Patient's Self-recognition of Reduced Visual Acuity Due to Recurrence of Macular Edema and Prompt Visitation to the Hospital in Retinal Vein Occlusion

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Purpose: To evaluate patients' self-recognition of reduced visual acuity due to recurring macular edema in retinal vein occlusion.

Methods: A retrospective review of medical records of patients who were diagnosed with recurring macular edema secondary to retinal vein occlusion was performed. The proportion of patients who recognized reduced visual acuity due to the recurrence of macular edema and who visited the hospital before the scheduled follow-up date was determined. Parameters including age, sex, diagnosis, visual acuity before recurrence of macular edema, and extent of visual acuity reduction due to recurrence of macular edema were compared in patients who recognized a reduction in visual acuity and those who did not. The proportion of patients who visited the hospital promptly was also determined.

Results: Forty eyes of 40 patients were included in the analysis. Sixteen and 24 patients were diagnosed with central retinal vein occlusion and branch retinal vein occlusion, respectively. Twenty-one patients (52.5%) recognized reduced visual acuity due to recurring macular edema. These patients were younger (59.2 ± 7.6 vs. 64.8 ± 9.4 years, $p = 0.046$), had better visual acuity before recurrence of macular edema (0.52 ± 0.48 vs. 1.02 ± 0.46, $p = 0.002$), and exhibited a greater reduction in visual acuity after recurrence of macular edema (0.34 ± 0.24 vs. 0.14 ± 0.13, $p = 0.003$). Only four patients visited the hospital before the scheduled follow-up date, and all of these patients lived relatively close to the hospital.

Conclusions: For prompt treatment of recurring macular edema, more intensive education about the self-estimation of visual acuity is necessary, particularly for elderly patients who have relatively poor visual acuity. In addition, a simple and easy way to identify the recurrence of macular edema at the local clinic should be established for patients who live relatively far from the hospital.

Key Words: Macular edema, Recognition, Retinal vein occlusion, Visual acuity

It is well-known that macular edema secondary to retinal vein occlusion (RVO) has a negative influence on visual acuity [1,2]. While spontaneous resolution of macular edema and subsequent recovery of visual function have been observed in branch retinal vein occlusion (BRVO) [1], spontaneous improvement has seldom been reported in the context of central retinal vein occlusion (CRVO) [2]. A variety of methods, including intravitreal anti-vascular endothelial growth factor injection [3-7], and intravitreal triamcinolone injection [8-10], have been advocated as effective

treatments for macular edema secondary to RVO. Prompt treatment for macular edema may minimize deterioration of retinal function.

In clinical practice, patients diagnosed with RVO are usually advised to visit the hospital earlier than their scheduled follow-up date if they recognize a reduction in visual acuity, due to the possibility of recurrence of macular edema or aggravation of vascular occlusion. In our experience, however, patients usually wait for the scheduled follow-up date even if the aforementioned condition is encountered. Prolonged duration of macular edema results in the accumulation of tissue damage and may have a negative effect on long-term visual prognosis. To date, numerous studies have investigated treatment modalities for macular edema secondary to RVO. However, patients' behavior following decreased visual acuity due to recurring macular edema has not yet been thoroughly investigated, despite the fact that doing so may provide useful information for consultation with patients about their treatment plan.

In the present study, we investigated both patients' self-recognition regarding recurring macular edema secondary to RVO and early visits to the hospital. We discuss the factors that may influence patients' recognition of a reduction in visual acuity due to the aforementioned condition.

Materials and Methods

We conducted a retrospective review of the medical records of patients diagnosed with macular edema secondary to RVO between July 2010 and June 2012. Patients who experienced resolution of macular edema after treatment and recurrence of macular edema during regular follow-up were included. Exclusion criteria included severe media opacity, previous vitreoretinal surgery, intraocular inflammation, and other disorders that may influence macular function, including exudative age-related macular degeneration, proliferative diabetic retinopathy, and epiretinal membrane. Patients with visual acuity of counter finger or hand motion before the recurrence of macular edema were also excluded.

Retinal thickness was measured using spectral domain optical coherence tomography (Spectral OCT/SLO; OTI Ophthalmic Technologies Inc., Miami, FL, USA). Because evaluation of macular volume was not routinely performed, central foveal thickness was measured for the analysis. The

vertical distance between the internal limiting membrane and retinal pigment epithelium at the foveal center was measured based on horizontal and vertical optical coherence tomography images centered at the foveal center (Fig. 1). The mean values of the two images were used for analysis. The resolution of macular edema was defined as less than 250 microns of central foveal thickness. The recurrence of macular edema was diagnosed when the increase in the central foveal thickness exceeded 100 microns.

Each patient's sex, age, and residence location were recorded. To reflect each patient's subjective recognition of change in visual acuity, visual acuity was measured with eyeglasses in patients who ordinarily wore eyeglasses, and without them in patients who did not. Visual acuities were converted to logMAR (logarithm of minimal angle of resolution) values for analysis. The distance between the hospital and the patient's residence location was measured using an electronic caliper provided by a web-based map service (http://map.naver.com). Visual acuity was measured before and after the recurrence of macular edema. The proportion of patients who recognized reduced visual acuity due to recurrence of macular edema and the proportion of patients who visited the hospital earlier than the scheduled follow-up were determined. Age, sex, types of RVO, visual acuity before the recurrence of macular edema, and extent of visual acuity reduction following the recurrence of macular edema were compared between patients who recognized a reduction in visual acuity and those who did not. In addition, the difference between the visual acuity of the studied eye before macular edema recurrence and that of the fellow eye was compared between the two groups. Visual acuity measured 3 months after treatment or recurred macular edema was also compared
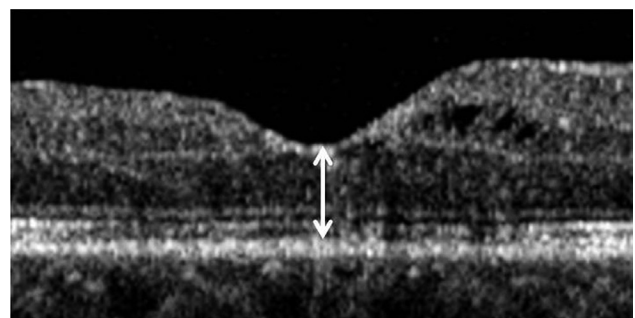
Fig. 1. Central foveal thickness (arrow) was defined as the vertical distance between the internal limiting membrane and the retinal pigment epithelium at the foveal center, based on optical coherence tomography imaging centered at the center of the fovea.

between patients who did and did not recognize a reduction in visual acuity.

Comparisons within the same group were performed using the paired *t*-test. Comparisons between the different patient groups were performed using the independent samples *t*-test. Non-parametric analyses were also performed using the chi-squared test or Fisher's exact test. Statistical analyses were performed with the commercially-available software package SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA). A *p*-value of <0.05 was considered significant.

Results

Forty patients (40 eyes, 17 men and 23 women) were included in the analysis. The mean (±standard deviation) age was 61.6 ± 8.8 years. Fifteen patients wore eyeglasses and 25 patients did not. CRVO and BRVO were diagnosed in 16 and 24 patients, respectively. All patients were administered at least one intravitreal anti-vascular endothelial growth factor injection to treat macular edema. Eight patients were also administered intravitreal triamcinolone injections or posterior sub-Tenon triamcinolone injections. Macular edema resolution was confirmed via optical co-

herence tomography. Mean central foveal thickness before recurrence of macular edema was 195.9 ± 26.6 microns and the mean visual acuity was 0.73 ± 0.53 (Snellen equivalent, 20 / 107). The patients were scheduled to visit the hospital a mean of 2.2 ± 1.1 months (range, 1 to 5 months) later. The mean central foveal thickness after recurrence of macular edema was 557.8 ± 157.1 microns and the mean visual acuity was deteriorated to 0.99 ± 0.49 (Snellen equivalent, 20 / 195). The central foveal thickness was significantly increased ($p < 0.001$), and visual acuity was significantly decreased ($p < 0.001$), following recurrence of macular edema.

Twenty-one (52.5%, 9 men and 12 women) patients recognized reduced visual acuity, whereas the remaining 19 (47.5%, 8 men and 11 women) did not. Table 1 compares the characteristics of these patients. Eight patients were diagnosed with CRVO and 13 with BRVO, among the patients that recognized visual changes. The mean age, visual acuity before the recurrence of macular edema, extent of reduction in visual acuity after recurrence of macular edema, visual acuity of the fellow eye, and difference between the visual acuity of the studied eye before macular edema recurrence and that of the fellow eye were 59.2 ± 7.6 years, 0.52 ± 0.48 (Snellen equivalent, 20 / 66), 0.34 ± 0.24, 0.12 ±

Table 1. Comparison between characteristics of patients who recognized reduced visual acuity due to recurring macular edema secondary to retinal vein occlusion and patients who did not

| Characteristics	Recognition (+) n = 21	Recognition (-) n = 19	*p*-value
Age (yr)	59.2 ± 7.6	64.8 ± 9.4	0.046[*]
Sex			0.701[†]
Male	9 (42.9)	8 (42.1)	
Female	12 (57.1)	11 (57.9)	
Diagnosis			0.721[†]
Central retinal vein occlusion	8 (38.1)	7 (35.0)	
Branch retinal vein occlusion	13 (61.9)	13 (65.0)	
BCVA (logMAR)			
At previous FU	0.52 ± 0.48	1.02 ± 0.46	0.002[*]
At recurrence	0.86 ± 0.51	1.15 ± 0.42	0.065[*]
Change in visual acuity	0.34 ± 0.24	0.14 ± 0.13	0.003[*]
Fellow-eye BCVA (logMAR)	0.12 ± 0.22	0.22 ± 0.26	0.184[*]
Difference in BCVA at previous FU and that of the fellow-eye	0.38 ± 0.43	0.79 ± 0.48	0.010[*]

Values are presented as mean ± SD or no. (%).
BCVA = best-corrected visual acuity; logMAR = logarithm of the minimal angle of resolution; FU = follow-up.
[*]Statistical significance was determined using the independent samples *t*-test; [†]Statistical significance was determined using the chi-square test.
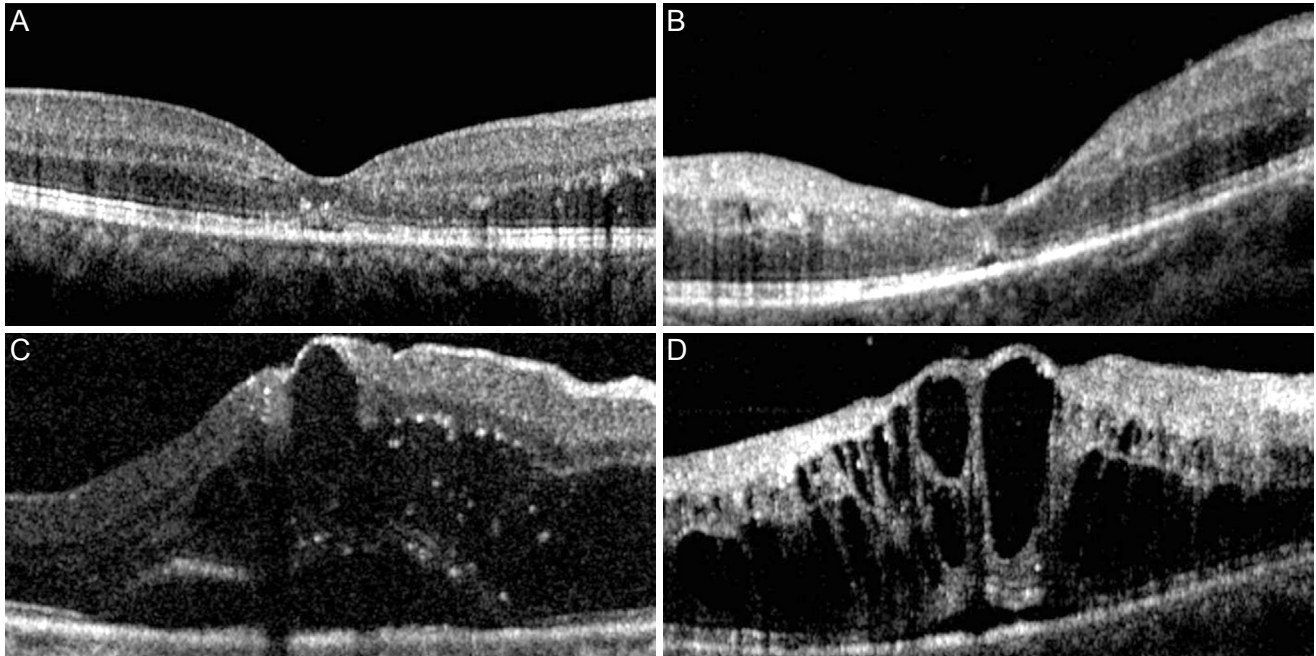
Fig. 2. Optical coherence tomography findings before (A,B) and after (C,D) recurrence of macular edema in 2 patients with retinal vein occlusion who recognized reduced visual acuity. Left column: visual acuity deteriorated from 20 / 40 (A) to 20 / 200 (C). The patient visited the hospital 3 weeks earlier than the scheduled follow-up date. The distance between the hospital and this patient's residence was approximately 8 km. Right column: visual acuity had deteriorated from 20 / 30 (B) to 20 / 100 (D). The patient visited the hospital on the scheduled follow-up date despite recognizing a definite reduction in visual acuity. The distance between the hospital and this patient's residence was approximately 295 km.
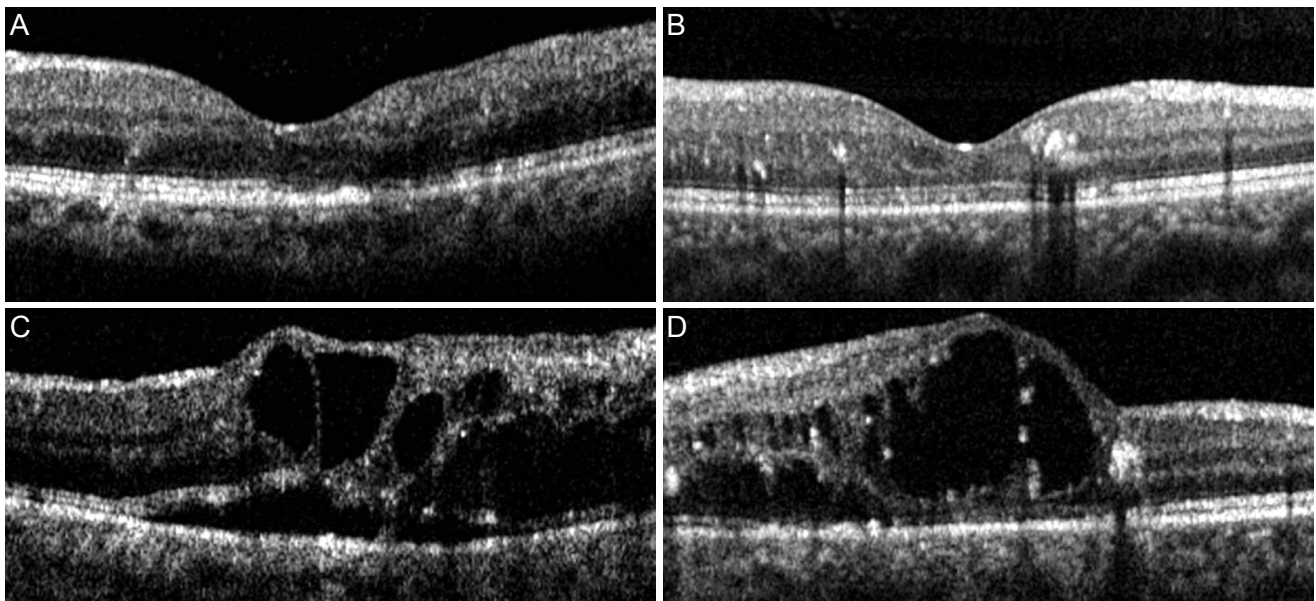
Fig. 3. Optical coherence tomography findings before (A,B) and after (C,D) recurrence of macular edema in 2 patients with retinal vein occlusion who did not recognize a reduction in visual acuity. Left column: visual acuities before and after recurrence were 20 / 100 (A) and 20 / 200 (C), respectively. Right column: visual acuities before and after recurrence were 20 / 63 (B) and 20 / 100 (D), respectively.

0.22 (Snellen equivalent, 20 / 26), and 0.38 ± 0.43, respectively. Of the patients who did not recognize a reduction in

visual acuity, seven were diagnosed with CRVO and 13 with BRVO. The mean age, visual acuity before the recur-

rence of macular edema, the extent of reduction in visual acuity after recurrence of macular edema, visual acuity of the fellow eye, and difference between the visual acuity of the studied eye before macular edema recurrence and that of the fellow eye were 64.8 ± 9.4 years, 1.02 ± 0.46 (Snellen equivalent, 20 / 209), 0.14 ± 0.13, 0.22 ± 0.26 (Snellen equivalent, 20 / 33), and 0.79 ± 0.48 respectively. Patients who recognized reduced visual acuity were younger ($p = 0.046$), had better visual acuity before the recurrence of macular edema ($p = 0.002$), experienced greater reductions in visual acuity after recurrence of macular edema ($p = 0.003$), and showed smaller differences between the visual acuity score of the studied eye before macular edema recurrence and that of the fellow eye ($p = 0.010$), than patients who did not recognize reduced visual acuity. Sex ($p = 0.701$), types of RVO ($p = 0.721$), and fellow eye visual acuity ($p = 0.184$) did not differ significantly between the two groups. Figs. 2 and 3 show representative cases of patients who recognized and did not recognize reduced visual acuity, respectively.

Only four patients visited the hospital before the scheduled follow-up date. The mean age of these four patients was 63.5 ± 9.3 years, mean visual acuity before the recurrence was 0.51 ± 0.42 (Snellen equivalent, 20 / 64), and the mean extent of reduction in visual acuity following the recurrence was 0.59 ± 0.33. The mean distance between the hospital and the location of the four patients' residences was 9.5 ± 6.2 km. The hospital was within 20 km for all four patients (100%). The mean distance for the remaining 17 patients who recognized reduced visual acuity, but did not visit the hospital prior to the scheduled date, was 50.5 ± 88.1 km. The hospital was within 20 km for 10 patients (58.8%) and beyond 20 km for seven patients (41.2%). The proportion of patients residing within 20 km from the hospital was greater in the early-visit group ($p = 0.035$).

All patients underwent additional treatment for macular edema recurrence. After macular edema recurrence, 34 patients were administered 1 to 2 intravitreal anti-vascular endothelial growth factor injections alone for 6 months, while five were also administered intravitreal triamcinolone injections. Five patients were administered intravitreal triamcinolone injections alone and one was treated with a posterior sub-tenon triamcinolone injection only. The mean visual acuity at 3 months after treatment was 0.91 ± 0.53 (Snellen equivalent, 20 / 162). The mean visual acuity in patients who did and did not recognize a reduction in

visual acuity was 0.75 ± 0.45 and 1.12 ± 0.53, respectively ($p = 0.032$). The mean visual acuity at 3 months after treatment of patients who visited the hospital before the scheduled follow-up date was 0.65 ± 0.48.

Discussion

In this study, we first investigated patients' recognition and behavior regarding the recurrence of macular edema in RVO. Approximately half of the patients recognized reduced visual acuity due to recurrence of macular edema. Younger patients with relatively good visual acuity and patients who had experienced greater reduction in visual acuity were more likely to recognize reduced visual acuity. However, only a few patients visited the hospital promptly, and all of these few patients were living relatively close to the hospital.

In the present study, the exact time of macular edema recurrence could not be accurately determined. However, considering the approximately 2-month period between the follow-ups before and after recurrence of macular edema, treatment may have been delayed by at least several weeks in many of the included patients. Generally, macular edema secondary to RVO was not regarded as urgent. In the present study, the effect of prompt hospital visitation on treatment outcome was not demonstrated. However, given that the results of some previous studies have suggested that prompt treatment may improve visual prognosis [10-13], delayed treatment due to a delay in visiting the hospital may have a negative impact on visual prognosis. In particular, one previous study revealed a definite difference in the treatment outcomes of eyes with symptoms for ≤3 months and those with symptoms for ≥3 months [10]. Significantly improved visual acuity and decreased foveal thickness was maintained for 6 months after treatment in eyes with shorter symptom duration, whereas the values at 3 months and 6 months after treatment were not different from the baseline values in eyes with longer symptom duration. These results indicate the importance of early treatment after visual and anatomical prognosis. Recognition of reduced visual acuity is thus an extremely important issue with regard to prompt treatment for recurring macular edema. In this study, older patients and patients with relatively poor visual acuity tended not to recognize reduced visual acuity. This result suggests that more intensive patient education with regard

to the recurrence of macular edema as indicated by changes in vision, and the fact that it necessitates a prompt visit to the hospital, is very important for these vulnerable patients. Frequent, regular self-examination, such as that which is usually recommended for patients with exudative age-related macular degeneration, should be recommended to these patients [14]. This patient education is particularly pertinent when the scheduled period between follow-up visits is relatively long. In addition, considering the relatively older age of patients who did not recognize visual changes in this study, educating the relevant caretakers may be as important as educating the patients themselves. The significantly smaller difference in the visual acuity scores of the studied eye before macular edema recurrence and that of the fellow eye observed in the present study was interesting. It is possible that patients may depend on the vision in the fellow eye during daily life when there is a relatively greater difference between the visual acuities of the two eyes. In this respect, a more specific and sensitive method, such as occluding the fellow eye and measuring the visual acuity of the affected eye once every several days, may be required to determine a decrease in the visual acuity of the affected eye.

In this study, we could not definitively determine why a majority of patients that recognized reduced visual acuity did not visit the hospital promptly. The mean age of the four patients who did visit the hospital promptly was slightly older than that of the remaining patients who recognized reduced visual acuity. Visual acuity before the recurrence was comparable between the patients with and without prompt hospital visitation. While various personal reasons may contribute to a decision not to visit the hospital early despite changes in visual acuity, we suspect that the distance between the hospital and the patient's residence is one of the primary reasons. All four of the patients who visited the hospital promptly lived relatively close to it. Although statistical analysis was not feasible due to the very small number of cases, the mean distance between the hospital and the patients' residences in these four cases was approximately 1 / 5 of that of the other patients who recognized reduced visual acuity but waited until the scheduled follow-up date to visit the hospital. This result may highlight the need for a simple and easy way to verify macular edema recurrence in these patients, as well as a need for more intensive patient education. Considering potential problems related to a patient's time

and expense, an initial eye check at a clinic located close to the patient's residence may be an option. If the recurrence of macular edema is confirmed at the clinic, the patient could be promptly referred to the hospital before the scheduled follow-up date. For this method to operate effectively, information about the location of a local clinic with optical coherence tomography facilities is needed, because optical coherence tomography exhibits superior sensitivity with regard to the detection of macular edema, as compared to standard fundus examination [15,16].

The present study has several limitations. The study was retrospective. The exact time when visual acuity was reduced was not known. The patient may not think that a prompt hospital visit is necessary if the reduction in visual acuity occurs just few days before the scheduled follow-up date. Also, the results were all derived from a single treatment facility. Socio-economic status and level of education may be different among patients at different hospitals. The relative proportions of patients who live close to the hospital and far from it will also differ for each given hospital. Thus, some of our results may not be directly applicable to other hospitals.

In summary, approximately 1 / 2 of the patients investigated recognized recurrence of macular edema in RVO. These patients were relatively younger, had better visual acuity, and experienced greater reductions in visual acuity. Among them, only a few patients visited the hospital promptly, and all of them lived relatively close to the hospital. These results underscore the need for intensive patient education for elderly patients with poor visual acuity, and the importance of establishing simple and easy methods to verify the recurrence of macular edema for patients who live far from the hospital. We hope further studies may reveal the influence of prompt hospital visitation on the long-term visual prognosis in these patients.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Acknowledgements

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