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Case Report

Full-Thickness Macular Hole Formation in the Postoperative Period After Initial Vitrectomy for Rhegmatogenous Retinal Detachment

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Keywords

Macular hole · Epiretinal membrane · Postoperative period · Intentional hole · Rhegmatogenous retinal detachment · Retinal pigment epithelium

Abstract

Background and Objective: To evaluate full-thickness macular hole (MH) formation in the postoperative period after initial vitrectomy for rhegmatogenous retinal detachment (rRD). ***Materials and Methods:*** We retrospectively reviewed the medical records of 4 consecutive eyes that required additional vitrectomy for full-thickness MH between April 2013 and March 2016 after undergoing an initial vitrectomy for rRD. ***Results:*** Epiretinal membrane (ERM) was identified by preoperative optical coherence tomography or intraoperative dye staining in each case. Photocoagulation of retinal breaks prior to initial vitrectomy was performed in Cases 1, 2, and 3 (4–16 days), with yttrium-aluminum-garnet capsulotomy after cataract extraction also performed prior to the retinal break formation in Case 3. At the initial vitrecto-

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my, there was a superior retinal break which crossed the equator in Case 2, and an intentional hole was created in Cases 1 and 4. The mean interval from the initial vitrectomy until MH formation was 27.5 ± 15.8 months. As with Case 2, the intervals in Cases 1 and 4, in which an intentional hole was created, were clearly shorter than in those in Case 3. Finally, MH closure was achieved after an additional vitrectomy (removal of the internal limiting membrane with ERM and gas tamponade) and best-corrected visual acuity improved in each case. ***Conclusion:*** ERM was identified in the cases examined in our study. The presence of an intentional hole might shorten the interval of MH formation after vitrectomy for rRD.

Introduction

The underlying mechanism of macular hole (MH) formation is reported to be tangential vitreofoveal [1] and anteroposterior vitreofoveal traction [2]. However, MH formation in the vitrectomized eye, in which such traction does not exist, was reported in several articles [3–11]. Lee et al. [3] reported that the cause of MH formation after vitrectomy was epiretinal membrane (ERM), cystoid macular edema, or high myopia and suggested that MH formation within 3 months after vitrectomy was possibly iatrogenic. Furthermore, Kumagai et al. [4] stated that the mean interval from previous vitrectomy to MH formation and improvement of visual acuity were dependent on underlying ocular disease. Despite these prior studies, it can be difficult to evaluate the cause and prognosis of MH formation after vitreoretinal surgery (vitrectomy and/or buckling) due to the small number of cases included in previous studies. The current study examined patients who had undergone an additional vitrectomy to treat MH developed in the postoperative period after an initial vitrectomy for rhegmatogenous retinal detachment (rRD).

Materials and Methods

We enrolled 4 eyes of 4 consecutive patients who underwent additional vitrectomy for full-thickness MH between April 2013 and March 2016 after undergoing an initial vitrectomy for rRD. After ophthalmic examinations, which included best-corrected visual acuity, funduscopy, and optical coherence tomography (OCT), all patients underwent additional vitrectomy (Constellation®; Alcon Laboratories, Fort Worth, TX, USA) in order to close the MH. The same ophthalmic examinations were repeated postoperatively. Previous medical records of the cases were reviewed for the details of the initial vitrectomy, except one who had been treated elsewhere.

Results

Table 1 presents the clinical data for each case. The mean age was 59.5 ± 6.0 years, and the mean axial length was 25.9 ± 1.2 mm.

Procedures Performed before the Initial Vitrectomy

Three cases (Cases 1, 2, and 3) underwent photocoagulation for a retinal break within 1 month before the initial vitrectomy (Table 1). In Case 3, yttrium-aluminum-garnet capsulotomy after cataract extraction was performed at 31 days prior to the initial vitrectomy. There were no particular treatments performed in Case 4 prior to undergoing the initial vitrectomy.

Initial Vitrectomy

In 3 cases (Cases 1, 2, and 3), the initial vitrectomies were performed at our hospital. In Case 1, there was a superior rRD from a superior retinal break, which was peripheral to the equator, to the fovea (the border of the rRD crossed the fovea). In Case 2, there was a superior rRD from a superior retinal break, which crossed the equator, to the vascular arcade (macular-on). In Case 3, there was a peripheral retinal break in the superior nasal quadrant (macular-on). Thorough peripheral vitrectomy, photocoagulation, and gas exchange were performed in all 3 cases, with an intentional hole made in Case 1. Although Case 4 underwent the initial vitrectomy at another hospital, an intentional hole was confirmed during an examination at our hospital. In each of these cases, reattachment was achieved by a single vitrectomy.

MH Formation after the Initial Vitrectomy

MH was identified in each case through the use of OCT, with a mean interval from the initial vitrectomy to MH formation of 27.5 ± 15.8 months. Although spectral domain-OCT imaging (Cirrus HD-OCT 5000; Carl Zeiss Meditec, Dublin, CA, USA) revealed ERM in Cases 3 and 4, time domain-OCT (3D OCT-1000; Topcon, Tokyo, Japan) did not find ERM in Cases 1 and 2 (Fig. 1).

Vitrectomy for MH

ERM was identified by a mottled dyeing pattern (brilliant blue or indocyanine green) or glaring in all cases, including Cases 1 and 2 for which ERM was not found by time domain-OCT (Fig. 2). The internal limiting membrane was removed and 20% sulfur hexafluoride (SF_6) gas tamponade was performed. Postoperatively, closure of the MH was confirmed using OCT imaging, and best-corrected visual acuity improved in all cases (Table 1).

Discussion

Medina et al. [5] reported that the possible associations found in patients with MH formation after pars plana vitrectomy for RD included ERM, macular-off RD, recurrent RD, and high myopia, and several studies have reported that ERM was especially found as the cause of MH formation after vitrectomy for rRD [4, 6–8]. Our study found no cases with conclusive macular-off or recurrent rRD, and only 1 case with high myopia (Case 4). Based on these findings, ERM was the most likely cause of the MH in the cases examined in our study.

Nam and Kim [12] reported that postoperative ERM tended to occur within 3 months of the vitrectomy for rRD, with the interval (within 3 months) clearly shorter than the interval from the initial vitrectomy to the MH formation in our current study. Thus, it is possible that the MHs might have been developed after continuous traction caused by the ERMs. On the other hand, the risk factors for the development of ERM after the repair of rRDs include equatorial rather than anterior breaks [13] and multiple or large retinal breaks [14]. Therefore, an equatorial break could shorten the interval of MH formation after vitrectomy for rRD. In fact, the interval observed in Case 2 was clearly shorter than that in Case 3. However, the interval in Case 2 was not all that much shorter than that observed in Cases 1 and 4. In an ERM that occurs after rRD, the retinal pigment epithelial cells migrate to the vitreous cavity through the retinal break and settle on the macular surface, forming the membrane [12]. As with an equatorial break, an intentional hole might shorten the interval, because of the presence at the posterior vitreous cavity.

There were some limitations for our current study. First, we did not take into consideration the dimensions of the retinal break. Second, residual vitreous cortex on the macular can be a source of ERM [15]; however, we could not confirm the presence of residual vitreous cortex during the initial vitrectomy, as there was no video recording of the initial surgeries.

In conclusion, ERM was identified in the cases examined in our study. The presence of an intentional hole might shorten the interval of MH formation after vitrectomy for rRD.

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Statement of Ethics

This study complied with the tenets of the Declaration of Helsinki and was approved by the Ethics Committee of the National Hospital Organization (NHO) Sagamihara Hospital, Kanagawa, Japan. All patients provided informed written consent.

Disclosure Statement

The authors have no financial or proprietary interest in the material presented herein. This paper has not been presented at any meeting or conference.

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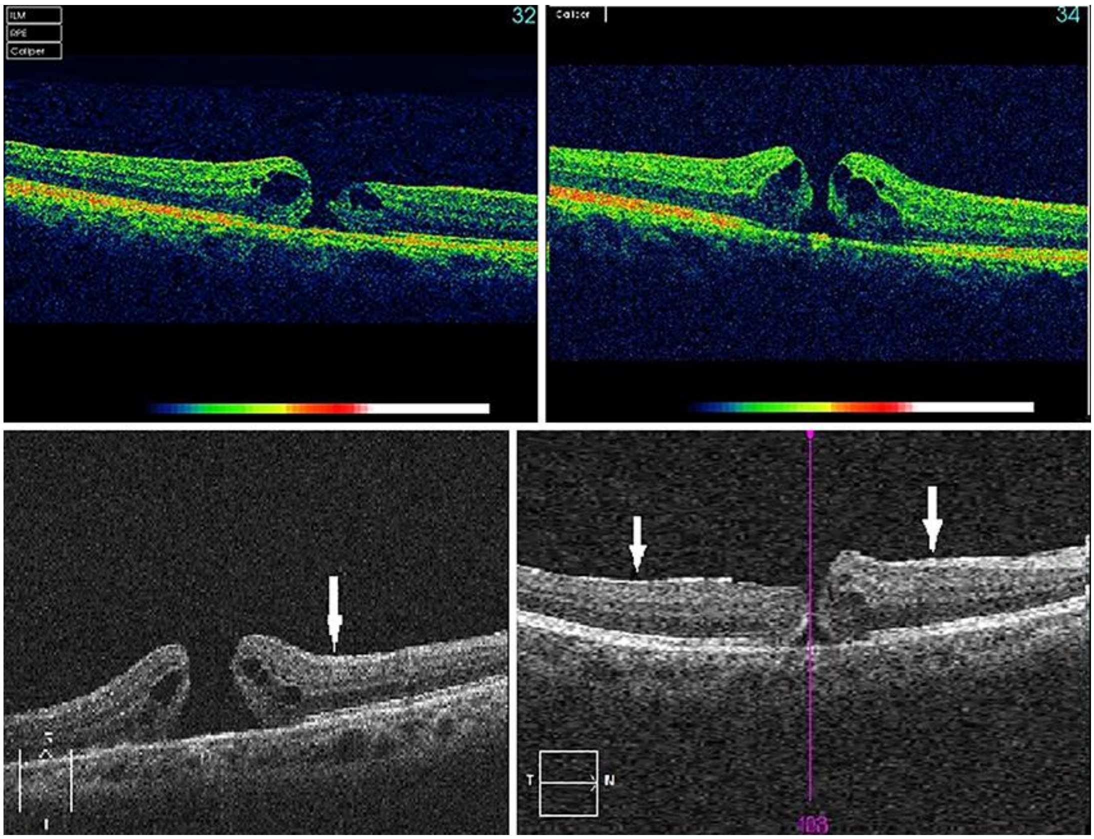

Fig. 1. Preoperative optical coherence tomography (OCT) in each case (upper left: Case 1, upper right: Case 2, lower left: Case 3, lower right: Case 4). Time domain-OCT did not find epiretinal membrane in Cases 1 and 2.

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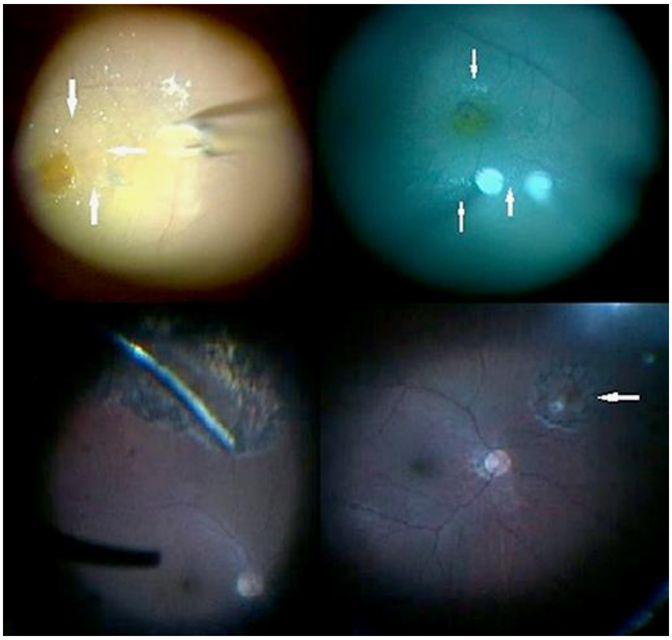

Fig. 2. Upper left: epiretinal membrane near the fovea in Case 1 (surrounded by arrows). Upper right: epiretinal membrane (glaring area) near fovea in Case 2 (arrow). Lower left: posterior break across the equator in Case 2. Lower right: intentionally created hole of initial vitrectomy in Case 4 (arrow).

Table 1. Clinical outcome of MH in each case

	Case 1	Case 2	Case 3	Case 4
Age, years	53	66	65	54
Sex	male	male	female	male
Axial length, mm	26.19	24.05	25.90	27.27
Interval from initial Vit to MH, months	22	25	53	10
Preoperative VA	20/33	20/33	20/400	20/22
Postoperative VA	20/20	20/20	20/40	20/17
ERM at MH Vit	+	+	+	+
Exposed RPE posterior from equator	intentional hole	posterior break	none	intentional hole
Interval from PC to initial Vit, days	16	14	4	none

Vit, vitrectomy; MH, macular hole; VA, visual acuity; ERM, epiretinal membrane; RPE, retinal pigment epithelium; PC, photocoagulation.