• Letter to the Editor •

An improved technique to treat persistent extensive Descemet's membrane detachment following cataract surgery: a case report

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Dear Editor,

Descemet's membrane detachment (DMD) is considered as a potential sight-threatening complication following various intraocular surgeries, particularly cataract surgery[1]. The labile adhesion between the Descemet's membrane (DM) and the posterior corneal stromal layer can be easily separated with minimal mechanical force. Several risk factors have been associated with the development of DMD including old age, improper intraoperative operation, corneal ectatic disorders, and endothelial disorders and so on[1-4]. Abundant management strategies for early DMD have been discussed in the literature. However, a very limited number of articles provide insight into the management of persistent DMD. Here we report an unusual case of extensive DMD lasted for 19mo after cataract surgery, along with slit-lamp photoes, anterior segment optical coherence tomography (AS-OCT) documentation, corneal endothelial cell count and management details.

CASE PRESENTATION

Ethical Approval The study adhered to the principles outlined in the Declaration of Helsinki and received approval from the ethics committee of the Xiamen Eye Center (No.FZYKYY-KY-2022-003). Informed written consent for the use of the patient's data was obtained from both the patient and his son.

A 90-year-old man underwent phacoemulsification with posterior chamber intraocular lens implant in the left eye in local hospital. According to the patient past medical records and the statements of the patient's family members, we learned that the uncorrected visual acuity (UCVA) of the left eye was limit to 20/400 before cataract surgery. On the first post-operative day, the UCVA of the operated eye was unchanged, with remarkable corneal edema. The patient was managed conservatively with 50% glucose eye drops, topical steroids and antibiotics in the local hospital. Medical therapy failed to control the symptoms and instead contributed to aphakic bullous keratopathy after two weeks. Then, a bandage contact lens was then placed on the left eye for one month. After that, carbomer eye gel, mecobalamin and vitamin C was used for some time. Before he visited to our hospital, the patient only received intermittent and conservative medication treatments without any other interventions during the last 19mo.

On presentation to our clinic, his best-corrected visual acuity was light perception and intraocular pressure (IOP) was 17 mm Hg in the left eye. Slit-lamp examination was remarkable for the presence of corneal neovascularization (CNV), stromal edema and aphakic bullous keratopathy (Figure 1A). A thick hyperreflective strand was displayed in AS-OCT (Figure 2A; CASIA2, Tomey, Nagoya, Japan), which

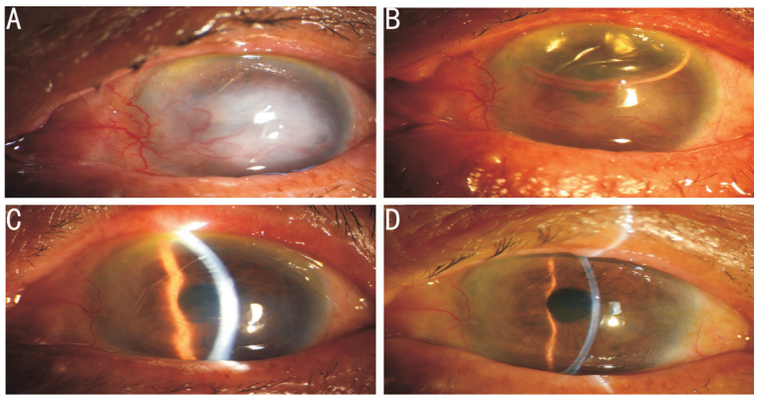

Figure 1 Slit-lamp examination before and after air injection A: Preoperative slit-lamp photograph; B: Slit-lamp photograph on the 2nd day after the third air injection; C: Slit-lamp photograph on the 23rd day after the third air injection; D: Slit-lamp photograph on almost one and a half years after the third air injection.

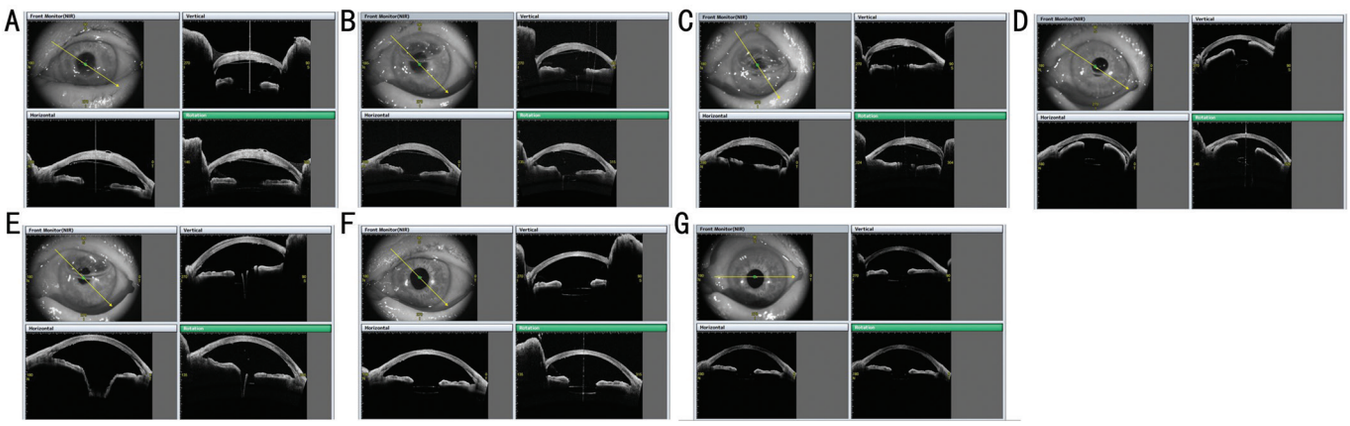

Figure 2 AS-OCT examination before and after air injection A: Preoperative AS-OCT images; B: AS-OCT images on the first day after the first attempt; C: AS-OCT images on the first day after the second attempt; D: AS-OCT images on the first day after the third attempt; E: AS-OCT images on the 2nd day after the third attempt; F: AS-OCT images on the 23rd day after the third attempt; G: AS-OCT images on almost one and a half years after the third attempt. AS-OCT: Anterior segment optical coherence tomography.

was straight and chord-like, presenting a long-lasting extensive detachment of DM in the left eye. Significant aphakic bullous keratopathy was also observed in AS-OCT (Figure 2A). No known family history of corneal abnormalities was reported.

Surgical Technique A complete intracameral air injection using a 30-G needle was done in an operating room with all aseptic precautions by an experienced surgeon (Ye XY). The surgery was conducted using a 3D visualization surgical system (NGENUITY VR, Alcon Laboratories, Inc. USA). The clear zone in the periphery of the patient's cornea provided sufficient visibility for the surgery, and with the assistance of the 3D surgical system, peripheral light interference was minimized, further enhancing corneal visibility. Outcome appraisal was conducted one day following the air injection surgery. We observed that the UCVA improved at finger counting at a distance of 30 cm but there was still an extensive detached DM with corneal edema in the left eye (Figure 2B). No pupillary block was found.

Considering the long period of detachment and the potential transformation of the DM to a fibrosis or scar form, we thought that air injection was necessary to perform again for a complete reattachment of DM. Then the same operation procedure was performed again on the following day. Fortunately, a decreased covering area of the DMD was observed on AS-OCT (Figure 2C) along with a slightly resolved cornea edema and an unchanged UCVA one day after the second injection. However, it did not achieve the expected ideal post-operative effect.

Although the first and second injections did not achieve complete DM attachment, partial attachment was observed in the peripheral region, indicating the method was effective but that the pressure and duration were insufficient. Thus, we proceeded with a third intracameral air injection, implementing several critical improvements. First, a greater volume of air was injected to ensure sufficiency. Additionally, a significant enhancement in this procedure was the use of an air-seal technique to close the needle puncture port, effectively preventing air leakage and maintaining adequate mechanical support. The key surgical techniques of the improved air injection were documented in a video (Video 1, online supplementary).

Seven hours post-surgery, during the night, the patient reported eye pain, and IOP was unmeasurable. AS-OCT examination revealed pupil block (Figure 2D). We administrated mydriatic treatment and closely monitored the patient's condition. A reexamination with AS-OCT the following day showed the reattachment of DMD (Figure 2E) and significant resolution of corneal edema, confirmed by slit-lamp photography (Figure 1B). By the third day, the UCVA in the left eye had improved to 20/500.

Based on the patient's subsequent follow-up results, we observed that the DMD still keep attached on the 23rd postoperation day, as confirmed by slit-lamp examination (Figure 1C) as well as AS-OCT imaging (Figure 2F). His UCVA improved to 20/166 and the central corneal thickness decreased to 557 μm in his left eye. After nearly one and a half years of follow-up, his UCVA further improved to 20/100, with a best-corrected visual acuity of 20/66. Slit-lamp examination displayed a transparent left eye without stromal edema, and CNV in the central area was nearly invisible (Figure 1D). Some folds in the reattached DM were visible outside the central pupil area but did not interfere with normal visual function. Specular microscopy of the left eye showed an endothelial cell density of 1645.2 cells/mm^2, though some cells appeared kind of deformed (Figure 3). AS-OCT imaging revealed that the Descemet's membrane remained attached (Figure 2G).

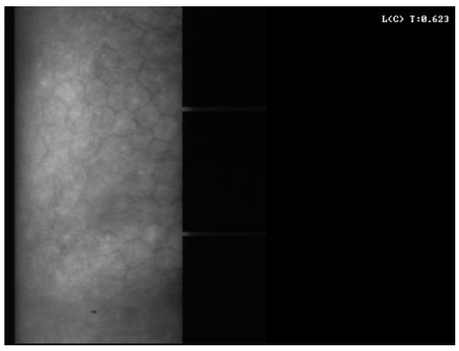

Figure 3 Corneal endothelial cell count on almost one and a half years after air injection.

DISCUSSION

DMD is a common complication following cataract surgery. When the counterbalance of cornea homeostatic mechanism is compromised because of DMD, corneal edema can ensue. If persistent corneal edema is observed after cataract surgery, DMD should be considered.

Clinical observations showed that most DMD were not accompanied by CNV. The balance between pro-angiogenesis and anti-angiogenesis exists to maintain corneal avascularity. However, infection, inflammation, hypoxia, trauma, corneal degeneration, and so on can disrupt these homeostatic protective mechanisms to promote neovascularization[5-7]. Besides long-term corneal edema of this patient, frequent exposure of the patient's cornea to multiple preservative-containing eye drops further perturbated the homeostatic conditions and enhanced inflammatory cytokines, maybe thereby leading to the degeneration of corneal epithelial barrier function, resulting in CNV.

The treatment of DMD primarily depends on its size, location, and content. Kumar *et al*[8] proposed the height-, extent-, length-, and pupil-based (HELP) algorithm, which uses AS-OCT-based height, extent, and relation to the pupil for managing post-phacoemulsification DMD[1]. Cases with nonplanar DMD, scrolled edge, length of DMD>2 mm, or involving the central cornea generally require surgical intervention, especially those involving the visual axis or containing hemorrhagic DMD[1,8-9]. Surgical intervention can rapidly restore vision, reduce the risk of corneal complications, and lower the need for future corneal transplantation.

Since Sparks[10] first introduced air injection for the management of DMD in 1967, it has become a successful standard treatment for DMD. In a retrospective case series (n=60), Jain and Mohan[11] reported no difference in success rates between intracameral air and 14% C_3F_8 injection and less complications in the air injection group for cases of DMD following cataract surgery. The authors concluded that air offers better efficacy with a lower risk of postoperative complications and should be prioritized. Although air has better efficacy, the absorption of 100% air from the anterior chamber was too rapid[11]. Thus, in order to provide adequate time of mechanical support, the key technique was to inject adequate air and to close the puncture port using an air-seal technique to prevent air leakage. It's clear that the case we report is the most severe DMD, which lasted for the longest time but treated with the relatively simplest intervention with good anatomical and functional outcomes. The improved technique was proved to be efficient to repair prolonged extensive DMD, which could avoid further complex surgical procedures and wastage of medical resources.

After conducting a literature review on (28/10/2024) utilizing PubMed, Google Scholar and Web of Science, using the key words (DM, DMD, air injection, C_3F_8, cataract surgery), we found no previous reports addressing the management of persistent extensive DMD over such a prolonged duration. This finding suggests that our research is pioneering in reporting a treatment approach for this particular form of prolonged, extensive DMD. Despite being detached for at least 19mo, it can be effectively repaired using a relatively simple and safer air injection technique, avoiding more complex procedures, such as keratoplasty, and conserving medical resources. What's more important is that we have, for the first time, proposed an air-seal technique at the needle puncture site to maintain high

pressure within the anterior chamber, which is also the key to the success of our procedure.

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REFERENCES

1 Singhal D, Sahay P, Goel S, *et al*. Descemet membrane detachment. *Surv Ophthalmol* 2020;65(3):279-293.

2 Benatti CA, Tsao JZ, Afshari NA. Descemet membrane detachment during cataract surgery: etiology and management. *Curr Opin Ophthalmol* 2017;28(1):35-41.

3 Dai Y, Liu ZZ, Wang W, *et al*. Real-time imaging of incision-related descemet membrane detachment during cataract surgery. *JAMA Ophthalmol* 2021;139(2):150-155.

4 Ventura BV, Silvestre F, Lima NC, *et al*. Descemet membrane detachment due to laser application in femtosecond laser-assisted cataract surgery: incidence and risk factors. *J Refract Surg* 2021;37(7):466-471.

5 Nicholas MP, Mysore N. Corneal neovascularization. *Exp Eye Res* 2021;202:108363.

6 Rangu N, Dang DH, Riaz KM. Current trends in the management of corneal neovascularization. *Curr Opin Ophthalmol* 2024;35(4):329-342.

7 Abdelfattah NS, Amgad M, Zayed AA, *et al*. Clinical correlates of common corneal neovascular diseases: a literature review. *Int J Ophthalmol* 2015;8(1):182-193.

8 Kumar DA, Agarwal A, Sivanganam S, *et al*. Height-, extent-, length-, and pupil-based (HELP) algorithm to manage post-phacoemulsification Descemet membrane detachment. *J Cataract Refract Surg* 2015;41(9):1945-1953.

9 Assia EI, Levkovich-Verbin H, Blumenthal M. Management of descemet's membrane detachment. *J Cataract Refract Surg* 1995;21(6):714-717.

10 Sparks GM. Descemetopexy. Surgical reattachment of stripped Descemet's membrane. *Arch Ophthalmol* 1967;78(1):31-34.

11 Jain R, Mohan N. Outcomes of repeat descemetopexy in post-cataract surgery descemet membrane detachment. *Am J Ophthalmol* 2014;157(3):571-575.e1-2.