외상망막병증 환자에서 복합영상 분석의 의의

Multi-modal Imaging Analysis in the Patients with Traumatic Maculopathy

강혜민

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Purpose: To report the multi-modal imaging characteristics from two cases of traumatic maculopathy and their visual outcomes.

Case summary: (Case 1) A 37-year-old male patient visited the ophthalmology clinic after a contusion to the left eyeball. The best-corrected visual acuity (BCVA) in the left eye was 20/100 by the Snellen visual acuity chart. Fundus examination showed yellow-gray-colored retinal edema along the superotemporal vascular arcade and macula in the left eye. Spectral domain optical coherence tomography (SD OCT) revealed subretinal fluid with diffuse ellipsoid zone disruption. On fluorescein angiography (FA), the edematous retinal lesion showed hypofluorescence with stippled hyperfluorescent spots in the early phase followed by diffuse leakage in the late phase. After 1 week, the subretinal fluid completely resolved. After four months, BCVA improved to 20/20, and the ellipsoid zone was nearly recovered. (Case 2) A 47-year-old male patient visited the ophthalmology clinic after a contusion to the left eyeball. The BCVA of the left eye was count finger. Foveal depigmentation was noted on fundus examination. Foveal detachment with diffuse disruption of the ellipsoid zone was noted by SD OCT. On FA, dye pooling in the fovea was shown throughout the examination. After 5 days, the foveal detachment completely resolved, and BCVA was 20/200. After 5 months, BCVA was 20/50, and SD OCT showed partial recovery of the ellipsoid zone.

Conclusions: Multi-modal imaging analysis seems to be useful for differentiating the characteristics of traumatic maculopathy and predicting visual outcomes.

Keywords: Optical coherence tomography; Trauma

Introduction

Closed globe trauma (CGT) can cause various retinal injuries, such as commotio retinae, retinal detachment, traumatic macular hole, and vitreous hemorrhage [1,2]. These retinal complications may lead to permanent visual deterioration,

and CGT is one of the most common causes of visual loss in people aged 20-50 years [1,2].

Recently, several studies have investigated the macular complications associated with CGT using spectral domain optical coherence tomography (SD OCT) [3-5]. SD OCT is helpful for the diagnosis, classification, and prediction of vi-

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sual prognosis for traumatic maculopathy, although studies on traumatic maculopathy lack multi-modal imaging analysis.

We recently managed two patients with traumatic maculopathy who underwent multi-modal imaging analyses, including fundus autofluorescence (FAF) image, SD OCT, and fluorescein angiography (FA), and herein we report the cases.

Case Report

Case 1

A 37-year-old male patient visited the ophthalmology clinic after a left eyeball contusion from a soccer ball. The best-corrected visual acuity (BCVA) in the left eye was 20/100 by the Snellen visual acuity chart. Fundus examina-

tion showed yellow-gray-colored retinal edema along the superotemporal vascular arcade and macula in the left eye (Fig. 1A). Preretinal hemorrhages and commotio retinae were shown at the superior periphery (Fig. 1A). Decreased autofluorescence was noted in the FAF image (Fig. 1B), and SD OCT revealed subretinal fluid with diffuse ellipsoid zone disruption and hyper-reflectivity of the inner retina (Fig. 1C). On FA, the edematous retinal lesion showed hypofluorescence in the early phase (Fig. 1D), and then stippled hyperfluorescent spots appeared (Fig. 1E) followed by diffuse leakage in the late phase (Fig. 1F). One week later, the patient's BCVA was 20/100 with complete resolution of the subretinal fluid (Fig. 1G). Six weeks later, BCVA improved to 20/30, and depigmentation of the retinal pigment epithelium (RPE) appeared (Fig. 1H). Autofluorescence increased with multiple hypofluorescent spots in the FAF image (Fig. 1I). At

Figure 1. (A) Wide-field fundus photography showed yellow-gray-colored retinal edema along the superotemporal vascular arcade and macula in the left eye. (B) Fundus autofluorescence (FAF) showed decreased autofluorescence. (C) Spectral domain optical coherence tomography (SD OCT) showed subretinal fluid with diffuse ellipsoid zone disruption and hyper-reflectivity of the inner retina. (D) Fluorescein angiography (FA) revealed a hypofluorescent area corresponding to the retinal lesion in the early phase, and then (E) stippled hyperfluorescent spots appeared in the FA. (F) FA showed diffuse leakage within the hypofluorescent area in the late phase. (G) One week later, best-corrected visual acuity (BCVA) was 20/100, and complete resolution of subretinal fluid was noted on SD OCT. Six weeks later, BCVA improved to 20/32, and (H) wide field fundus photography showed depigmented change in the macula (black arrowheads). (I) FAF revealed increased autofluorescence with multiple hypofluorescence spots. At 4 months, BCVA improved to 20/20, and (J) SD OCT showed recovered ellipsoid zone integrity.

4 months, BCVA improved to 20/20 in the left eye, and the ellipsoid zone was nearly recovered although mild disruption was present (Fig. 1J).

Case 2

A 47-year-old male patient visited the ophthalmology clinic after a left eyeball contusion by a baseball. He had history of uveitis in the right eye, but not in the left eye. The BCVA was count finger in the left eye. Slit lamp examination showed traumatic hyphema with a small blood clot. On fundus examination, foveal depigmentation was noted (Fig. 2A). On the FAF image, increased autofluorescence corresponding to foveal depigmentation was noted (Fig. 2B). Foveal detachment with diffuse ellipsoid zone disruption was noted by SD OCT (Fig. 2C). Adjacent retinal layers showed hyper-reflectivity (Fig. 2C). On FA, pooling of dye in the fovea was shown throughout the early (Fig. 2D) to late phase (Fig. 2E). After 1 day, the foveal detachment was much improved by SD OCT (Fig. 2F) and completely resolved after 5 days, although BCVA was 20/200 (Fig. 2G). After 5 months, BCVA improved to 20/50 in the left eye. On the AF image, increased autofluorescence had decreased (Fig. 2H) when compared with the first visit. SD OCT showed partial recovery of the ellipsoid zone in the left eye (Fig. 2I).

Discussion

In the present case study, we demonstrated multi-modal imaging findings for traumatic maculopathy. Multi-modal imaging evaluations for traumatic maculopathy provided further information for the differential diagnosis and visual prognosis.

In case 1, we were able to add additional information about the transient breakdown of the blood-retinal barrier (BRB) caused by CGT and its natural course by using multi-modal imaging modalities. There are some reports demonstrating the breakdown of the BRB, especially at the level of the RPE or choroidal blood impairment after CGT [1,6,7]. This breakdown of the BRB may lead to retinal pigment epithelial cell edema and overlying serous retinal detachment [1]. On FA, progressive patchy staining at the level of RPE may be seen [1]. Our case showed vascular leakage on FA with subretinal fluid and diffuse ellipsoid zone disruption on SD OCT. The subretinal fluid resolved rapidly, suggesting that the BRB breakdown after GCT may be transient. Although the photoreceptor integrity was nearly recovered during follow up, macular depigmentation and increased autofluorescence on FAF images developed during the follow-up period, suggesting RPE damage. Our case also suggests that patients with this type of traumatic maculopathy may have a relatively good visual prognosis

Figure 2. (A) Wide field fundus photography showed foveal depigmentation. Fundus autofluorescence (FAF) showed increased autofluorescence corresponding to foveal depigmentation. (B) FAF. (C) Spectral domain optical coherence tomography (SD OCT) revealed foveal detachment with diffuse ellipsoid zone disruption. Adjacent retinal layers were hyper-reflectivity in SD OCT. Dye pooling of the fovea was seen throughout the early (D) to late phase (E). (F) SD OCT showed improvement of the foveal detachment after one day and (G) complete resolution after five days. After 5 months, best-corrected visual acuity improved to 20/50 in the left eye. On FAF image, increased autofluorescence was seen (H) when compared with the first visit. SD OCT demonstrated partial recovery of the ellipsoid zone in the left eye (I).

with recovery of the photoreceptor integrity.

For case 2, the traumatic maculopathy seemed to be similar to a traumatic macular hole. Unlike the patient in case 1 who maintained a nearly intact inner retinal layer, the patient from case 2 had an SD OCT that showed thinning of the inner retinal layer at the foveal center with foveal detachment at the time of diagnosis. FA showed fluorescein dye pooling, a characteristic of structural damage not vascular leakage. When compared with the previous classification system for traumatic macular hole [8], case 2 may have been an impending macular hole which spontaneously resolved. Although the foveal detachment recovered within 5 days, the disrupted photoreceptor ellipsoid zone integrity did not fully recover, leading to limited visual recovery.

Several recent studies have demonstrated the value of SD OCT for traumatic maculopathy. One study described the grading system for visual prognosis of traumatic maculopathy by using SD OCT [4]. SD OCT also provides various information for traumatic macular hole, including its classification, possibility of spontaneous closure, and visual outcome [8-10]. In our cases, SD OCT was also useful for evaluating the retinal structures, especially the foveal status. SD OCT showed foveal detachment in both cases. FA provided additional information which was helpful for differentiating the subtypes of traumatic maculopathy in our cases. Based on SD OCT and FA imaging, we could classify case 1 as traumatic maculopathy associated with subretinal fluid and case 2 as traumatic macular hole. FAF images showed the status of the retinal pigment epithelium, and we observed attenuated autofluorescence, although the traumatic maculopathy had resolved.

In the present cases, multi-modal imaging modalities were useful for the differentiation of and monitoring traumatic maculopathy. Although the exact mechanism for traumatic maculopathy is still under investigation, multi-modal imaging analysis may be helpful for accurate prognosis and diagnosis.

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Designed and conducted the study (H.M.K.); collected the data (H.M.K.); managed, analyzed, and interpreted data

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Conflicts of Interest

The author declare no conflicts of interest relevant to this article.

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