CASE REPORT

Optical Coherence Tomography Angiography in a Patient with Optic Atrophy After Non-arteritic Anterior Ischaemic Optic Neuropathy

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ABSTRACT

A 75-year-old female noticed a lower visual field (VF) defect in the right eye. A diagnosis of non-arteritic anterior ischaemic optic neuropathy (NAION) was made. The lower VF defect in the right eye did not change after onset. Optical coherence tomography (OCT) angiograms on the disc and the macula showed decreased retinal perfusion in the upper retina of the right eye. Retinal nerve fibre layer loss and ganglion cell complex loss in the upper retina were also seen in the right eye. OCT angiography could non-invasively detect the decrease of the retinal perfusion due to NAION.

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Case Report

A 75-year-old female noticed a lower visual field (VF) defect in the right eye. Her best-corrected visual acuity was 20/32 in both eyes. The critical flicker frequency was 28 Hz in the right eye and 35 Hz in the left eye. A relative afferent pupillary defect was detected in the right eye. Slit-lamp biomicroscopy with a fundus lens stereoscopically revealed oedema of the optic disc in her right eye. Fluorescein fundus angiography showed hypoperfusion in the upper right optic disc (Figure 1A, B). VF testing using the Humphrey Field Analyzer (HFA; Carl-Zeiss Meditec, Dublin, CA, USA) showed a lower VF defect in the right eye. Magnetic resonance imaging (MRI) did not show high intensity in the right optic nerves or compression due to the extraocular muscles and paranasal sinus disease. Although the erythrocyte sedimentation rate (ESR) was increased (81.5 mm; normal, 3–15 mm), C-reactive protein (CRP) was only slightly increased (0.48 mg/dL; normal, <0.3 mg/dL), and there was dissociation in the ESR and low CRP. Because she had a cold for 1 week and CRP levels were low, we hypothesized that the high ESR caused by having a cold,

and the dissociation in ESR and CRP, suggested convalescence from having the cold. She did not have a headache, jaw pain, or retro-ocular pain that increased with eye movement. She had been treated for diabetes mellitus; however, she did not have hypertension, hypercholesterolaemia, or systemic vasculitis such as systemic lupus erythematosus. A diagnosis of non-arteritic anterior ischaemic optic neuropathy (NAION) was made in the right eye, and the patient was treated with oral mecobalamin (1.5 mg/day). The VF defect in the right eye did not change (Figure 1C, D), and the optic disc in the right eye became pale after onset (Figure 2A, B).

Optical coherence tomography (OCT) angiograms on the disc (4.5 × 4.5 mm, radial peripapillary capillary image) and the macula (6.0 × 6.0 mm, superficial image) and en face OCT images of the areas were obtained using spectral-domain OCT (RTVue XR Avanti; Optovue, Fremont, CA, USA) after onset. The retinal nerve fibre layer (RNFL) thickness of the disc and ganglion cell complex (GCC) thickness of the macula were measured with RTVue XR Avanti software. This study was approved by the Institutional Review Board of the Shiga University of Medical

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Figure 1. Fluorescein fundus angiography and visual field findings. (A and B) Fluorescein fundus angiography of the right eye (A) and the left eye (B) at onset, showing hypoperfusion in the upper right optic disc. (C and D) Pattern deviation using the 30-2 Swedish Interactive Threshold Algorithm-fast program of the Humphrey Field Analyzer for the right eye (C) and the left eye (D), 2 months after onset.

Science and was conducted in accordance with the tenets of the Declaration of Helsinki. Written informed consent was obtained from the patient. The OCT angiogram showed decreased peripapillary retinal perfusion in the upper retina, corresponding to the VF defect in the right eye (Figure 2C), although it did not show a decrease of peripapillary retinal perfusion in the left eye (Figure 2D). A dark region was shown in the upper retina of the right eye on en face OCT images (Figure 2E, F). RNFL loss was also seen in the upper retina of the right eye (Figure 2G, H). The OCT angiogram of the macula showed decreased retinal perfusion in the upper retina, corresponding to the GCC loss in the right eye (Figure 3). Therefore, OCT angiography could non-invasively detect the decrease of the retinal perfusion due to NAION.

Discussion

OCT angiography was recently reported as a new technique for mapping ocular perfusion, including

capillaries, because it can distinguish the areas of blood flow.¹⁻⁵ OCT angiography can clearly show retinal capillaries, retinal non-perfused areas, and microaneurysms in patients with diabetic retinopathy.⁵ OCT angiography can also evaluate the peripapillary retinal perfusion.^{1,6-8} Liu et al. reported that the peripapillary retinal perfusion was reduced in glaucoma.⁸ In the present study, we showed that OCT angiography can detect decreases of retinal perfusion due to NAION. The OCT angiogram on the disc and macula in the right eye showed decreased retinal perfusion in the upper retina, corresponding to the RNFL loss and GCC loss, respectively.

Wang et al. further suggested a cause for the decreased retinal perfusion in the optic nerve head of multiple sclerosis patients.⁹ MS damages the optic nerve and reduces the number of nerve fibres, the optic nerve head, and the RNFL. These reductions cause a decrease of metabolic activities, lowering blood flow via autoregulatory mechanisms. In this current study, the RNFL and GCC were also reduced owing to NAION. This results

Figure 2. Optic disc findings. (A and B) Color fundus photos of both eyes 7 months after onset. (C and D) Optical coherence tomography (OCT) angiogram of the disc in the right eye (C) and the left eye (D) 10 months after onset. The retinal perfusion decreased in the upper retina corresponding to the visual field (VF) defect. (E and F) The en face OCT images in the right eye (E) and the left eye (F) 10 months after onset. A dark region was shown in the upper retina of the right eye. (G and H) Retinal nerve fibre layer (RNFL) thickness in the right eye (G) and the left eye (H) 12 months after onset. RNFL loss was seen in the upper retina of the right eye.

in decreased metabolic activities of the superior retina, and the reduction lowers retinal perfusion of the area.

OCT angiography can non-invasively evaluate the retinal perfusion in NAION, which is an advantage

Figure 3. Macular findings. (A and B) Optical coherence tomography (OCT) angiogram of the macula in the right eye (A) and the left eye (B) 10 months after onset. (C and D) Ganglion cell complex (GCC) significance map in the right eye (C) and the left eye (D) 12 months after onset. N and T indicate the nasal and temporal sides, respectively. Green areas are normal regions, yellow areas are borderline significant losses, and red areas are significant losses. The OCT angiogram on the macula showed decreased retinal perfusion in the upper retina, corresponding to the GCC loss in the right eye.

over fluorescein angiography. Fluorescein angiography should not be used for pregnant women or in patients who are allergic to fluorescein, although it is useful for the diagnosis of NAION. OCT angiography can show retinal capillaries more clearly than fluorescein angiography. OCT angiography may therefore be more useful than fluorescein angiography for the evaluation of retinal perfusion.

There are some limitations in the present study. First, we reported only one case. Second, the measurement area of the OCT angiogram was smaller than that of the VF testing.

In conclusion, OCT angiography could non-invasively detect the decrease of the retinal perfusion due to NAION. OCT angiography of the disc and macula showed decreased retinal perfusion in the retina, corresponding to the RNFL loss and GCC loss due to NAION.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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