American Journal of Ophthalmology Case Reports 27 (2022) 101663

Contents lists available at ScienceDirect

American Journal of Ophthalmology Case Reports

journal homepage: www.ajocasereports.com/

Coughing-induced retinal pigment epithelial tear after trabeculectomy combined with pars plana vitrectomy

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ARTICLE INFO

Keywords:
Choroidal detachment
Exudative retinal detachment
Retinal pigment epithelial tear
Glaucoma filtering surgery
Submacular hemorrhage
Recombinant tissue plasminogen activator

ABSTRACT

Purpose: To report a case of retinal pigment epithelial (RPE) tear after trabeculectomy combined with pars plana vitrectomy (PPV).

Observations: A 65-year-old man with neovascular glaucoma due to proliferative diabetic retinopathy presented with visual impairment and elevated intraocular pressure (IOP) in the right eye and underwent trabeculectomy combined with PPV. Three weeks after surgery, the best-corrected visual acuity (logarithm of minimal angle of resolution) improved from 3.0 to 0.30, and the IOP was controlled within normal limits. Four weeks after the surgery, he noticed visual impairment and ocular pain in the right eye after continuous coughing associated with asthma. Fundus examination revealed bullous retinal detachment, choroidal detachment, and submacular hemorrhage (SMH) due to a giant RPE tear at the posterior pole. Visual acuity worsened considerably to 1.7, while IOP was not elevated (6 mmHg). The patient received PPV with recombinant tissue plasminogen activator (rt-PA) and fluid/air exchange for internal tamponade and achieved anatomic retinal and choroidal attachments.

Conclusions and importance: The acute increase in hydrostatic pressure in the choroidal interstitium due to continuous coughing induces an RPE tear. Vitrectomy with rt-PA and fluid/air exchange may be a favorable treatment for exudative retinal detachment and SMH due to RPE tears.

1. Introduction

Retinal pigment epithelium (RPE) tear is a well-known vision-threatening complication in eyes with exudative age-related macular degeneration (AMD).[1] Previous reports have shown that RPE tear also occurs in eyes after therapeutic interventions, such as glaucoma filtration surgery,[2–5] retinal detachment surgery,[6] and panretinal photocoagulation.[7,8] In each of these conditions, increased hydrostatic pressure is considered the cause of the RPE tear.[9]

Submacular hemorrhage (SMH) is a typical complication of retinal diseases, including AMD, diabetic retinopathy, and macroaneurysms.[10] Although RPE tears secondary to exudative AMD are common, there are few reports on RPE tears with SMH in eyes that underwent glaucoma surgery. Here, we report a case of exudative retinal detachment and SMH with RPE tear in a patient who recently underwent combined trabeculectomy and vitrectomy for diabetic neovascular glaucoma.

2. Case report

A 65-year-old man with a 10-year history of type 2 diabetes mellitus (HbA1c 7.5%) presented to our clinic complaining of visual disturbance in the right eye. The patient had a history of diabetes, hypertension, chronic kidney disease, and asthma. He had undergone cataract surgery and panretinal photocoagulation in both eyes three years ago, and combined trabeculectomy without mitomycin C (MMC), and pars plana vitrectomy (PPV) in the left eye one and a half years ago (Fig. 1). At the initial visit, best-corrected visual acuity (logarithm of minimal angle of resolution) was 3.0 and 0 in the right and left eyes, respectively. Intraocular pressure (IOP) was 32 mmHg in the right eye and 17 mmHg in the left eye. The axial length was 24.60 mm in the right eye and 25.72 mm in the left eye. Slit-lamp examination of the right eye revealed rubeosis iridis and peripheral anterior synechiae (PAS) (PAS index, 0.7). Fundus examination of the right eye revealed a vitreous hemorrhage. He was diagnosed with NVG stage 3 and underwent trabeculectomy without MMC and PPV in the right eye, which was the same surgical procedure in the left eye. No intraoperative complications occurred. Best-corrected

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https://doi.org/10.1016/j.ajoc.2022.101663
Received 9 March 2022; Received in revised form 5 July 2022; Accepted 8 July 2022
Available online 13 July 2022

visual acuity (BCVA) improved to 0.3 and IOP was 6 mmHg in the right eye. Fundus examination revealed no abnormalities in the right eye. Four weeks later, he experienced sudden ophthalmalgia and reduced visual acuity in the right eye, with continuous coughing and asthma. BCVA worsened to 1.7, and IOP was 6 mmHg in the right eye. Fundus examination of the right eye revealed retinal detachment, overlying choroidal detachment, and an SMH (Fig. 2). Intravitreal injection of aflibercept was administered on the same day to decrease exudative changes from suspicious choroidal/retinal neovascularization. Four days later, a surgical procedure inspired by the report by Kimura and associates[11] was performed to displace the SMH. A 25-gauge PPV was performed, and after a vitreous hemorrhage which was derived from the SMH was washed out, we encountered an extremely large crescentic RPE tear on the temporal side of the posterior pole. The RPE tear occurred within the non-photocoagulated region of the retina, and the temporal edge was consistent with the boundary between the photocoagulated and non-photocoagulated areas. There was no obvious retinal tears or holes. Attempts to displace the clot by cannula-assisted active backflush with a fluid jet towards the lesion through drainage retinotomy were performed. The fluid was composed of 1 mL of 100 μg alteplase (recombinant tissue plasminogen activator, rt-PA) to liquefy the SMH. Complete fluid-air exchange was then performed. Endolaser photocoagulation was performed at the edge of the RPE tear in order to achieve instantaneous fusing of the retina and RPE, and seal the subretinal space around the RPE tear.[12] The air was exchanged for sterile, filtered 25% sulfur hexafluoride, and the patient was maintained in a postoperative prone position. The size of the RPE tear at the end of the operation was almost the same irrelevant to the invasiveness of the surgery, compared to the size of it at the start of the operation. The next day, both retinal and choroidal detachments completely resolved with elevation of the IOP (20 mmHg). Although the IOP gradually decreased, BCVA 12 days after treatment increased to 0.4 with no recurrence of retinal or choroidal detachments. Complete resolution of SMH from the fovea was obtained, and the area of the RPE defect did not increase further. The fundus autofluorescence image showed a large, sharply delineated, hypoautofluorescent signal in the RPE tear area, and a hyperautofluorescent area corresponding to the enrolled RPE (Fig. 3).

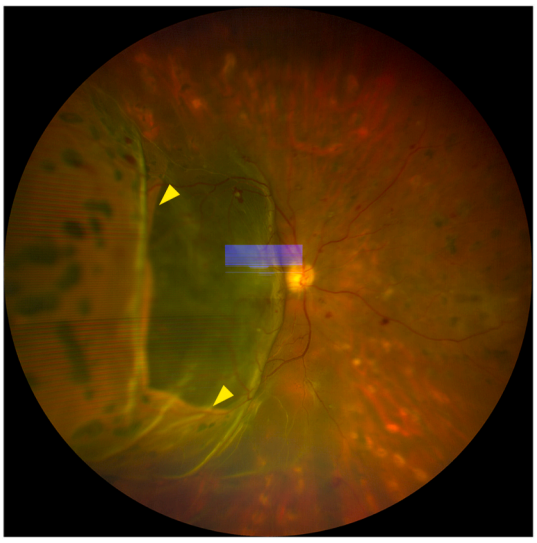

Fig. 2. Fundus photograph of the patient's right eye, taken 35 days after combined trabeculectomy and vitrectomy, showing a bullous macula-off retinal detachment, overlying a temporal choroidal detachment, and submacular hemorrhage (SMH). The sharply vertical and horizontal line at the edge of SMH represented retinal pigment epithelium tear (arrow heads). Optical coherence tomography was not available by the back-shadowing of the retinal detachment.

3. Discussion

We experienced a case of exudative retinal detachment and SMH with an RPE tear four weeks after trabeculectomy. We underwent trabeculectomy without MMC because voluntary recall of MMC had been conducted due to concerns that its sterility could not be guaranteed because of manufacturing deviations in Japan. Previous reports suggested the IOP elevation was useful for the resolution of the retinal detachment after glaucoma-filtering surgery.[2–5] However, we considered the only IOP elevation was insufficient because there were a large amount of subretinal fluid and SMH through the giant RPE tear, so we promptly performed pneumatic displacement and PPV. As a result, the

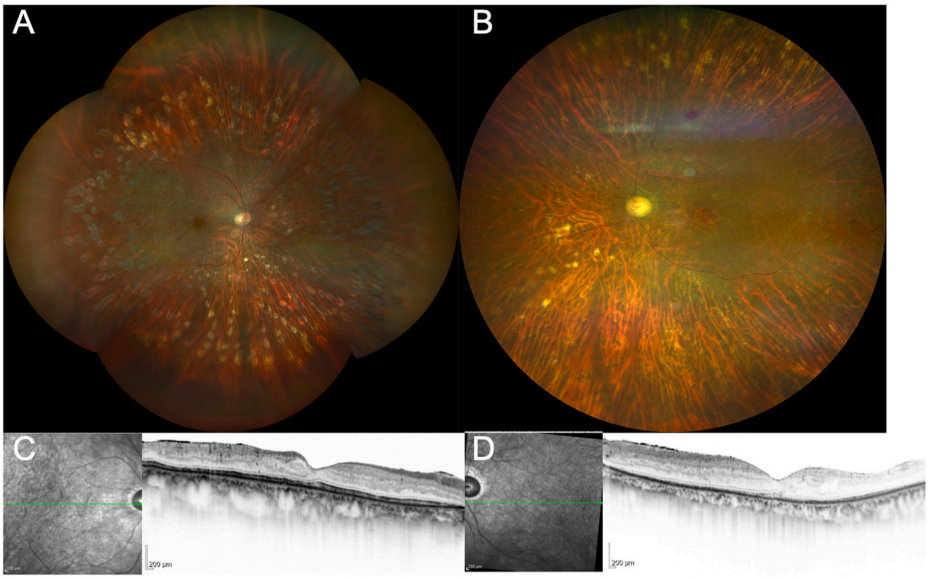

Fig. 1. Fundus photograph of the right eye (A) and left eye (B) and optical coherence tomography (OCT) of the right eye (C) and left eye (D) half a year before the initial presentation. Fundus photography showed widespread bilateral scarring from the previous panretinal photocoagulation. The OCT images were almost normal in both the eyes.

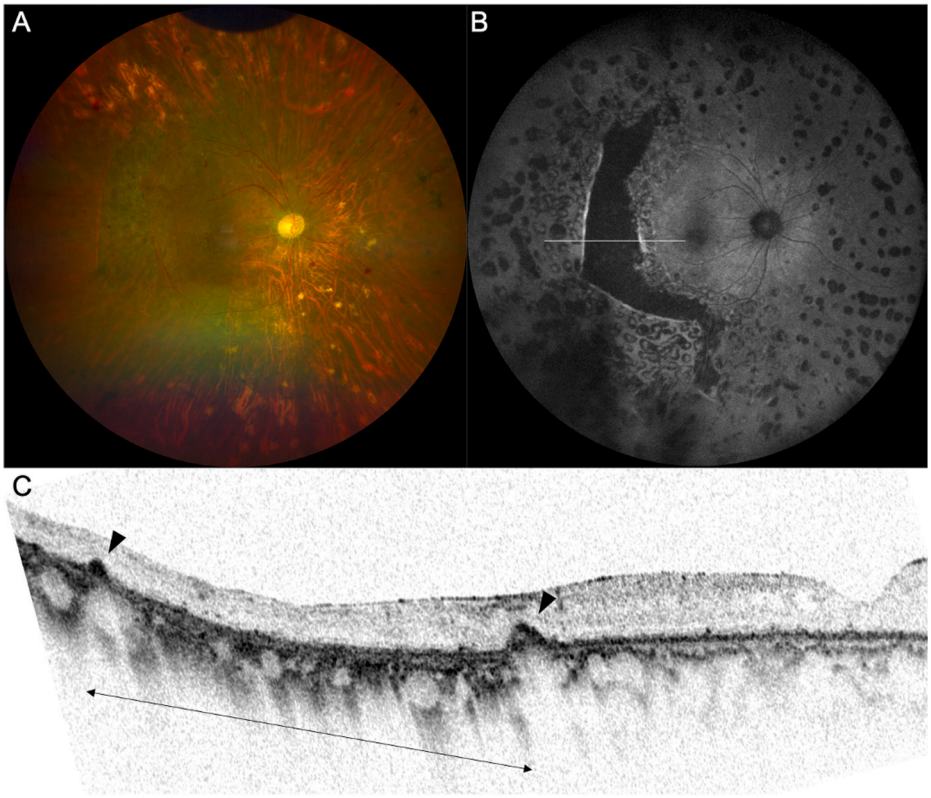

Fig. 3. Fundus photograph (A), fundus autofluorescence (FAF) image (B), and OCT (C) of the patient's right eye, taken 12 days after vitrectomy with recombinant tissue plasminogen activator and fluid-gas exchange. The retinal detachment and choroidal detachment were completely resolved with residual intraocular gas and laser barricade around the retinal pigment epithelium (RPE) tear. FAF showed a giant RPE defect but not foveal involvement. OCT showed the scrolled RPE at the edge of the RPE tear (arrow heads), and between the both sides the direct attachment of the outer retina to Bruch's membrane without the RPE line (arrow). The line in the FAF image indicates the scan line for the OCT image.

postoperative IOP was elevated from 6 mmHg to 20 mmHg, which could contribute to resolve retinal detachment.

It is unclear how exudative retinal detachment, overlying choroidal detachment, and SMH developed in this case. We derived a hypothesis for their causes. The continuous cough caused by asthma causes a sudden increase in venous pressure[13] and choriocapillaris microvasculature pressure. This Valsalva effect led to an imbalance between the hydrostatic and colloid osmotic pressures,[14] which favored fluid movement from the vascular to extravascular compartment in the choroidal layer, as stated in Starling's principle.[15] The excessive pressure gradient caused choroidal rupture, which was a similar mechanism to closed-globe injuries.[16] These serum-like transudate, exudates, or blood from choroidal vessels accumulated in the suprachoroidal space, which led to choroidal detachment. It was thought that the choroidal detachment in only right eye was due to the presence of post operated hypo-IOP in this case. As the RPE was stretched, mechanical stress was directly loaded to a boundary between the photocoagulated and non-photocoagulated regions of the retina because the RPE layer was absent within the photocoagulated area.[17] Though the RPE tear, fluid and blood moved to the subretinal space, which led to exudative retinal detachment and SMH.[18,19]

Because of the toxicity of subretinal blood to the neurosensory retina,[20] clearing the submacular blood to minimize permanent damage to photoreceptors is crucial for management. SMH treatment can be broadly divided into non-vitrectomizing and vitrectomizing techniques. Both approaches are combined with intravitreal injection of rt-PA, anti-vascular endothelial growth factor, gas, or a combination of both. In this case, we chose the vitrectomizing technique because the SMH was large and could not be liquefied by intravitreal aflibercept injections. Although a technique for treating SMH using rt-PA was an off-label use, we found that PPV with rt-PA and gas tamponade is a safe and effective treatment for removing SMH due to an RPE tear. Because of the RPE tear without foveal involvement, the patient was able to maintain visual acuity. However, this is a single case report, and a larger number of patients would be needed to assess the benefit of this technique in the management of SMH due to the RPE tear.

4. Conclusions

We demonstrated the effectiveness of surgical intervention in cases of exudative retinal detachment and SMH due to RPE tear. The acute increase in hydrostatic pressure in the choroidal interstitium due to continuous coughing might induce RPE tears and SMHs. Our findings may help determine a strategy for RPE tear treatment.

Ethics approval

The use of rt-PA was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Osaka Red Cross Hospital.

Patient consent

The patient provided written consent for the use of rt-PA and the publication of this study.

Funding

This study did not receive any external funding or grant.

Authorship

All authors attest that they meet the current ICMJE criteria for authorship.

Declaration of competing interest

The following authors have no financial disclosures: MY, YH, and MA.

Acknowledgements

None.

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