



Development of acute hydrops in eye with infectious keratitis: A case report

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ABSTRACT

Purpose: To determine the characteristics of an eye that developed acute hydrops while being treated for infectious keratitis.

Observation: A 35-year-old man presented with pain and blurred vision in his left eye. He had undergone cataract surgery seven years earlier and was being treated for poorly controlled atopic dermatitis. The decimal best-corrected visual acuity (BCVA) of the left eye was 0.01. Slit-lamp microscopy showed conjunctival injection, corneal opacification, and a corneal ulcer. The patient was diagnosed with infectious keratitis and was treated with topical and systemic antibiotics. During the hospitalization, the patient was noted to rub his eyes frequently and vigorously. Five days after the first visit, the cornea protruded markedly, and the stroma surrounding the ulcerated area was edematous. These findings led to a diagnosis of acute hydrops. Penetrating keratoplasty was performed to prevent corneal perforation. Histopathological study of the excised cornea showed stromal edema, infiltration of leukocytes, and a tear in Descemet's membrane. Unfortunately, the patient developed endophthalmitis the day after the surgery. The anterior chamber was irrigated with antibiotics, and antibiotics were also injected into the vitreous. The endophthalmitis gradually subsided, and two years after the surgery, the patient's decimal BCVA had improved to 0.6.

Conclusion and importance: Vigorous eye rubbing in cases of infectious keratitis can induce acute hydrops, and timely surgical intervention is recommended.

1. Introduction

Acute corneal hydrops is a complication of corneal ectatic disorders and is characterized by a tear in Descemet's membrane and endothelium. This leads to an influx of aqueous humor into the stroma causing corneal edema. It can result in eye pain and reduced vision. Most cases improve with conservative therapy within a few months. However, some cases can develop complications including corneal infections and corneal perforation.¹ While there have been reports of acute hydrops followed by infectious keratitis, there have been no reports of infectious keratitis complicated by acute hydrops.

We present a case of infectious keratitis complicated by acute hydrops in a patient with poorly controlled atopic dermatitis. The patient developed endophthalmitis immediately after therapeutic keratoplasty, and the visual prognosis initially appeared poor. However, early diagnosis and treatment allowed us to preserve his vision.

2. Case report

A 35-year-old man presented to our hospital with hyperemia and blurred vision in his left eye. He had been previously diagnosed with atopic dermatitis and was being treated by a local dermatologist. He had undergone bilateral cataract surgery at the age of 28 and was being followed for atopic keratoconjunctivitis by another doctor. He had no other ocular issues, and his decimal best-corrected visual acuity (BCVA) at the first visit was 1.0 with a correction of -1.00 DC ax 90° in the right eye and 0.01 (uncorrectable) in the left eye. Slit-lamp biomicroscopy revealed a dense corneal opacity and a corneal ulcer in the left eye (Fig. 1A). Corneal scraping showed no obvious microorganisms, and cultures of the corneal abrasion were negative. Based on the slit-lamp findings, we suspected infectious keratitis induced by gram-negative bacteria. The patient was treated with topical 0.3% dibekacin and 1.5% levofloxacin six times a day. On the third day of treatment, a

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corneal ring infiltrate and an abscess appeared in the anterior chamber (Fig. 1B). The patient was hospitalized and treated with hourly application of topical 0.3% dibekacin and 1.5% levofloxacin, as well as systemic infusion of imipenem. During hospitalization, we observed that the patient habitually rubbed his affected eye vigorously. On the fifth day of treatment, the abscess in the anterior chamber was resolved, but the cornea became markedly edematous, protruding with an appearance similar to acute hydrops (Fig. 1C and D). We attempted to evaluate the left cornea with anterior segment optical coherence tomography but were unable to record an image due to the marked corneal protrusion.

Considering the high risk of corneal perforation, we performed penetrating keratoplasty using a fresh cornea. However, the day after the surgery, vitreous opacity and a bacterial mass-like opacity appeared on the intraocular lens. The patient was diagnosed with infectious endophthalmitis, and vancomycin and ceftazidime were irrigated into the anterior chamber and injected into the vitreous cavity. The endophthalmitis improved, and we gradually tapered the topical antibiotics. Two years after the surgery, the patient's BCVA in the left eye was 0.6 with a correction of -6.00 DS = -2.25 DC Ax 82° . We examined the corneal topography of the fellow eye several times during the postoperative period and found no obvious changes indicative of keratoconus (Fig. 2).

Cultures of the aqueous humor collected during surgery and of the excised cornea were negative. Histopathology of the excised cornea showed severe stromal edema, infiltration of leukocytes, and a tear in Descemet's membrane (Fig. 3A and B).

3. Discussion

Acute hydrops is a rare complication occurring in approximately 2% of keratoconus cases.² A tear in Descemet's membrane is associated with a structural weakening of the cornea. It is believed that repetitive

pressure on the cornea exceeding its resistance can cause a rupture of Descemet's membrane.³ Eye rubbing is a commonly observed in patients with atopic dermatitis, and it can increase the intraocular pressure to about 300–400 mmHg and raise the risk of developing acute hydrops.⁴ Infectious keratitis is one of the complications of acute hydrops, and acute hydrops has been reported in less than 2% of bacterial keratitis cases.¹ Corneal stromal edema and rupture of Descemet's membrane are believed to predispose the eye to infectious keratitis following acute hydrops. Corneal stromal edema widens and irregularizes the collagen layer, reducing the barrier function of the corneal epithelium and facilitating the movement of microorganisms into the cornea, thus leading to a rapid progression of bacterial keratitis.

In our case, there was no history of keratoconus, and acute hydrops developed during the course of keratitis. Histopathology of the excised cornea showed a rupture of Descemet's membrane, loss of the normal collagen layer, and infiltration of inflammatory cells into the cornea. These findings are similar to reports of acute hydrops complicated by infectious keratitis,⁵ and led us to conclude that acute hydrops had also developed in our case. The intense eye rubbing while the cornea was structurally weakened due to infectious keratitis likely contributed to the development of acute hydrops. We propose that these changes, along with rapid expansion of the posterior cornea due to the formation of large Descemetocells, caused the tear in the relatively inelastic Descemet's membrane.

In Asia, therapeutic corneal transplantation has been performed in 9.4% of infectious keratitis cases.⁶ A study of the National Transplant Registry data in the United Kingdom reported an incidence of endophthalmitis after penetrating keratoplasty (PKP) of 0.67%.⁷ Risk factors for endophthalmitis after PKP include infectious keratitis, corneal trauma, corneal ulcer, corneal perforation, and previous ophthalmological surgery. In our case, the size of the infectious infiltration was 8 mm, and there was a rupture of Descemet's membrane close to the corneal

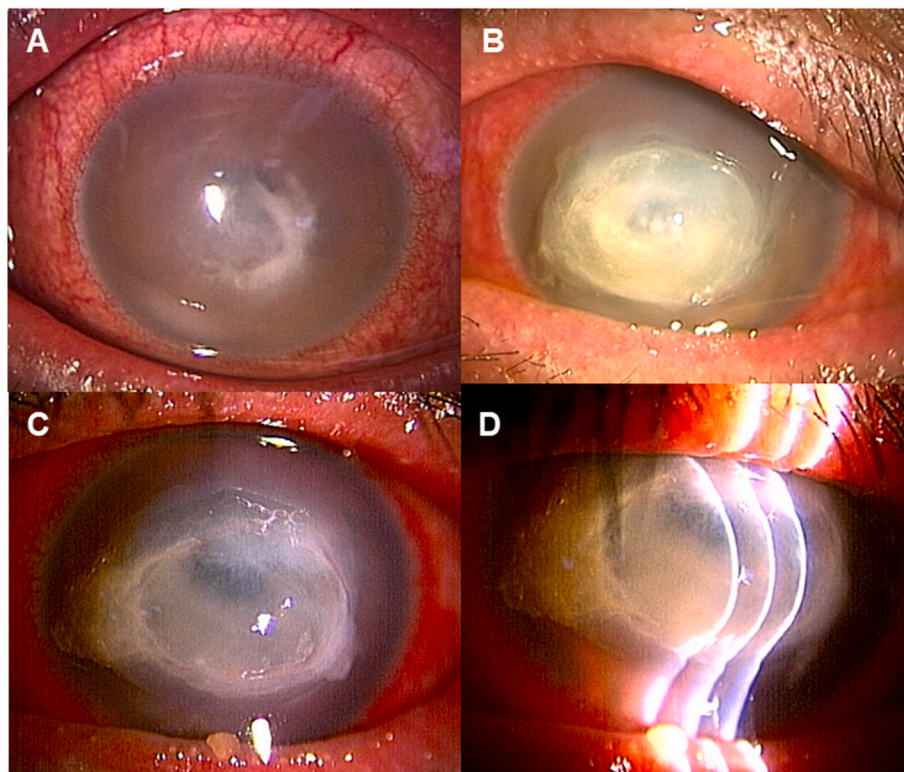


Fig. 1. Slit-lamp images of the corneas of a patient with infectious keratitis who developed acute hydrops. A: Slit-lamp image at the initial visit showing central corneal opacity and edema of the entire cornea. B: Three days after the initial visit, the slit-lamp image shows exacerbated opacity with a ring infiltrate and hypopyon. C: Diffuse illumination image at five days after the initial visit. The central corneal opacity has improved with increased transparency in the peripheral cornea. D: Direct focal illumination image taken five days after the initial visit. The central cornea is edematous and markedly protruded.

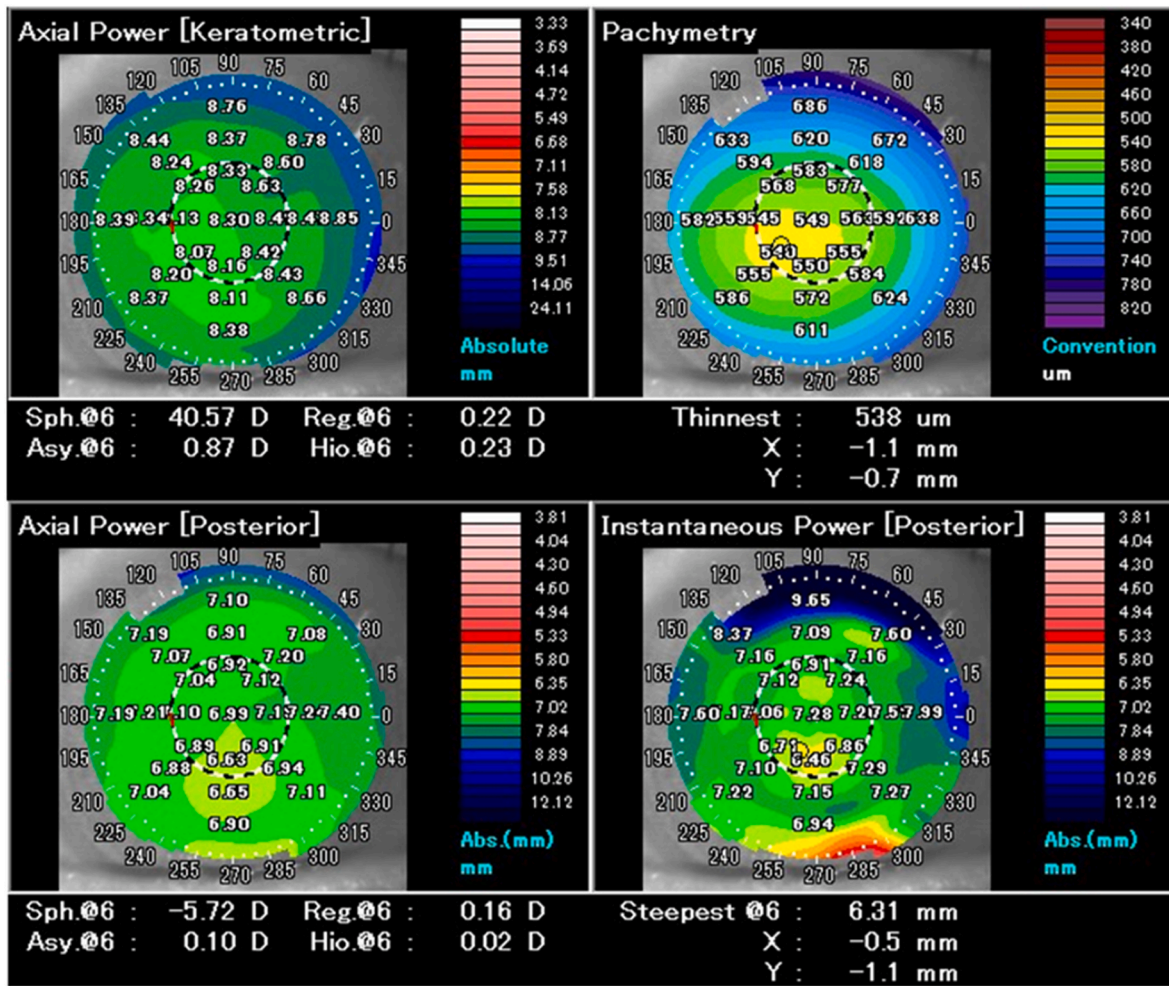


Fig. 2. Corneal topography of the fellow right eye shows no obvious changes of keratoconus.

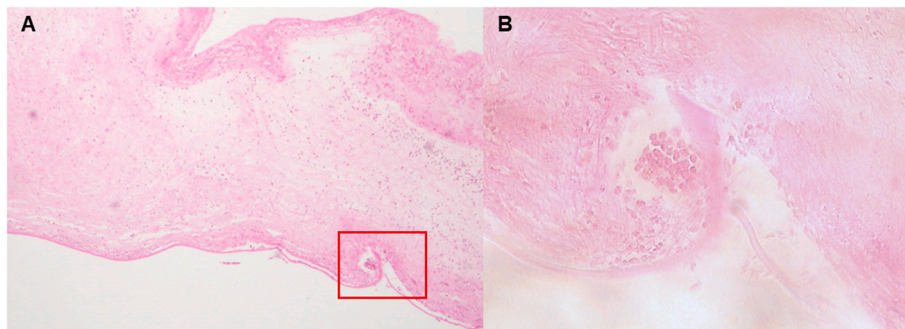


Fig. 3. Histopathological findings of the corneal button removed during penetrating keratoplasty
 A: Histopathological image showing severely swollen corneal stroma. Hematoxylin-eosin staining, original magnification $\times 100$. B: High magnification view of the squared area in Fig. 2A. A tear in Descemet's membrane and infiltration of leukocytes into the surrounding area can be seen. Original magnification $\times 400$.

perforation. These factors can explain the development of endophthalmitis after PKP. In cases of therapeutic corneal transplantation during the acute phase of infectious keratitis, the use of fresh corneas is preferable to enable screening for postoperative endophthalmitis.

The prevalence of *Staphylococcus aureus* carriage on the skin, eyelids, and conjunctival sacs of patients with atopic dermatitis has been reported to be significantly higher than in healthy controls.⁸ The presence of *S. aureus* increases the expression of inflammatory cytokines,⁹ which can disrupt the barrier function of the epidermis and corneal epithelium, increasing the risk of ocular surface infections. Additionally, the eye

rubbing behavior commonly seen in patients with atopic dermatitis damages the barrier function of the ocular surface and makes the cornea more susceptible to infections. Therefore, patients with atopic dermatitis are more likely to develop ocular surface infections and may be at a higher risk of developing endophthalmitis as a postoperative complication. Adequate control of atopic dermatitis is important for infection prevention and perioperative management.

One limitation of this case is the possibility of undiagnosed keratoconus preceding the corneal infection as we do not have corneal topography data before the onset of infection. However, the affected eye

had good visual acuity before the infection, and the patient was unaware of any difference in the visual acuity between the two eyes, making it unlikely that the patient had keratoconus.

4. Conclusions

In conclusion, we report a case of acute hydrops developing during the acute phase of infectious keratitis. Eye rubbing behavior, common in patients with atopic dermatitis, should be noted as it can exacerbate corneal infection and contribute to the development of acute hydrops. Furthermore, when infectious keratitis is complicated by acute hydrops, the possibility of corneal perforation or endophthalmitis should be considered, and arrangements should be made for therapeutic corneal transplantation.

Declarations

Ethics Approval and Informed Consent: Ethical approval by the Ethics Committee of Mie University Hospital was waived due to the retrospective nature of the study, as no personally identifying information about the patients was available in the records, and the study was limited to the collection of clinical data.

Consent for publication

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images.

Availability of data and materials

Not applicable.

CRediT authorship contribution statement

Yuzen Kashima: Writing – original draft. **Kumiko Kato:** Conceptualization, Data curation, Writing – review & editing. **Maki Takeuchi:** Data curation. **Yuka Yonekawa:** Data curation. **Yuko Takashima:** Data curation. **Koji Hirano:** Writing – review & editing. **Mineo Kondo:** Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviations

IOP intraocular pressure
BCVA best corrected visual acuity

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