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Case report

Novel surgical approach for removing intraretinal loculated foveal hemorrhage in a patient with hypertensive retinopathy

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ABSTRACT

Purpose: To present a surgical approach for removing intra-retinal loculated foveal hemorrhage due to hypertensive retinopathy (HR) in a patient with uncontrolled hypertension (HTN).

Observations: A 67-year-old man presented to a tertiary retina clinic with the complaint of decreased vision in his left eye (OS) for the past six months. He had a history of uncontrolled HTN, which caused HR; otherwise, his past medical and ocular history were insignificant. His best-corrected visual acuity (BCVA) was 20/20 right eye (OD) and 20/400 OS. Fundus examination of OD did not show significant pathology except mild arterial narrowing. Fundus examination of OS revealed arterial narrowing and multiple areas of small retinal hemorrhage. Old, organized hemorrhage with a yellow foveal centered lesion appearance was detected on fundus examination. Spectral-domain optical coherence tomography (SD-OCT) showed a dense hyper-reflective intra-retinal lesion at the fovea. Pars plana vitrectomy was performed. Internal limiting membrane (ILM) was stained with Brilliant Blue G (BBG) and peeled off around the lesion using ILM forceps. Attempts to remove the lesion with cannula-assisted active backflush and aspiration were unsuccessful. Therefore, the lesion was gently dissected and extracted by using 41-gauge needle. After removing the clot, the rotational ILM flap technique was used to repair the developed macular hole-like tissue defect. At the two-month follow-up visit, BCVA improved considerably to 20/50, and significant anatomical restoration was observed.

Conclusion and Importance: HR is relatively common among patients with elevated blood pressure. To date, management of HR and its complications such as retinal hemorrhage is limited to non-surgical methods. For the first time, a surgical approach is utilized to manage one of the HR's complications with prominent visual and structural improvement. The index case report presents a new management option for hypertensive retinal hemorrhage, but only in appropriate patients with ocular indications and understanding of the potential adverse events associated with the surgical procedure.

1. Introduction

Hypertensive retinopathy (HR) is a critical retinal vasculature finding in patients with elevated blood pressure (BP). Based on the Joint National Committee (JNC) on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure declaration, HR should be considered as an end-organ damage in hypertensive patients. Therefore, HR often needs therapeutic management initiation even in patients who have mild hypertension (HTN) without any other organ-involvement.[1] It is estimated that one out of three American adults have HTN.[2] Previous studies reported the prevalence of 30.6–51% for HR among hypertensive patients.[3–7] Unlike other blood vessels, retinal vessels do not have sympathetic nerve supply and utilize autoregulation for adjusting the blood flow. Increasing BP causes the vasoconstriction of retinal vessels (first phase). If this situation lasts long, intima thickening and media hyperplasia will happen. Arteriolar narrowing and sclerosis of the vessels are the characteristics of this stage (second phase). If the BP increases severely, the blood-retina barrier will disrupt, erythrocyte and plasma will leak out of the vessels (third phase). Retinal hemorrhage (blot, dot, or flame-shaped), microaneurysms, cottonwool spots, hard

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exudates, necrosis of smooth muscle cells, and retinal ischemia occurs in this stage. Papilledema and optic nerve ischemia are results of malignant HTN (fourth phase).[2,8–10]

Managing the different HR stages and their complications is limited to controlling BP by non-surgical treatments [e.g., BP-lowering and intravitreal anti-vascular endothelial growth factor (VEGF) therapy when there is retinal neovascularization] and routine monitoring/follow-up.[8,11,12] To the best of our knowledge, there has not been any reported surgical approach for managing HR-induced intra-retinal macular hemorrhage to date.

Herein, we present a novel surgical approach to remove the intra-retinal loculated foveal hemorrhage in an elderly man with HR.

2. Case report

A 67-year-old man presented to our clinic with the complaint of progressive diminution of vision in his left eye (OS) for the past six months. He had a history of uncontrolled HTN, which had led to HR. He did not have any other significant past medical history or background diseases.

Despite six months of metabolic control and medical therapy for the HTN, the patient's vision was getting worse. Ophthalmic examination revealed best-corrected visual acuity (BCVA) of 20/20 in the right eye (OD) and 20/400 in the left eye (OS); intraocular pressure (IOP) was 17 mmHg in OD and 18 mmHg in OS. Anterior segment examination was unremarkable. Fundus examination of OS revealed arterial narrowing and multiple areas of small retinal hemorrhage. Old, organized hemorrhage with a yellow foveal centered lesion appearance was detected (Fig. 1A). Late phase of fluorescein angiography (FA) showed blocked fluorescence corresponding to the retinal hemorrhages. No abnormal leakage was detected at the site of foveal lesion (Fig. 1B). Macular optical coherence tomography (OCT) showed a dense hyper-reflective intra-retinal lesion at the fovea (Fig. 1C). Fundus examination of OD showed mild arterial narrowing without any other pathology.

Discussion about surgical intervention versus observation was thoroughly made, including the potential complications that can occur with the surgery such as further or complete loss of vision, and the patient desired to proceed with vitrectomy because of the visual deterioration despite six months of medical therapy and metabolic control. Complete pars plana vitrectomy (23-gauge) was performed (Video). In order to get access to the lesion, the internal limiting membrane (ILM) was stained with Brilliant Blue G (BBG) and peeled off over the lesion using ILM forceps. The lesion seemed to be unroofed. However, attempts to displace the clot by cannula-assisted active backflush with fluid jet towards the lesion were unsuccessful; the lesion seemed to be deeply buried. During the next step, a 41-gauge was inserted gently into the lesion to try to aspirate the clot, but it was too dense and organized (Fig. 2A). At that moment, we decided to dissect the lesion with the same needle (which unintentionally might have caused loss of parts of the inner retinal layers overlying it) (Fig. 2B); the whole clot was gently extracted. After the complete removal of the clot, we encountered a macular hole-like tissue defect, which was treated successfully by rotational ILM flap technique. A temporal ILM flap was created beyond the peeled area (Fig. 2C), and then it was rotated to cover the defect during air-fluid exchange. The vacuum created by the soft-tip cannula stabilized the flap on the hole (Fig. 2D and E). After complete drying, which is necessary and vital to have a stable flap, the eye was filled with SF6 gas, and the patient was asked to maintain a facedown position for 4 days postoperatively. Two-month postoperative examination showed marked improvement of BCVA to 20/50 with significant anatomical restoration as determined by OCT (Fig. 2F).

3. Discussion

Management of submacular hemorrhage is controversial. For large submacular hemorrhages secondary to choroidal neovascularization (CNV), there is no significant difference between surgical intervention with pars plana vitrectomy (PPV) and submacular surgery compared to observation regarding the visual acuity improvement.[13] In a retrospective study, Lim et al. reported that submacular injection of tissue plasminogen activator (tPA) could improve the visual outcome of submacular hemorrhage.[14] On the other hand, Ibanez et al., in a prospective randomized controlled trial, have shown that submacular tPA did not improve the results compared with mechanical clot extraction. Minimally invasive procedures such as intravitreal injection of anti-VEGF agents and pneumatic displacement have also been advocated to manage such cases with promising results.[15,16]

Our index case was unique and complex, not only because there was no CNV to justify intravitreal anti-VEGF therapy but also because the hemorrhage was intrafoveal in contrast to subfoveal. At the time of initial presentation, clinicians decided to observe and follow the patient closely. However, as visual acuity remained suboptimal (20/400) and the patient felt his vision was getting worse after six months, we employed a surgical approach to remove the clot. The surgical plan was to remove the clot from the retina's inner side as the OCT had shown that it was near the ILM. To our knowledge, the described technique has not been reported previously.

The main risks of the proposed surgical technique, other than standard PPV complications, include the induction of a traumatic macular hole (which happened in our case), retinal pigmented epithelium (RPE) damage, subretinal hemorrhage from Bruch's membrane trauma, and sacrificing parts of the inner retinal layer overlying the lesion. Induced

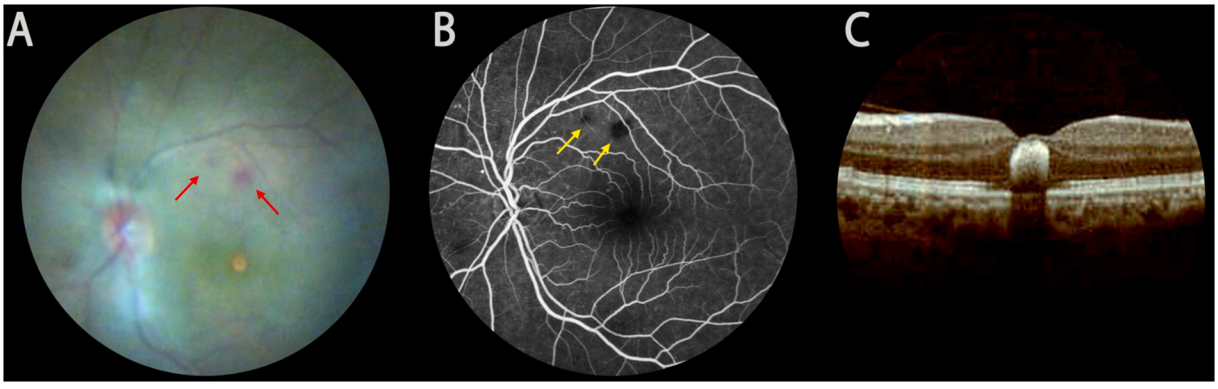

Fig. 1. Fundus photograph of the left eye shows areas of retinal hemorrhage (red arrows) and yellow organized clot at the fovea (A). Late phase of fluorescein angiography (FA) demonstrates blocked hypo fluorescent areas (yellow arrows) due to hemorrhage and no apparent leakage at the foveal lesion (B). Spectral-domain optical coherence tomography (SD-OCT) of the macula illustrates dense hyper-reflective intra-retinal lesion at the fovea (C). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

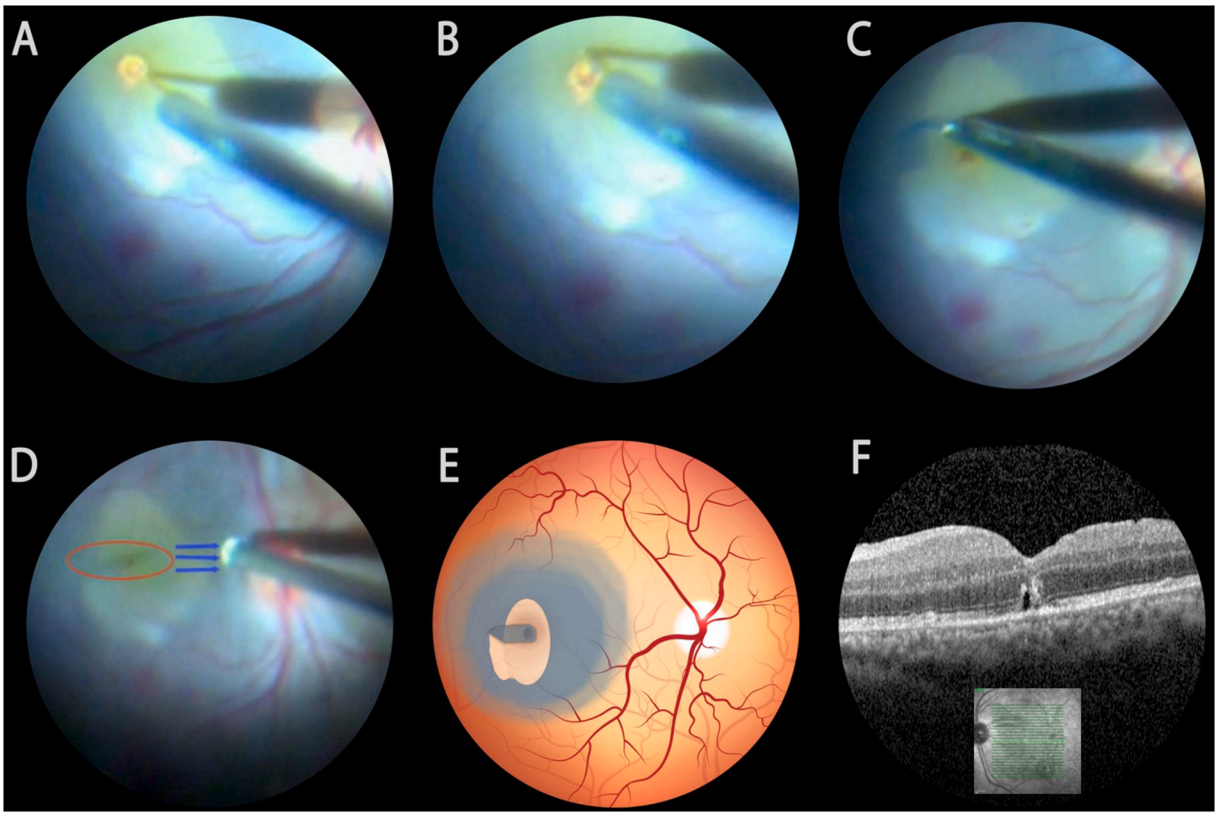

Fig. 2. Figures A to D are the intraoperative surgeon views of different stages of the surgery. A 41-gauge needle was inserted into the lesion to aspirate it (A). The lesion was gently dissected by a 41-gauge needle (B). Internal limiting membrane (ILM) flap was created using forceps (C). A rotational ILM flap was placed over the hole (red ellipse), using a passive vacuum of cannula (blue arrows) to stabilize the flap during air-fluid exchange (D). Schematic picture showing rotational ILM flap (E). Two-month postoperative SD-OCT of the lesion shows marked anatomical improvement (F). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

macular hole was successfully managed by an inverted rotational ILM flap and intraocular gas. We attempted to stabilize the ILM flap in the fovea using the vacuum "drying method" and SF6 gas. However, due to the invisibility of ILM flap on the post-op OCT, it is hard to prove the beneficial effects of the flap on the successful outcome of the surgery; the macular hole might be closed due to ILM peeling and SF6 gas. The visual outcome at two months follow-up was favorable (20/50) and OCT showed significant structural improvement.

It should be mentioned that our procedure was very delicate. Given the current limitation of capacity and quality of surgical instruments and intra-operative imaging devices, we do not recommend our procedures in the management of benign regular/mild intraretinal hemorrhage/lesions, which do not affect the quality of life or daily routines of the patients, or which may spontaneously resolve. Unlike the aforementioned situation, the BCVA for our patient deteriorated over the 6-month period, which affected his quality of life and work efficiency significantly. Based on our evaluation, loculated nature of the blood clot, and the patient's desire, we concluded that spontaneous improvement of his BCVA would not be probable and an intervention was needed.

Although selecting the proper therapeutic approach to remove the retinal lesions could vary based on their location, extension, speed/grade of progression/aggression, and their effects on RPE, photoreceptors, and visual field of the patients, the proposed surgical technique may shed light on the promising potential future of this method, particularly with the advancement of surgical instruments and imaging modalities including refined intra-operative 3D-OCT.

In summary, we do not want to advocate or propose that our surgical technique is to be employed routinely in the management of foveal hemorhage secondary to hypertensive retinopahy. Rather, we would like to share a potential option when there are no other alternatives to attempt to preserve or improve vision for the affected patients.

4. Conclusion

In cases of organized intrafoveal hemorrhage that are not related to CNV, gentle manual dissection may yield good visual outcomes even if an iatrogenic macula hole is induced. Given the potential adverse events, the described technique should be employed only in cases with non-resolving or organized hemorrhage associated with poor visual acuity after a sufficient period of monitoring and medical therapy. Advancements in imaging modalities such as intraoperative 3D-OCT may pave the way for performing similar surgeries with a higher level of precision and minimal complications.

Patient consent

Written informed consent was obtained from the patient for the publication of this manuscript.

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Authorship

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

Intellectual property

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

Research ethics

We further confirm that any aspect of the work covered in this manuscript that has involved human patients has been conducted with the ethical approval of all relevant bodies and that such approvals are acknowledged within the manuscript.

IRB approval was obtained (required for studies and series of 3 or more cases).

Written consent to publish potentially identifying information, such as details or the case and photographs, was obtained from the patient(s) or their legal guardian(s).

Declaration of competing interest

None of the authors has any relevant conflict of interests pertaining to the index manuscript.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2021.101217.

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