





# Use of compression sutures and intracameral injection of perfluoropropane (C3F8) gas in the management of acute corneal hydrops in a pediatric patient: a case report

Uso de suturas compressivas e injeção de gás perfluoropropano (C3F8) em câmara anterior no manejo de hidropsia aguda em paciente pediátrico: relato de caso

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## ABSTRACT

Acute corneal hydrops is an ophthalmologic emergency resulting from rupture of Descemet's membrane with entry of aqueous humor into the corneal stroma. Patients typically present with ocular pain, blurred vision, photophobia, and tearing. The main risk factors include trauma due to ocular itching, allergic keratoconjunctivitis, corneal ectasia, and Down syndrome. Although a rare complication, it is most commonly associated with keratoconus. Clinical treatment with eye drops should always be initiated, but in advanced cases, combined surgical intervention may be necessary. This case describes a 7-year-old male patient with corneal hydrops that did not improve with conservative treatment. Compressive corneal sutures and perfluoropropane gas injection into the anterior chamber were indicated, resulting in significant symptomatic improvement. Subsequent treatment with topical losartan was administered for visual rehabilitation, which acts on the cicatricial corneal opacity, resulting in long-term improvement in visual acuity.

## RESUMO

Hidropsia corneana aguda é uma urgência oftalmológica resultante da ruptura da membrana de Descemet com entrada de humor aquoso no estroma corneano. O paciente costuma apresentar quadro de dor ocular, turvação visual, fotofobia e lacrimejamento. Os principais fatores de risco envolvidos são trauma por prurido ocular, ceratoconjuntivite alérgica, ectasias corneanas e síndrome de Down. Apesar de ser uma complicação rara, está mais comumente relacionada a pacientes com ceratocone. O tratamento clínico com colírios deve ser sempre iniciado, mas, em casos avançados, pode ser necessária uma conduta cirúrgica associada. Este caso relata um paciente do sexo masculino de 7 anos com quadro de hidropsia corneana sem melhora com tratamento conservador, sendo indicada conduta cirúrgica com suturas compressivas de córnea e injeção de gás perfluoropropano em câmara anterior, evoluindo com melhora importante da sintomatologia. Posteriormente, foi realizado tratamento com losartana tópico na reabilitação visual com ação sobre a opacidade corneana cicatricial, resultando em melhora da acuidade visual a longo prazo.

## INTRODUCTION

Acute corneal hydrops (ACH) is a condition of sudden corneal edema resulting from a rupture of the Descemet's membrane with influx of aqueous humor into the corneal stroma. It can last from 3 to 9 months in cases of severe Descemet's membrane rotations.<sup>(1)</sup>

Persistent edema can lead to complications such as corneal neovascularization, infection and perforation.<sup>(2)</sup>

The main risk factors are ocular trauma/itching, cough, allergic keratoconjunctivitis, keratoconus and patients with Down syndrome.<sup>(1,3,4)</sup>

Keratoconus is most commonly associated with this type of complication, but it can also occur in other types of ectasias, such as keratoblobus and pellucid marginal degeneration.<sup>(5,6)</sup>

These patients present with symptoms such as reduced visual acuity, photosensitivity, and pain. The diagnosis is made based on history and ophthalmological examination at the slit lamp, which commonly demonstrates extensive edema and opacification of the corneal stroma. It can be confirmed by optical coherence tomography of the anterior segments with a ruptured Descemet's membrane.<sup>(2,5,7,8)</sup>

Initially, medical treatment with hyperosmotic agents, hypotensive agents, corticosteroids, and mydriatics is advisable. However, in severe cases, conservative management is ineffective, and surgical treatment may be indicated to reduce complications and morbidity.<sup>(5)</sup>

Penetrating keratoplasty is among the surgical options currently available, which should be avoided in emergency situations due to the higher risk of complications and loss.

Injecting 14% perfluoropropane (C<sub>3</sub>F<sub>8</sub>) gas or air into the anterior chamber and compressive sutures accelerates the reduction of corneal edema by preventing the entry of aqueous humor through the Descemet's membrane route. In some cases, further gas injections may be necessary.<sup>(9,10)</sup>

The intracameral injection agents include air, 20% sulfur hexachloride (SF<sub>6</sub>), and C<sub>3</sub>F<sub>8</sub>. An anterior chamber (AC) paracentesis is performed, and air or gas is then injected through a fresh paracentesis to obtain a complete fill of AC. After some time, the gas is removed partially, and the patient is instructed to lie supine for 4 to 6 hours.<sup>(11)</sup>

In the presence of large gaping tears or stromal clefts, the use of compressive corneal sutures has been described to aid the closure of the defect. Full-thickness sutures or pre-Descemet sutures were used alone or in combination with gas or air injection.<sup>(11)</sup>

While placing the pre-Descemet sutures, the needle is inserted deep into the stroma, and the presence of Descemet's membrane wrinkling adjacent to the level of the air bubble acts as a guide for the placement of sutures.<sup>(11)</sup>

The possible complications with the use of full-thickness sutures are trauma to the corneal endothelium, neovascularization, positive Seidel test, increased risk of infection, including keratitis or endophthalmitis, and suture tract scarring in the visual axis.<sup>(11)</sup>

Another surgical option described in the literature would be a mini-Descemet's membrane endothelial transplant.<sup>(5)</sup>

This strategy is beneficial in eyes with inferior breaks, where intracameral gas or air might not provide extended tamponade, and for patients who require sutures across the visual axis.<sup>(11)</sup>

The vast majority of cases remain with corneal opacity, with subsequent indication for penetrating keratoplasty for visual rehabilitation.<sup>(12)</sup>

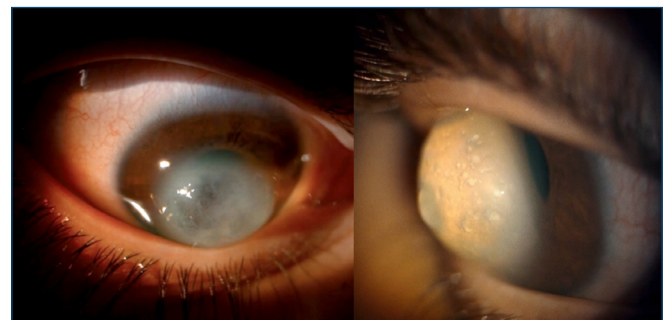
This case describes a 7-year-old male patient with corneal hydrops that did not improve with conservative treatment (CAAE: 89017125.3.0000.0134).

## CASE REPORT

A 7-year-old male patient presented to the ophthalmology emergency room complaining of eye pain, photophobia, and sudden loss of vision in the right eye (RE) after rubbing his eyes. He denied any ophthalmological history or comorbidities.

An ophthalmological examination revealed visual acuity in the RE with hand movements and in the left eye (LE) of 20/20.

Biomicroscopy of the RE showed hyperemia 2+, intense corneal edema, stromal and central thinning, and extensive tear of the Descemet's membrane (Figure 1).

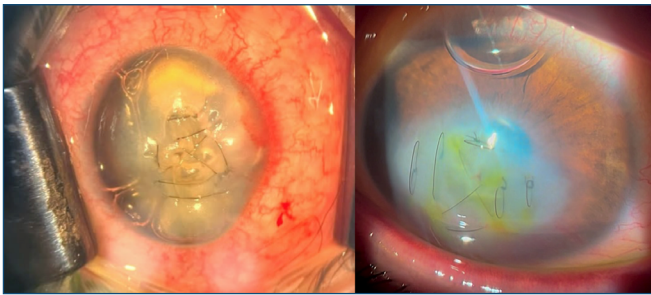


**Figure 1.** Corneal biomicroscopy examination on the first day.

The LE had no particularities. The fundus examination in the RE was impossible, and the LE was within normal limits.

Conservative management was initially indicated, using corticosteroid eye drops and antihypertensives. However, after 1 week, the patient returned with worsening of the condition. Surgical management was then indicated due to the severity of the condition and the risk of perforation.

The decision was made to perform corneal compressive sutures in addition to C3F8 gas 14% injection into the AC. A gas bubble was placed to fill the AC approximately two-thirds of its capacity to compress the cornea and prevent aqueous humor from entering the corneal stroma. Approximately eight interrupted pre-Descemet sutures were placed using 10.0 nylon thread. A prophylactic inferior iridectomy was also performed at 6 hours (Figure 2).



**Figure 2.** On the left, the immediate postoperative result of corneal sutures. On the right, a biomicroscopic examination of the cornea after 5 days.

In the immediate postoperative period, the patient was started on moxifloxacin 0.5% eye drops six times a day, prednisolone acetate 1% six times a day in a decreasing dose, ketotifen eye drops 2 times a day, preservative-free sodium hyaluronate eye drops 6 times a day, and timolol maleate 2 times a day. He was instructed to maintain a supine position for the first 24 hours to improve the gas action in the AC.

Throughout the follow-up, he was instructed on the importance of using the prescribed eye drops and not to rub his eyes. He chose to wear an acrylic shield while sleeping due to the difficulty his mother reported in monitoring the patient at night.

On the first postoperative day, the patient recovered painlessly and opened his eyes more easily, despite continued blurred vision and photophobia. The biomicroscopy showed improvement in corneal edema by more than 50%.

One week after the procedure, symptoms improved, with visual acuity improving to 20/400 and no corneal edema.

Approximately two months after surgery, the sutures were removed, and the patient's vision improved to 20/100. An ophthalmological examination revealed a

calm eye and a cornea with a central cicatricial opacity partially reaching the visual axis. (Figure 3).



**Figure 3.** Corneal biomicroscopy 2 months after surgery

Treatment with losartan 0.08% eye drops every 6 hours was then initiated to treat corneal opacity. The preservative-free lubricant and ketotifen eye drops were continued, with complete control of ocular itching.

After 2 months of treatment with losartan, the vision was 20/80, and the patient was advised to continue using the eye drops for at least another 6 months.

After 6 months of treatment with losartan eye drops, vision improved to 20/50 (Figure 4).

The patient continues to be followed up in the cornea department every six months.



**Figure 4.** Corneal biomicroscopy after 6 months of topical losartan use.

## DISCUSSION

Acute corneal hydrops is a self-limiting condition that can resolve spontaneously within 2 to 6 months.<sup>(7)</sup>

Surgical treatment may be chosen to reduce the time of edema recovery and enable earlier visual rehabilitation.<sup>(5)</sup>

The combination of compression sutures with air or gas injection into the AC in the management of corneal hydrops produces better results than either technique alone. The gas in the AC acts as a tamponade and prevents aqueous humor from entering the stroma, and the sutures approximate the ruptured margins of the Descemet's membrane, helping to expel the fluid present in the stroma.<sup>(5)</sup>

In this patient, we chose to initiate medical treatment, but due to clinical worsening and severity of the condition, surgical management was indicated. This resulted in immediate improvement in the edema and subsequent improvement in visual acuity.

In addition to multiple compression sutures and C3F8 gas in the AC to tamponade the Descemet's membrane rupture, a prophylactic iridectomy was performed in the inferior region.

The use of gases such as C3F8 is associated with an increased risk of malignant glaucoma, making prophylactic iridotomy essential.<sup>(13,14)</sup>

Cases of acute hydrops represent a relative contraindication to corneal transplantation in the absence of perforation due to an increased risk of rejection. The case reported involving a child presents an even higher risk of post-transplant rejection due to a tendency toward more severe inflammation in this age group.

An emergency transplant should be avoided in these cases due to a higher risk of button rejection due to inflammation and edema. The main advantage of this technique is the rapid resolution of edema, which prevents corneal angiogenesis.<sup>(5)</sup>

The pathophysiology of corneal scarring is mediated by myofibroblast proliferation that occurs after damage to corneal epithelium and corneal basement membrane. There is an influx of cytokines, transforming growth factor (TGF)- $\beta$ , interleukin-1, and platelet-derived growth factor (PDGF) into the corneal stroma, inducing transformation of keratocytes into corneal myofibroblasts that drive dysregulated wound healing and corneal haze and opacities. Persistent TGF- $\beta$  levels inhibit myofibroblasts apoptosis, which leads to disorganized extracellular matrix deposition and resultant fibrosis.<sup>(15)</sup>

To assist in this patient's visual rehabilitation, losartan 0.08% eye drops were initiated due to their antifibrotic

properties. Studies have shown efficacy in reducing corneal fibrosis after descemetorexis, alkali burns, PRK injuries, and other types of haze. Topical losartan inhibits this signaling pathway, reducing TGF- $\beta$  and myofibroblast proliferation, type IV collagen deposition, and stromal fibrosis formation.<sup>(15,16,17)</sup>

The present study may contribute to a better result of similar cases in the control of acute hydrops and subsequent visual rehabilitation, given that we did not find previous reports of pediatric patients on the combination of surgical procedures or the use of topical losartan.

## AUTHORS' CONTRIBUTION

Mariana Mendes Campos da Costa - Direct involvement in patient care and in the surgical procedure. Manuscript drafting. Final review. Raquelle Machado Vargas - Direct involvement in the patient care and reference organization. Selection of clinical and surgical images. Jaqueline Bozzolo Ogeda - Participation in the surgical procedure and contribution to therapeutic planning. Raissa Nogueira Silva - Literature review and translation. Gustavo Souza Gonçalves - Academic mentoring. Julia Teles Triglia Pinto - Medical record organization, translation and literature review.

## REFERENCES

- Maharana PK, Sharma N, Vajpayee RB. Acute corneal hydrops in keratoconus. *Indian J Ophthalmol.* 2013;61(8): 461-4.
- Vajpayee RB, Maharana PK, Kaweri L, Sharma N, Jhanji V. Intrastromal fluid drainage with air tamponade: anterior segment optical coherence tomography guided technique for the management of acute corneal hydrops. *Br J Ophthalmol.* 2013;97(7):834-6.
- Grewal S, Laibson PR, Rapuano CJ. Acute hydrops in the corneal ectasias: associated factors and outcomes. *Trans Am Ophthalmol Soc.* 1999; 97:187-98; 198-203.
- Sharma N, Maharana PK, Jhanji V, Vajpayee RB. Management of acute corneal hydrops in ectatic corneal disorders. *Curr Opin Ophthalmol.* 2012;23(4): 317-23.
- Elnaggar F, Alsharif H, Almutlak M, Fairaq R, Kirat OM, Bin Helayel H. Management of Acute Corneal Hydrops Using Compression Sutures and Intracamerai Air Injection. *Am J Case Rep.* 2024;25:e944517.
- Fan Gaskin JC, Patel DV, McGhee CNJ. Acute corneal hydrops in keratoconus – new perspectives. *Am J Ophthalmol.* 2014;157(5):921-28.e1.
- Galvis V, Tello A, Cianci MF, Escaf LC, Parra MM. Giant intrastromal cleft in corneal hydrops. *Int Ophthalmol.* 2018;38(4):1727-32.
- Bachmann B, Händel A, Siebelmann S, Matthaei M, Cursiefen C. Mini-Descemet Membrane Endothelial Keratoplasty for the Early Treatment of Acute Corneal Hydrops in Keratoconus. *Cornea.* 2019;38(8):1043-1048.
- Miyata K, Tsuji H, Tanabe T, Mimura Y, Amano S, Oshika T. Intracamerai air injection for acute hydrops in keratoconus. *Am J Ophthalmol.* 2002;133(6):750-2.
- Sayadi JJ, Lam H, Lin CC, Myung D. Management of acute corneal hydrops with intracamerai gas injection. *Am J Ophthalmol Case Rep.* 2020;20:100994
- Bafna RK, Kalra N, Asif MI, Beniwal A, Lata S, Sharma SV, et al. Management of acute corneal hydrops - Current perspectives. *Indian J Ophthalmol.* 2024;72(4):495-507.

12. Rajaraman R, Singh S, Raghavan A, Karkhanis A. Efficacy and safety of intracameral perfluoropropane (C3F8) tamponade and compression sutures for the management of acute corneal hydrops. *Cornea*. 2009;28(3):317-20.
13. Basu S, Vaddavalli PK, Ramappa M, Shah S, Murthy SI, Sangwan VS. Intracameral perfluoropropane gas in the treatment of acute corneal hydrops. *Ophthalmology*. 2011;118(5):934-9.
14. Sharma N, Mannan R, Titiyal JS. Nonresolution of acute hydrops because of intrastromal migration of perfluoropropane gas. *Cornea*. 2010;29(8):944-6.
15. Min H, Ambati B. Topical losartan and systemic vitamin C to mitigate corneal fibrosis after superficial keratectomy complicated by infection. *JCRS Online Case Reports*. 2025; 13 (1):e00153.
16. Sampaio LP, Hilgert GSL, Shiju TM, Santhiago MR, Wilson SE. Losartan Inhibition of Myofibroblast Generation and Late Haze (Scarring Fibrosis) After PRK in Rabbits. *J Refract Surg*. 2022 Dec;38(12):820-829.
17. Abdelghaffar M, Güell JL, Moura-Coelho N. Topical losartan ophthalmic drops - a review of corneal wound healing and topical losartan for managing corneal haze and potential future indications. *Graefes Arch Clin Exp Ophthalmol*. 2025;263(4):925-34.