermokeratoplasty and pre-DM sutures, respectively. Both studies reported faster edema resolution in the full-thickness sutures and intracameral air injection than in their respective control groups. Accordingly, we decided to use full-thickness compression sutures combined with intracameral air injection.

Incorporation of the advantages of compression sutures and intracameral air in the management of corneal hydrops produces better outcomes than using a single technique. While compression sutures approximate detached DM margins and help in squeezing the fluid out of the corneal stroma, intracameral air acts as a tamponade and prevents further penetration of aqueous humor into the corneal stroma. Due to the higher risk of malignant glaucoma associated with the use of non-expansile gasses for descemetopexy, intracameral air injection is preferred to tamponade detachments [19,21]. Nevertheless, prophylactic iridotomy was deemed necessary to surmount the risk of acute glaucoma secondary to the presence of air bubbles in the anterior chamber.

**Conclusions**

Full-thickness compression sutures combined with intracameral air injection seems to be an effective and safe method for the management of corneal hydrops and to minimize the risk of vascularization. Development of corneal scars is a common complication of acute corneal hydrops, necessitating keratoplasty for visual rehabilitation. Prompt management of corneal hydrops may be important in reducing the risk of corneal vascularization to ensure successful keratoplasty.

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**References:**