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Rapid flattening of massive hemorrhagic retinal pigment epithelial detachment secondary to polypoidal choroidal vasculopathy after surgery

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ABSTRACT

Purpose: To report 2 polypoidal choroidal vasculopathy (PCV) patients whose massive hemorrhagic pigment epithelial detachments (PEDs) were flattened within a short period after surgery.
Observations: Two PCV patients who presented with submacular hemorrhage and massive hemorrhagic PEDs with sizes of more than 50 disc areas underwent pars plana vitrectomy combined with subretinal injection of tissue plasminogen activator (tPA), intravitreous injection of anti-vascular endothelial growth factor medicine, and perfluoropropane tamponade. The massive hemorrhagic PEDs were flattened within a short period after both surgeries, and both patients experienced improved visual acuity.
Conclusions: These findings suggest that subretinal injection of tPA together with perfluoropropane tamponade promotes the rapid clearance of hemorrhage under RPE.

1. Introduction

Submacular hemorrhages (SMH), including sub-neurosensory retina and sub-retinal pigment epithelium (RPE) hemorrhages, are severe complications in eyes with polypoidal choroidal vasculopathy (PCV) and can lead to irreversible damage to the photoreceptors and the outer nuclear layer.[1] Pars plana vitrectomy (PPV) with subretinal or intravitreal tissue plasminogen activator (tPA) injection, intravitreal gas tamponade, and/or anti-vascular endothelial growth factor (VEGF) agent administration has been used to treat SMH with satisfactory outcomes,[2–6] although there is no consensus on the standard treatment for SMH. Flattening of small pigment epithelial detachments (PED)s has been reported previously.[7,8] However, a successful treatment of massive hemorrhagic PEDs, which exceed vascular arcades and occupy more than 50 disc areas, has not yet been reported.

2. Findings

The study was approved by the Institutional Review Board of the Second Affiliated Hospital of Zhejiang University (IR2022268). Two PCV patients with massive hemorrhagic PEDs underwent combined phacoemulsification and PPV together with subretinal injection of tPA (25μg/100μl) using a 41-gauge needle, 100% perfluoropropane (C3F8) tamponade (0.3mL), and intravitreal injection of anti-VEGF by an experienced surgeon (FXY). The patients were placed in a face-up position for 1 hour and then maintained in a prone position for 7 days. Wild-field fundus imaging (Daytona P200T, Optos PLC, Dunfermline, UK), B-ultrasound (AVISO, Quantel Medical, Quantel, France), fundus fluorescein angiography (Spectralis HRA, Heidelberg Engineering GmbH, Heidelberg, Germany), indocyanine green angiography (ICGA), swept-source optical coherence tomography (SS-OCT) (BM-400K BMizar, TowardPi Medical Technology, Beijing, China), and SS-OCT angiography (SS-OCTA) were acquired before and after the surgeries. Both patients experienced improved visual function, displacement, and absorption of submacular hemorrhage. The massive hemorrhagic PEDs unexpectedly flattened in a short time after PPV.

3. Case 1

A 51-year-old male who presented with a sudden decrease in vision in the left eye for 3 days. Fundus examination revealed an SMH beyond the vascular arcade of the left eye (Fig. 1A) and the normal retina of the right eye. The blood was located beneath the neuroretina and RPE (Fig. 1A and G). A B-ultrasound proved the elevation of the SMH in the posterior pole, which corresponds to the hemorrhagic PED (Fig. 1B). A late ICGA image showed 2 leaking spots of dye from the blockage of a

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massive hemorrhage (Fig. 1C). At the 2-week follow-up after surgery, a vitreous hemorrhage (VH) occurred and prevented fundus examination. However, a B-ultrasound revealed the complete disappearance of the PED (Fig. 1E). The vitreous hemorrhage was removed through a vitreous cavity lavage 1 month after the first surgery. During the lavage surgery, the complete disappearance of the PED was observed. An area of pigment change in the inferior-temporal retina, which was demonstrated to be an RPE tear by autofluorescent imaging and the displacement of the residual subretinal hemorrhage to the inferior peripheral retina were noted (Fig. 1D). The SS-OCTA image acquired on the first day after the lavage showed a tangled type 1 choroidal neovascularization (CNV) (Fig. 1F). The 24mm SS-OCT image proved the flattening of the RPE (Fig. 1H). The best corrected visual acuity (BCVA) had improved to 20/25 by the most recent visit.

4. Case 2

A 62-year-old female who presented with a blockage of vision for 2 weeks. Fundus examination revealed a VH in the inferior vitreous cavity, a subretinal hemorrhage, and a massive PED temporal to the macula, which could be better observed after clearing the VH during PPV (Fig. 2A). An elevation of SMH was also demonstrated via B-ultrasound (Fig. 2B) and SS-OCT (Fig. 2C). During the 1-week post-operative follow-up, the patient presented with a mild VH. The SS-OCT image through the fovea was able to document the disappearance of the massive PED, leaving a small PED temporal to the macula (Fig. 2D). At the 3-week follow-up, a minor amount of blood remained beneath the fovea, and the small PED remained stable (Fig. 2E). The patient received another anti-VEGF agent intravitreal injection 1 month after the PPV. At 2 months post-PPV, the patient presented with an improved BCVA of 20/150. The SS-OCT image through the fovea showed an obscured central ellipsoid zone, although the subretinal hemorrhage under the fovea was mostly absorbed (Fig. 2F). SS-OCTA imaging revealed a small CNV on the edge of the residual PED (Fig. 2G and H). Fundus examination showed an RPE tear and a large amount of coagulated blood in the peripheral retina (Fig. 2I and J).

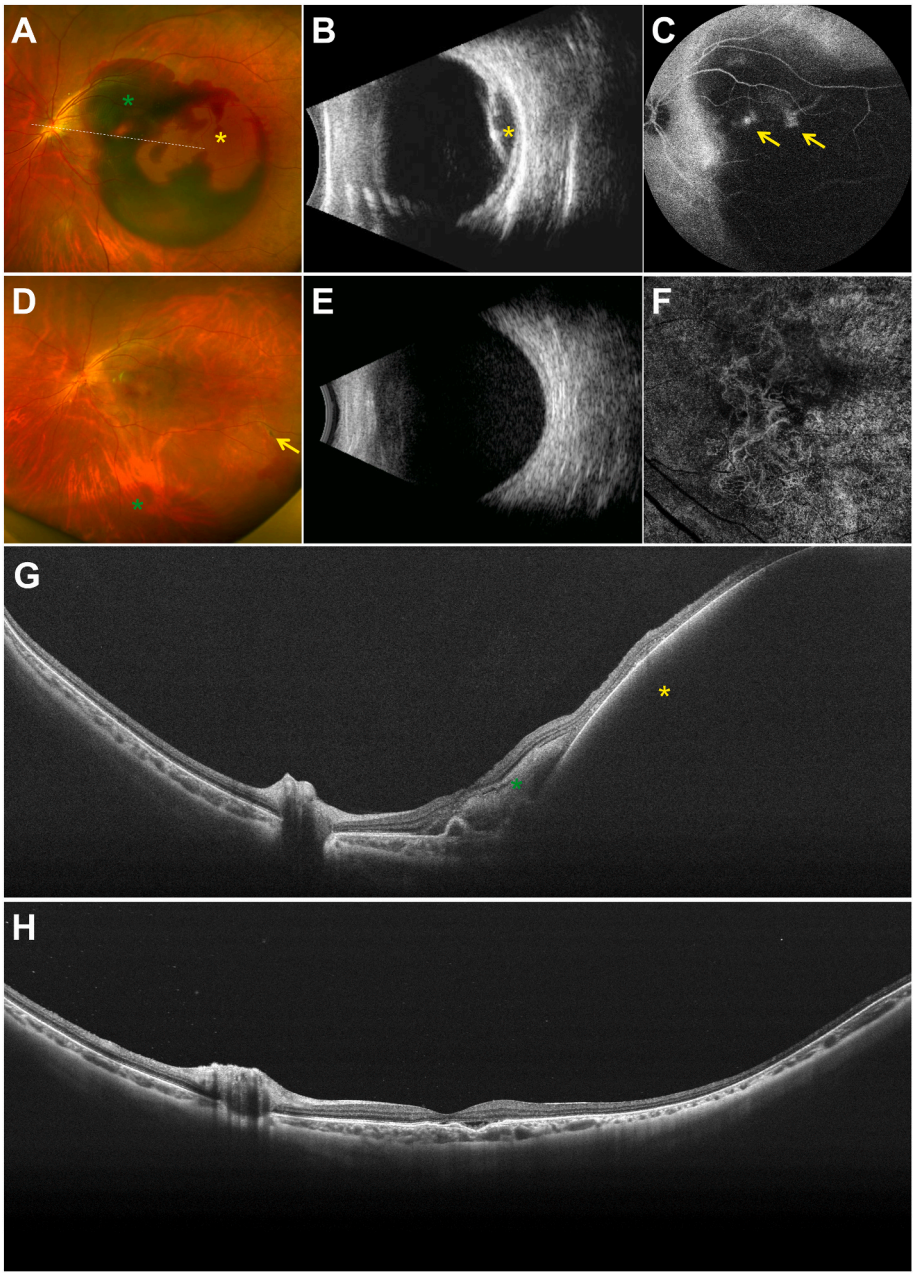
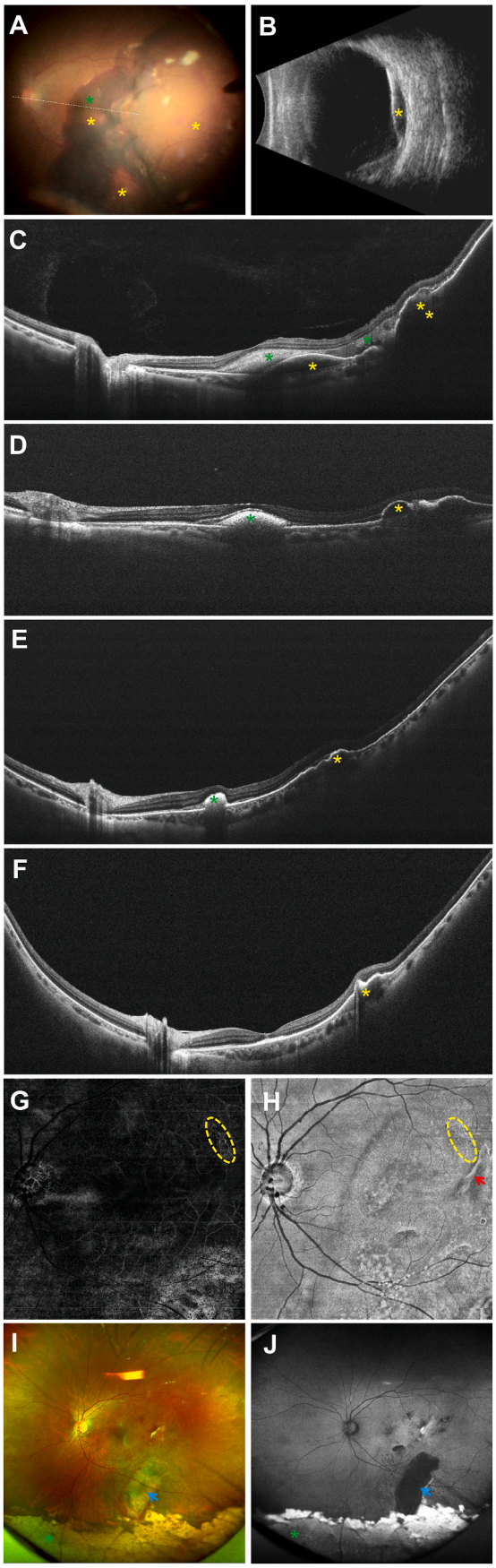


Fig. 1. Clinical examinations of a 51-year-old SMH patient secondary to PCV. A. A fundus image before surgery revealed a subretinal hemorrhage (green asterisk) and a sub-RPE hemorrhage, also known as a hemorrhagic PED (yellow asterisk); B. A B-ultrasound image before surgery demonstrated a moderate echo hemorrhage below a high echo RPE, indicating the presence of hemorrhagic PED (yellow asterisk); C. A late ICGA image showed 2 leaking spots (yellow arrows) in the center of a blockage of the dye from the hemorrhage; D. A fundus image taken 1 month after the first surgery and 1 day after the second surgery revealed no SMH, no PED, a small size RPE tear in the inferior-temporal retina (yellow arrow), and displacement of the subretinal hemorrhage in the inferior peripheral retina (green asterisk); E. A B-ultrasound image taken 2 weeks after the first surgery showed a vitreous hemorrhage and the absence of a PED; F. The 6 × 6mm SS-OCTA image taken 1 day after the second surgery revealed a type 1 CNV in the macula; G. The 24mm SS-OCT image before surgery demonstrated the subretinal hemorrhage (green asterisk) and elevation of RPE temporal to the macula (yellow asterisk); H. The 24mm SS-OCT image taken 1 day after the second surgery proved flattening of PED, a double-layer sign, and choroidal excavation together with mild subretinal fluid in the macula. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)



(caption on next column)

Fig. 2. Clinical examinations of a 62-year-old SMH patient secondary to PCV. A. A fundus image during PPV after removing the vitreous hemorrhage demonstrated a subretinal hemorrhage (green asterisk) and hemorrhagic PEDs (yellow asterisks); B. A B-ultrasound image before surgery demonstrated the presence of hemorrhagic PED (yellow asterisk); C. The 18mm SS-OCT image before surgery demonstrated the subretinal hemorrhage (green asterisk) and PEDs (yellow asterisks); D. The 12mm SS-OCT image taken 1 week after surgery demonstrated the residual subretinal hemorrhage (green asterisk) and a small PED temporal to the macula (yellow asterisk); E. The 24mm SS-OCT image taken 3 weeks after surgery demonstrated the subretinal hemorrhage (green asterisk) and stable PED (yellow asterisk). F. The 24mm SS-OCT image taken 2 months after surgery demonstrated the diminishing subretinal hemorrhage under the fovea and stable PED (yellow asterisk). G. The 12 × 12mm SS-OCTA flow image with the boundary from outer plexiform layer to Bruch's membrane demonstrated the location of the CNV (yellow dash-lined circle). H. The corresponding structure image of Fig. 2G demonstrated the relationship between the CNV and PED (red arrow). I. The fundus image taken 2 months after surgery demonstrated RPE tear (blue arrow) and depigmented subretinal blood the peripheral retina (green asterisk). J. The autofluorescence image taken on the same day of Fig. 2I better presented the RPE tear (blue arrow) and coagulated subretinal blood the peripheral retina (green asterisk). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

5. Discussion

What is striking about these two cases is that such massive hemorrhagic PEDs disappeared within a short period (1 or 2 weeks) after surgery. Flattening of PEDs after pneumatic displacement of SMH secondary to PCV and AMD has been reported before.[7,8] However, the PEDs in previous reports were within the macula and much smaller than the ones documented in this article. With the advanced SS-OCT instrument,[9] the disappearance of massive hemorrhagic PEDs was well documented. The reasons for this rapid disappearance of the massive hemorrhagic PED are considered below.

First, subretinal tPA injection might dissolve not only the subretinal clot but also the conjugated blood within a massive hemorrhagic PED. Liquefaction is the precondition for the absorption or drainage of blood. Second, an RPE tear was noticed after the surgery in both patients. The liquefied hemorrhage under RPE could have drained into the subretinal space via the tears. In addition, the subretinal hemorrhage may enter the vitreous cavity through the pinhole at the injection site and cause a breakthrough VH, which is known as a common complication of SMH after surgery,[10,11] or be displaced into the peripheral retina. The RPE tears may have existed before surgery and partially caused the massive sub-RPE hemorrhage. In that case, they may have been blocked by the subretinal hemorrhage and been revealed once the hemorrhage resolved. They also can be caused by the pressure from the gas bubble after surgery. Moreover, the possibility of iatrogenic injury to the underlying RPE from the needle used for subretinal injection cannot be ruled out, although we were confident that the needle only entered the subretinal space during the operations, and the injection sites were far away from the RPE tears. Whatever the reason for the RPE tears, the large amount of VH after the PPV in the first case and the increased volume of the subretinal hemorrhage after the PPV in the second case indicate that the liquefied blood could have come into the vitreous cavity or subretinal space through the RPE tears. Lastly, anti-VEGF monotherapy has been shown to be valuable for the absorption of subretinal hemorrhage.[12] The anti-VEGF medicine injected into the vitreous cavity at the end of the PPV in both patients might have also assist the hemorrhage absorption to some extent. However, it is still unknown which factor, out of the tPA, gas tamponade, and anti-VEGF, contributed more to the flattening of the PEDs. We believe that the tPA played an essential role in liquefying the blood under the RPE and made it possible for the blood to flow through the RPE tears and/or be absorbed through choroidal circulation.

SMH can cause irreversible vision loss due to damage to

photoreceptors from iron toxicity, a thicker diffusion barrier, and fibrin meshwork contraction.[1] Both intra-vitreous and subretinal injections of tPA have been proven effective for medium-sized SMH.[2,3,5,6] In our patients, SMH secondary to PCV was displaced with a combined therapy comprising a subretinal injection of tPA, intravitreal injection of an anti-VEGF agent, and gas tamponade. Both patients' vision had improved at 2 or 3 months after treatment. The second patient, who had a more prolonged symptomatic period, experienced limited visual acuity improvement. This might be because persistent blood clots under the fovea damaged the photoreceptors. This finding also indicates that greater benefits can be achieved via faster displacement of subretinal hemorrhage.

6. Conclusions

Even with only 2 cases so far, we found that PPV combined with subretinal tPA injection, intravitreal anti-VEGF agent injection, and gas tamponade facilitated the rapid flattening of massive hemorrhagic PEDs. However, more clinical research is needed to verify our findings.

Patient consent

Informed consent forms for the above cases information to be published were provided by the patients.

Declaration of competing interest

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

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