Clinical Course of OCTA en face Imaging Findings in a Patient with HELLP Syndrome

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Abstract
A 36-year-old primigravid woman with suspected gestational hypertension was referred to our hospital for further examination and treatment of bilateral serous retinal detachment (SRD). At the previous hospital immediately after the onset of visual symptoms (decreased visual acuity), the best-corrected visual acuity (BCVA) had been 0.1 in the right eye (RE) and 0.08 in the left eye (LE). Funduscopy revealed diffuse SRD and white discoloration at the posterior pole but no retinal tear in both eyes (BE). Optical coherence tomography (OCT) also revealed SRD. One day after the onset, we diagnosed bilateral SRD due to preeclampsia with HELLP syndrome because of elevated blood pressure, hemolysis, elevated liver enzymes, and low platelet and performed an emergency cesarean section. One week after the onset, BCVA improved to 0.3 in BE. Funduscopy showed resolution of SRD and the remaining white discoloration at the posterior pole. OCT showed complete resolution of SRD, blurred external limiting membrane, and an invisible ellipsoid zone. OCT angiography (OCTA) segmentation of the deep retinal layer (using en face imaging) revealed multiple white materials, mainly in the macula. Although funduscopy and OCT showed almost normal appearance by 2 months after the onset, BCVA was not completely improved. OCTA using en face imaging revealed shrinkage of multiple white materials but remnant material at the posterior pole. One year after the onset, BCVA was 0.9 in the RE and 0.8 in the LE. OCTA using en face imaging revealed remnant white materials but marked improvement overall.
Introduction

HELLP syndrome is a rare complication of pregnancy characterized by hypertension, hemolysis, elevated liver enzymes, and low platelets [1]. This pathology is seen in about 0.5–0.9% of all pregnancies and in 10–20% of cases with severe preeclampsia [2, 3]. One of the first symptoms of HELLP syndrome is often visual abnormalities (10–20%) [4]. Clinical findings of ocular complications associated with preeclampsia or HELLP syndrome have been reported in the form of various funduscopic findings, including retinal hemorrhage, Elschnig spots, papilledema, and serous retinal detachment (SRD) [5]. Recent case reports have described the detailed clinical course in patients with bilateral SRD due to preeclampsia with HELLP syndrome [5, 6]. However, few case reports have focused on correlations between visual prognosis and clinical findings. We report herein the detailed clinical findings of a patient with bilateral SRD due to preeclampsia with HELLP syndrome.

Case Presentation

A 36-year-old primigravid woman noticed a sudden reduction in visual acuity in gestational week 30. Gestational hypertension had been suspected in gestational week 24, but no treatment had been administered. At the previous hospital immediately after the onset, decimal best-corrected visual acuity (BCVA) was 0.1 in the right eye (RE) and 0.08 in the left eye (LE). Slit lamp examination showed no abnormalities in the anterior and medial segments. Funduscopy revealed diffuse SRD and white discoloration at the posterior pole but no retinal tear in both eyes (BE) (Fig. 1a). Optical coherence tomography (OCT; Cirrus 5000, Carl Zeiss Meditec AG, Dublin, CA, USA) also revealed SRD and retinal edema in the Henle's fiber layer and between the

Fig. 1. a, b Fundus photograph and optical coherence tomography (OCT) findings from the previous hospital immediately after the onset. Funduscopy shows diffuse serous retinal detachment (SRD) and white discoloration at the posterior pole in both eyes (BE). OCT also shows SRD and macula edema in BE.
external limiting membrane and ellipsoid zone (EZ) (Fig. 1b). One day after the onset, SRD associated with preeclampsia was suspected based on the markedly elevated blood pressure (systolic, 216 mm Hg; diastolic, 140 mm Hg) in pregnancy and ocular complications, and she was referred to our hospital for further examination and treatment. On the same day, blood testing detected hemolysis (Hb: 10.4 g/dL), elevated liver enzymes (LDH: 814 U/L, AST: 131 U/L, and ALT: 125 U/L), and low platelets (Plt: 44 × 103/µL). The X-ray revealed pleural effusion in the chest, and physical findings showed edema of the upper and lower limbs. We diagnosed bilateral SRD due to preeclampsia with HELLP syndrome and performed an emergency cesarean section in the department of obstetrics. One week after the onset, BCVA had improved to 0.3 in BE. Funduscopy showed resolution of SRD and remnant white discoloration at the posterior pole. OCT showed complete resolution of SRD, blurred external limiting membrane, and invisible EZ. OCT angiography (OCTA; Cirrus 5000, Carl Zeiss Meditec AG, Dublin, CA, USA) segmentation of the deep retinal layer (using en face imaging) revealed multiple areas of white material, mainly in the macula (Fig. 2a). One month after the onset, BCVA had slightly improved to 0.4 in the RE and 0.5 in the LE. Funduscopy showed no marked changes compared to findings at 1 week after the onset. OCT showed improvement of the EZ compared with that 1 week after the onset. OCTA using en face imaging showed shrinkage of the white material (Fig. 2b). Two months after the onset, BCVA had slightly improved to 0.4 in the RE and 0.5 in the LE. Funduscopy showed a slight fading of the white discoloration around the macula. OCT and OCTA using en face imaging showed no marked changes compared with findings at 1 month after the onset (Fig. 2c). No evidence of improvement was seen on fundus examinations between 2 and 10 months after the onset. Ten months after the onset, BCVA had improved to 0.8 in BE. Funduscopy showed remnant white discoloration. OCT showed almost normal appearance. OCTA using en face imaging showed obvious disappearance of white materials (Fig. 2d). At the last visit (1 year after the onset), BCVA was 0.9 in the RE and 0.8 in the LE. Funduscopy and OCT showed almost normal appearance. OCTA using en face imaging showed almost complete resolution of white materials at the posterior pole (Fig. 2e).

Discussion

We have described the case of a patient with bilateral SRD due to preeclampsia with HELLP syndrome and provided a detailed clinical course using multimodal retinal imaging. Bilateral SRD due to preeclampsia with or without HELLP syndrome, which was first reported in 1989 [7], is a rare but well-described, ocular complication. SRD generally occurs before birth or in the postpartum period [8, 9]. The pathomechanism is proposed to involve generalized endothelial dysfunction and vasospasm in the maternal circulation, resulting in ischemia in retinal pigment epithelium (RPE) and choroid and secondary impairments to the retina [10–12]. As for visual prognosis, previous case reports have described resolution of SRD within a few weeks to months after treatment of the mother (e.g., emergency cesarean section) [5, 6, 13]. Although few studies have reported factors contributing to the visual prognosis, Lee et al. [14] reported features and factors for visual prognosis in patients with preeclampsia compared with those in patients with malignant hypertension. They revealed that blood pressure, including systolic blood pressure, diastolic blood pressure, and pulse rate, and the presence of hypertension retinopathy were significantly lower in patients with preeclampsia than in patients with malignant hypertension. Furthermore, the study also revealed that outcomes for visual acuity were more favorable for patients with preeclampsia than for patients with malignant hypertension, with exacerbating factors including the presence of hypertensive retinopathy and macula location of the SRD [14]. Our patient needed more time to achieve improvement in visual function compared with previous cases [5, 6, 13].
We attributed this to the existence of uncontrolled hypertension at 20 weeks of pregnancy, before emergency cesarean section, and after emergency cesarean section. Taking evidence from previous cases and the present findings, control of blood pressure during pregnancy and after delivery is likely important for visual prognosis.

Almost all previous cases showed recovery of visual function within a few weeks to months [5, 6, 13]. However, our patient did not show improvement in visual acuity within a few months after the onset despite the outer retinal layers appearing almost normal. We considered multimodal retinal findings related to visual function and focused on the multiple areas of white
materials on OCTA using \textit{en face} imaging or hyper-autofluorescent lesions on fundus autofluorescence at the posterior pole. Although the exact pathogenesis remains unknown, such retinal findings have been thought to involve the following pathomechanisms: endothelial dysfunction of the choroidal vasculature causing fibrinoid necrosis and choriocapillaris infarcts, leading to ischemic necrosis of the overlying RPE, and the fluid transudation through the choroidal vessels into the subretinal space [11, 12]. Indeed, OCTA segmentation of the deep retinal layer (using \textit{en face} imaging) revealed multiple accretions of white material corresponding to the white discolorations seen in fundus photographs. These findings on multimodal retinal imaging shrank and finally disappeared over time. Visual acuity showed limited improvement while the multiple areas of white material remained overlying the RPE (until 10 months after the onset), but visual acuity improved to 0.9 during the period in which white materials almost disappeared. These results indicated that circulation in the RPE and choroid remained impaired even though the outer retinal layers showed complete recovery and suggest a correlation between visual prognosis and findings of white materials. Further investigations in patients with preeclampsia are needed to confirm this hypothesis.

In conclusion, we reported the case of a patient with bilateral SRD due to preeclampsia with HELLP syndrome who showed changes in retinal, RPE, and choroid structures on multimodal imaging. These results have expanded the clinical spectrum of ocular complications associated with HELLP syndrome.

\textbf{Acknowledgments}

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\textbf{Statement of Ethics}

The protocol adhered to the tenets of the Declaration of Helsinki, and written informed consent was obtained from the patient for publication of this case report and any accompanying images. This study protocol was reviewed, and the need for approval was waived by Institutional Review Boards of the Jikei University School of Medicine.

\textbf{Conflict of Interest Statement}

The authors declare no competing financial interest.

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\textbf{Author Contributions}

Konuma Kokoro, Kei Mizobuchi, Akira Watanabe, and Tadashi Nakano contributed to the conception and design of this case report. Kei Mizobuchi wrote the draft of this manuscript. Kokoro Konuma and Kei Mizobuchi contributed to the diagnosis and treatment of the patient.
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**Data Availability Statement**

The imaging data are not publicly available due to their information that could compromise the patients’ privacy. All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

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