Case Report

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Attaining excellent visual acuity following acute corneal hydrops through medical management and scleral lens implementation

Abstract

We report a patient with successful visual rehabilitation of corneal hydrops in keratoconus using medical management and scleral lens implementation as an alternative to corneal transplantation or surgical intervention. This is a case report of a 27-year-old man with keratoconus who developed acute corneal hydrops in his left eye. Following medical management of his eye, the patient developed a central corneal scar, which was eventually corrected to 20/20 best corrected visual acuity (BCVA) through scleral lens use. The dramatic flattening on tomography in this patient demonstrates the natural course of corneal hydrops. Even with a central corneal scar, whether a patient has had hydrops or not, a scleral lens may dramatically improve vision and possibly avoid a corneal transplant.

Keywords: corneal hydrops, KMax, keratoconus, scleral lens, corneal transplant

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Abbreviations: ICRS, intracorneal ring segment implantation; PK, penetrating keratoplasty; BCVA, best corrected visual acuity; DALK, deep anterior lamellar keratoplasty; CTAK, corneal tissue addition keratoplasty, CAIRS, corneal allogenic intrastromal ring segments.

Introduction

A 27-year-old patient with a history of keratoconus presented with a sudden onset of pain and blurred vision. On examination, he was found to have severe keratoconus with corneal hydrops. His BCVA was hand motion. His Kmax on tomography (Oculus Pentacam, Wetzlar, Germany) was 120.8 diopters, and central corneal thickness was 1362 microns. He was started on 1% topical prednisolone drops, QID, and 5% hypertonic saline drops, QID. Two weeks later, his pain had improved, and the Kmax decreased to 96.5 diopters. At the three-month visit, the Kmax was dramatically flatter at 68.8 diopters, and the central edema had resolved, with the central corneal thickness improving to 495 microns (Figure 1). He was found to have a central corneal scar, but the surrounding corneal tissue was clear (Figure 2).

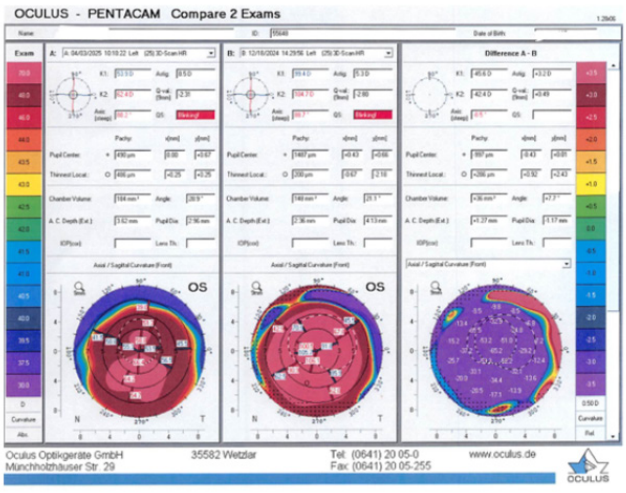

Figure 1 Oculus Pentacam tomography difference map comparing the initial presentation (central column) to the presentation three months later (left column). Note the significant flattening (right column) from 120.8 diopters to 68.8 diopters. Central corneal thickness also improved from 1362 microns to 495 microns.

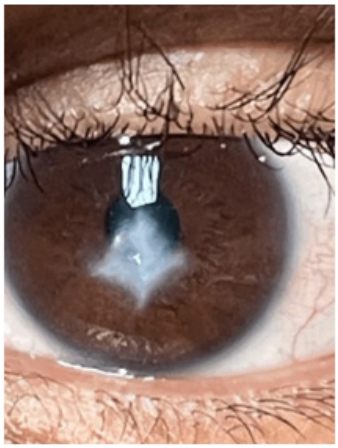

Figure 2 Slit-lamp image of the central cornea scar on the patient's left eye 4 months following presentation of hydrops. The best spectacle-corrected visual acuity was 20/50+ and improved to 20/20 with a fitted scleral lens.

Keratoconus is a progressive ectatic corneal disorder, often beginning in early adolescence and is a leading cause of corneal transplantation in young adults. It is associated with genetic predisposition, atopic disease and eye rubbing, with a mechanical weakening of the corneal stroma leading to ectasia. The disease progression can progress from mild visual changes to severe loss of visual acuity. As the disease progresses, the cornea becomes progressively steeper and thinner. Eventually, breaks in Descemet's membrane may develop, leading to corneal swelling and decompensation, known as corneal hydrops.[1] Patients with corneal hydrops typically present with visual loss and pain. Over time, they may develop severe scarring requiring corneal transplantation.[2] This report describes a case of a patient with severe corneal hydrops and decompensation that appeared to be headed for an eventual transplant. With medical treatment and eventual scleral lens fitting, he was able to correct to 20/20 and avoid transplantation.

Case report

A 27-year-old male with a known history of keratoconus presented with sudden-onset blurred vision, redness, and discomfort in his left eye. The patient has consented to use of this case for publication. He reported no preceding trauma or contact lens wear at the time of symptom onset. His past ocular history was significant for keratoconus, which had been diagnosed clinically but not yet treated with crosslinking. On examination, his BCVA was 20/30 in the right eye and hand motion in the left. A slit-lamp examination revealed marked stromal edema with folds in Descemet's membrane, consistent with acute corneal hydrops.

The patient was medically managed with topical hypertonic saline and a course of topical corticosteroids. No surgical intervention, such as anterior chamber gas injection or corneal transplantation, was performed. Over the following 12 weeks, the edema gradually resolved, and the patient developed a dense central stromal scar. Despite the presence of the scar, there was no neovascularization, persistent epithelial defect, or other complications.

At three months post-onset, his left eye had stabilized with a best-corrected visual acuity of 20/50+ on manifest refraction. Corneal tomography demonstrated a dramatic flattening of the cornea, from an initial Kmax of 120.8 diopters to 68.8 diopters. This flattening appeared to have a stabilizing effect on the keratoconus, and no further progression was noted over six months of follow-up.

Given the presence of central scarring and residual irregular astigmatism, the patient was fitted with a scleral contact lens in the left eye. With the scleral lens, his visual acuity improved to 20/20. He reported excellent comfort and visual quality, and he was able to avoid any surgical intervention, including corneal transplantation. No signs of contact lens intolerance or ocular surface compromise were observed at follow-up visits.

This case illustrates a favorable visual outcome in a patient with keratoconus and post-hydrops corneal scarring, managed conservatively without surgical intervention. The successful use of a scleral contact lens to achieve 20/20 vision, combined with proactive crosslinking in the fellow eye, underscores the importance of individualized, non-surgical strategies in keratoconus management. Importantly, the post-hydrops corneal flattening provided a degree of natural stabilization, allowing deferral of crosslinking in the affected eye and avoiding corneal transplantation altogether.

Discussion

Acute corneal hydrops represents a dramatic but not uncommon complication of advanced keratoconus, characterized by sudden stromal edema secondary to a break in Descemet's membrane. Historically, such events have often been seen as precursors to corneal transplantation due to the associated scarring and visual deterioration. However, this case reinforces the growing recognition that conservative management, coupled with advances in contact lens technology, particularly scleral lenses, can provide excellent visual outcomes in selected patients, potentially circumventing the need for penetrating or lamellar keratoplasty.[3–5]

Some have advocated for early intervention, such as air or gas injection for acute hydrops. But this is not without risk, such as infection and early cataract formation. In addition, most offices would not have gas available, which would then require bringing the patient to the operating room. For this patient, hydrops was managed medically with no surgical intervention. Despite the development of a dense central scar, the patient's best spectacle-corrected visual acuity reached 20/50+ and 20/20 with a scleral lens, illustrating that satisfactory functional vision is achievable even in the presence of central corneal opacity. This outcome underscores the importance of allowing the natural history of hydrops to unfold before considering invasive procedures. The corneal flattening that often occurs after hydrops, as seen in our case, can contribute to stabilization of the ectasia and a reduction in irregular astigmatism.[3] Thus, early referral for transplant in the setting of hydrops may be premature and, in some cases, unnecessary.[6]

Historically, penetrating keratoplasty (PK) and deep anterior lamellar keratoplasty (DALK) have been the preferred options for visual rehabilitation in patients with keratoconus no longer amenable to optical correction. However, these surgeries carry substantial risks, including but not limited to graft rejection, failure, high postoperative astigmatism, suture-related complications, infection, and endothelial cell loss.[7] Long-term outcomes are dependent on meticulous postoperative care, which includes prolonged use of topical corticosteroids and frequent follow-up. These burdens can be significant for young, otherwise healthy individuals with keratoconus, especially when a non-surgical path remains viable.

The increasing availability and success of scleral contact lenses have markedly shifted the landscape of keratoconus management. These lenses provide a regular refractive surface by vaulting over the irregular cornea and resting on the sclera, offering significant visual improvement in cases that were previously thought to require surgical intervention.[8] In our case, the scleral lens restored functional vision to 20/20 despite the presence of a central stromal scar, clearly demonstrating its rehabilitative potential even in eyes with corneal opacification. Furthermore, avoiding keratoplasty eliminates the risks associated with transplant surgery and its postoperative demands, making this approach particularly attractive in younger patients or those with limited access to specialty care. A scleral lens trial should be considered prior to proceeding with transplant surgery[4]. In our patient, continued topography further illustrated these trends. The right eye demonstrated progressive steepening, with Kmax measurements increasing from 60.9 D, 61.4 D, and most recently 62.6 D, respectively. This is in contrast to the post-hydrops eye, which showed continued flattening with Kmax decreasing from 68.8 D to 66.7 D in subsequent visits.

Beyond the affected eye, our case also highlights the importance of managing the fellow eye proactively. The patient's contralateral eye maintained good visual acuity but exhibited signs of keratoconus progression. In such cases, timely intervention with corneal linking is essential. Crosslinking remains the only proven modality to halt the progression of keratoconus and works by inducing collagen crosslinks within the corneal stroma, thereby increasing biomechanical rigidity.[9]

Prior to crosslinking, intracorneal ring segment implantation (ICRS) was a commonly adopted strategy for the prevention of keratoconus progression. This involves small plastic ring segments implanted in the corneal stroma, thus providing stability and preserving corneal shape.[10] However, to surgical complications, such as corneal tissue erosion, this procedure has fallen out of favor. More recently, corneal tissue addition keratoplasty (CTAK) and corneal allogenic intrastromal ring segments (CAIRS) have emerged as alternatives to the synthetic ring implants. These utilize donor corneal tissue to achieve corneal reshaping.[11] Similar to ICRS, these procedures do not halt disease progression, but rather are intended to reduce irregular astigmatism and improve best-corrected spectacle visual acuity, potentially decreasing reliance on contact lenses.

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Early crosslinking in a still-functional eye can prevent the vision-threatening complications seen in the affected eye, such as hydrops or advanced ectasia requiring more invasive rehabilitation.[12]

The patient's right eye remained unaffected by hydrops, but likely had been progressing, based on severe steepening and posterior elevation. Given the preserved visual acuity with a steep cone and history of hydrops in the other eye, corneal collagen crosslinking in the right eye was recommended even prior to documenting topographical progression. The goal is to preserve vision in the better-seeing eye and avoid complications similar to those experienced in the left eye. He delayed treatment for personal reasons and has already steepened by an additional 1.2 diopters in Kmax over the following 3 months, further emphasizing the importance of proactive treatment in high-risk patients when a documented history of topographical progression is not available.

Interestingly, the topographic evolution observed in our case demonstrates the dramatic flattening that may occur following hydrops. This phenomenon is believed to result from the inflammatory and fibrotic remodeling response following Descemet's membrane rupture, leading to a stiffer, flatter cornea.[13] Although post-hydrops flattening is variable, it can result in spontaneous stabilization of the cornea, potentially reducing or even eliminating the need for crosslinking in the short term. In our patient, keratometry values showed a marked reduction post-resolution of hydrops, with continued flattening seen over multiple follow-up visits. This reinforces the value of serial topography or tomography and clinical observation before initiating further interventions, particularly when the patient is visually rehabilitated with non-surgical means.

Despite the positive outcome in this case, it is important to recognize that not all patients with hydrops will experience sufficient corneal flattening or clarity to achieve functional vision. Close follow-up with anterior segment OCT and corneal imaging is essential to monitor for complications such as persistent edema, neovascularization, or non-resolving scarring that may indeed warrant surgical intervention. Nevertheless, our case supports a conservative initial approach, allowing the cornea adequate time to stabilize and heal before determining the necessity of transplant.

Furthermore, the decision to defer crosslinking after hydrops must be individualized. While the scar-induced flattening and biomechanical stiffening may mimic some of the effects of crosslinking, they are not equivalent. Patients should be monitored long-term for potential progression in residual ectatic areas, particularly if they are young or have known risk factors such as atopy or eye rubbing. If there is evidence of instability on serial imaging, crosslinking may still be indicated in the post-hydrops eye, although the altered corneal architecture may make standard protocols more challenging to apply.[14]

Conclusion

This case adds to the growing body of evidence supporting conservative management of acute corneal hydrops in keratoconus. It illustrates that meaningful visual recovery is possible without corneal transplantation, especially when leveraging modern contact lens options. The success achieved with a scleral lens in the presence of a central scar highlights the value of non-surgical rehabilitation in corneal ectatic disorders. At the same time, the fellow eye should not be neglected; early crosslinking offers the best opportunity to preserve vision and prevent bilateral visual compromise. Lastly, the dramatic corneal flattening observed on topography after hydrops resolution emphasizes the dynamic and, at times, favorable natural history of this condition. Careful monitoring and judicious decision-making remain the cornerstone of managing such complex cases.

Limitations

We recognize this is an anecdotal case, but as seen in the corneal photograph, this dense central scar typically requires a corneal transplant.

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None.

Credit authorship contribution statement

Cooper Bahr: Writing - Review & Editing. Writing - Original Draft

Kenneth Beckman: Writing - Review & Editing, Conceptualization

Authorship: All authors attest that they meet the current ICJME criteria for authorship.

Conflict of interests

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

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