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Footnotes and Disclosure

No conflicting relationship exists for any of the authors.

Use of ripasudil for rapid resolution of acute hydrops in keratoconus



Acute corneal hydrops (CH) is characterized by marked stromal edema from the influx of aqueous humour through a tear in Descemet membrane.¹ It is predominantly seen in patients with corneal ectasia and reported in up to 3% of patients with keratoconus.^{1,2} CH presents with an acute decrease in visual acuity, photophobia, and pain.¹ Conservative management of CH includes topical hypertonic

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. This study adhered to the Declaration of Helsinki. The University of British Columbia Clinical Research Ethics Board was contacted, and this study did not require institutional review board approval.

saline solution, cycloplegics, topical corticosteroids, topical antibiotics, and a bandage soft contact lens if needed for comfort.^{1,2} With these conservative measures, CH often resolves in 2–4 months.² This long duration of corneal edema not only prolongs the patient’s discomfort but also can have lasting sequelae such as infectious keratitis, corneal neovascularization, stromal scarring, corneal perforation, and the need for corneal transplantation.^{1,2}

In this article, we describe the successful use of the topical Rho kinase inhibitor ripasudil hydrochloride hydrate (Glanatec Ophthalmic Solution 0.4%, Kowa Co Ltd, Nagoya,

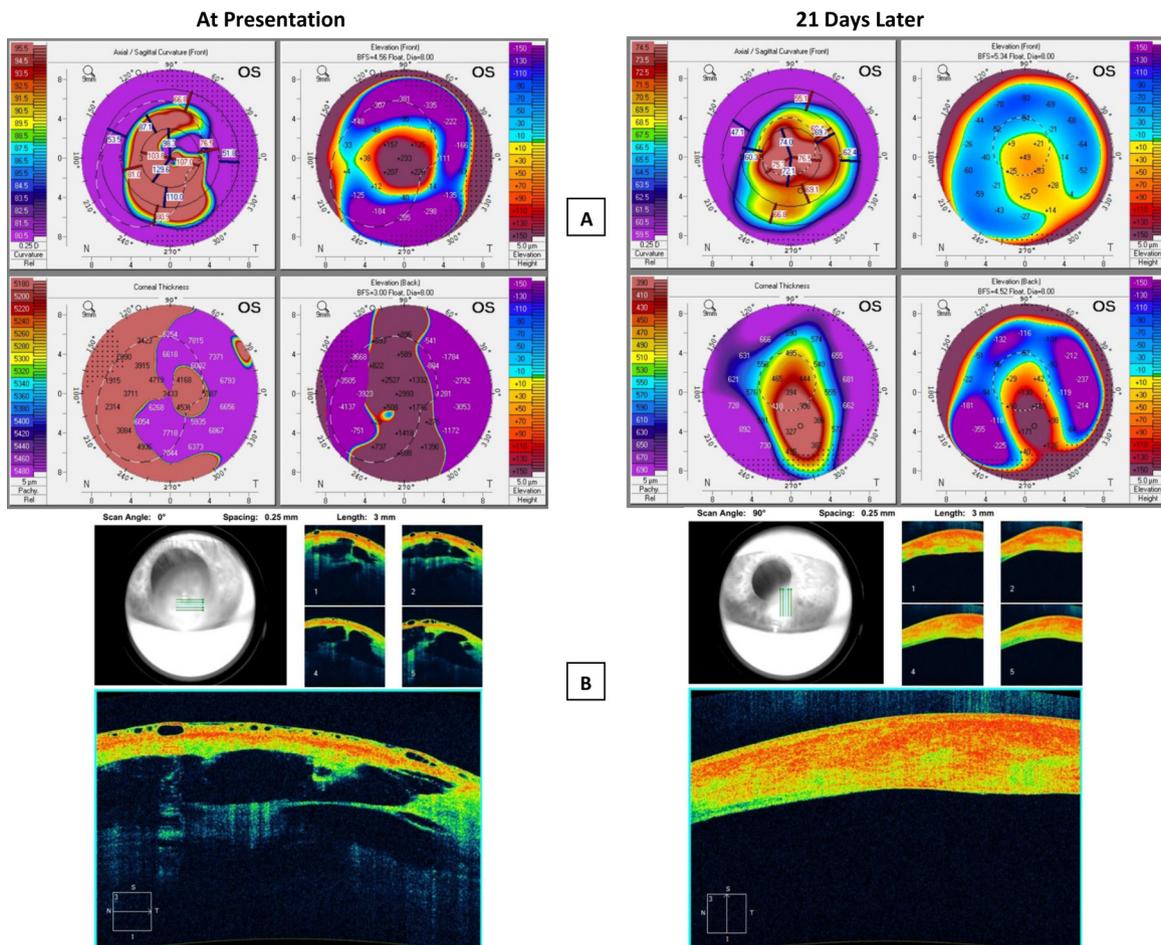


Fig. 1 — (A) Corneal tomography of the left eye depicting axial curvature, corneal thickness, and front and back elevation before and 3 weeks after ripasudil treatment. (B) Anterior segment optical coherence tomography of the left eye before and 3 weeks after ripasudil treatment.

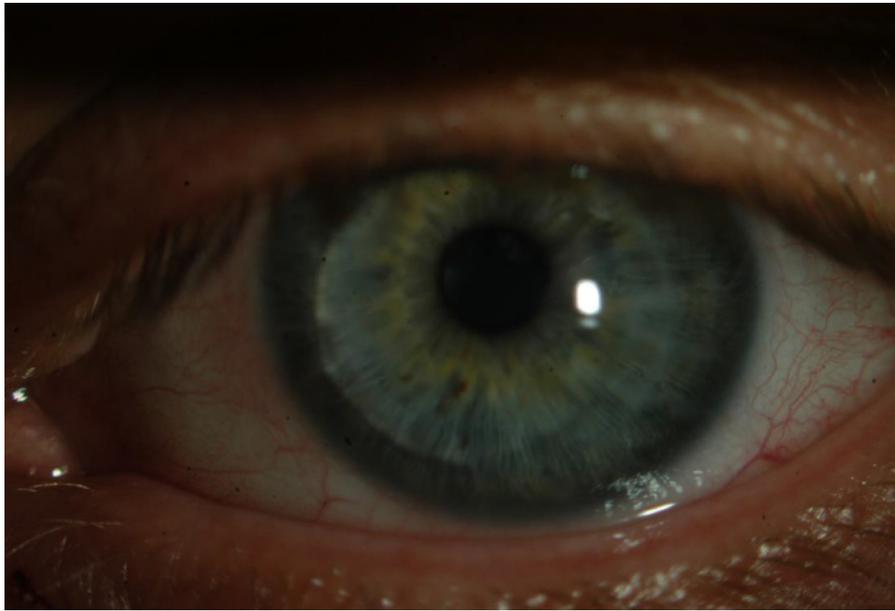


Fig. 2—Anterior segment photograph of the left eye following manual predescemetic deep anterior lamellar keratoplasty.

Japan) for noninvasive treatment of CH with rapid resolution of corneal edema in 21 days.

A 32-year-old male presented with a 2-week history of decreased vision in the central and inferior visual field of the left eye with irritation and foreign-body sensation. He had already been prescribed topical fluorometholone, sodium chloride 5% hypertonic ophthalmic ointment, and topical chloramphenicol by another provider, with no improvement. His distance corrected visual acuity with glasses was 6/6 OD and 6/60 OS. Anterior segment examination demonstrated a large central corneal edema of the left eye with central pachymetry above 2000 μm . He was diagnosed with CH and started on topical ripasudil 0.4% twice a day in the left eye in addition to topical chloramphenicol.

At the 3-week follow-up, his symptoms had improved significantly, but his distance corrected visual acuity of the left eye remained poor at 3/60. His corneal edema had resolved completely at this point but was replaced by visually significant stromal scarring. His corneal tomography and anterior segment optical coherence tomography images at presentation and 3-week follow-up are shown in [Figure 1](#).

Because of the poor visual acuity, a manual predescemetic deep anterior lamellar keratoplasty was offered at an early stage, 3 weeks after resolution of his CH. At 14 months after his transplant, his graft was clear ([Fig. 2](#)), and his visual acuity with glasses was 6/9 in the affected eye.

In this article, we report the successful use of ripasudil in rapid resolution of CH in keratoconus. To accelerate the resolution of CH, various surgical interventions have been used. Intracameral injection of air or gas (sulfur hexafluoride

[SF_6] or perfluoropropane [C_3F_8]) has been used to tamponade the tear and prevent further leakage of fluid into the stroma.^{2–8} In multiple comparative studies, intracameral gas or air injection appears to result in faster resolution of CH in as early as 3 weeks.^{3,4} However, multiple injections often were needed, and potential complications of intraocular pressure spikes, cataract formation, pupillary block, and intrastromal gas migration have been reported.^{3,4} The patient is also required to keep a supine position for optimal gas placement in the anterior chamber.² Additionally, corneal compression sutures have been employed to approximate the edges of Descemet membrane, especially for large defects with cleft formation.^{6–10} Other interventions include venting incisions,^{7,9} multifocal cauterization,¹¹ and the use of platelet-rich plasma intracameral injection.¹² None of these procedures has been consistently successful at resolving CH in less than 3 weeks.

Predescemetic deep anterior lamellar keratoplasty (DALK) has been described as an intervention for acute CH.¹³ The rapid resolution of edema in this case was unexpected. Although it provided rapidly improved comfort and re-formation of the epithelial barrier, it was not accompanied by improved visual acuity. A scleral lens may have been an option in this case, but a manual predescemetic deep anterior lamellar keratoplasty was chosen as a more definitive method of resolution. The clear view created allowed good visualization of planes and provided confidence that deeper layers were intact during surgery.

Rho kinase inhibitors have been reported previously to promote endothelial cell delamination and migration, accelerating endothelial wound healing.¹⁴ There is growing evidence supporting their utility in multiple corneal

pathologies. Our centre has reported positive experience with the use of Rho kinase inhibitors as an adjuvant to Descemet stripping only or descemetorhexis without endothelial keratoplasty.^{15–19} Similarly, netarsudil has been reported to assist with the treatment of corneal endothelial disease in iridocorneal endothelial syndrome and penetrating keratoplasty graft failure.²⁰ This is the first published report of the use of a Rho kinase inhibitor for the management of CH and offers a well-tolerated, noninvasive alternative to the surgical techniques used. The mechanism of healing is consistent with our understanding of Rho kinase inhibitors as promoters of cell migration across endothelial defects, such as those occurring in CH.

We acknowledge the lack of a control to confirm this finding as significant. In CH, it may be impossible to design such a study. Nevertheless, we present the fastest published resolution of CH with medical therapy and feel this to be of significance even in isolation.

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Originally received Sep. 25, 2021. Accepted Nov. 26, 2021.

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Footnotes and Disclosure

Greg Moloney was a previous consultant of Kowa India Private Limited, manufacturers of Ripasudil; the other authors have no conflicts of interest to disclose. Use of ripasudil for corneal hydrops is an off-label use of the medication.