CASE REPORT

Macular Involvement and Response to Steroid Therapy Demonstrated by Optical Coherence Tomography in Non-arteritic Anterior Ischaemic Optic Neuropathy

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ABSTRACT

Two consecutive patients with anterior non-arteritic ischaemic optic neuropathy were evaluated with spectral-domain optical coherence tomography. The optical coherence tomographic scans revealed subfoveal fluid and intraretinal fluid extending from the optic disc margin toward the fovea that made us think that the submacular fluid appeared to arise from the peripapillary region. Fluorescein angiography showed no accumulation in the macular area, whereas leakage and staining of the optic nerve was present. After systemic corticosteroid therapy, the submacular fluid decreased promptly and the visual acuity improved. Subretinal-fluid-associated disc oedema may develop in some patients with NAION and contribute to the visual loss associated with this condition. Optical coherence tomography should be performed to follow macular involvement in patients with neuro-ophthalmic disease as well as to monitor patients' response to treatment.

Keywords: Non-arteritic anterior ischaemic optic neuropathy, spectral domain optical coherence tomography, steroid therapy, subretinal fluid

INTRODUCTION

Non-arteritic ischaemic optic neuropathy (NAION) is characterised by a sudden, painless, monocular visual loss in patients after the fourth or fifth decade of life. It is characterised by visual loss associated with optic disc swelling, sometimes with flame-shaped haemorrhages and cotton-wool spots on the swollen disc or nearby neuroretinal layer and there is evidence of axoplasmic flow stasis in the optic nerve head.^{1,2} In recent years, because of advances in imaging technologies, subfoveal fluid and macular involvement were clearly demonstrated in patients with neuro-ophthalmological disorders such as NAION³ and papilloedema.⁴ The characteristics of the submacular fluid seen in these patients is similar to that seen in optic disc pit or coloboma associated macular detachment.¹

Recently Hedges *et al.* demonstrated subfoveal fluid in eight patients with NAION.³ In our report,

we aimed to present two consecutive NAION patients with submacular fluid that responded well to systemic corticosteroid treatment. We also emphasised the importance of spectral-domain optical coherence tomography (SD OCT) during the follow-up of these patients that had not been stated frequently before.

CASE REPORTS

Case I

A 65-year-old male complained sudden visual loss in his right eye for 1 week. There was no associated ocular pain or headache. For 5 years, the patient had been treated for non-proliferative diabetic retinopathy. On initial ophthalmic examination, the best-corrected visual acuity (BCVA) was counting fingers at 20 cm distance in the right eye and 20/20 in the left eye.

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FIGURE 1 (A) The colour fundus image showed optic disc oedema, flame-shaped peripapillary haemorrhage, and dot-blot haemorrhage related to diabetic retinopathy. (B) The fundus fluorescein angiography demonstrated optic disc leakage due to oedema. *Note:* Figures 1–4 of this article are available in colour online at www.informahealthcare.com/oph.

FIGURE 2 (A, A') The OCT demonstrated subfoveal fluid and oedema in the retinal layers. (B, B') The OCT scans showed partial resolution of subfoveal fluid after 1-week follow-up. (C, C') The OCT scans showed total resolution of subretinal fluid and oedema in the papillomacular area after 1-month follow-up.

Colour vision was impaired and a relative afferent pupillary defect was present in the affected eye. Fundus examination of the right eye demonstrated optic disc swelling and a flame-shaped peripapillary haemorrhage (Figure 1A). Peripheral laser spots and rare dot-blot haemorrhages were also seen. The fundus fluorescein angiography (FA) revealed no accumulation of dye in the macula, but leakage and late staining of the optic disc (Figure 1B). The SD OCT findings included intraretinal fluid extending from the optic disc margin toward the fovea and a separate area of subfoveal fluid (Figure 2A). He had neither clinical nor laboratory evidence of giant cell arteritis. Visual field examination revealed an inferior altitudinal defect. The diagnosis of NAION was established and the patient was treated with intravenous methylprednisolone 1 g/day for 3 days. The subfoveal fluid partially resolved after pulse steroid therapy and the BCVA improved to counting fingers at 2 m (Figure 2B) after 1 week. Oral corticosteroid 60 mg/day was given and decreased gradually following pulse

steroid therapy. After 1 month, the subretinal fluid completely resolved and the BCVA improved to 20/200 (Figure 2C).

Case 2

A 66-year-old female presented with painless sudden visual loss in her left eye for 7 days without any history of ocular trauma. From her medical records, it was learned that the patient had been treated for hyperlipidaemia and asthma. On initial ophthalmic examination, the BCVA was hand motion in the left eye and 20/20 in the right eye. Slit-lamp examination of the both eyes was unremarkable. Fundus examination revealed sectorial optic disc swelling in the left eye (Figure 3A). Ophthalmoscopy of the right eye was normal. A relative afferent pupillary defect was detected and colour vision was deteriorated in the left eye. Fluorescein angiography showed dye leakage and late staining of the optic disc (Figure 3B).

FIGURE 3 (A) The colour fundus image revealed optic nerve swelling and oedema in the macular area. (B) The fundus fluorescein angiography showed staining of the optic disk and no leakage from macular area.

FIGURE 4 (A, A') The OCT showed significant subfoveal fluid and oedema in the retinal layers located in papillomacular area. (B, B') The OCT revealed decreasing of subfoveal fluid and oedema of the retinal layers in the papillomacular area after 1-week follow-up. (C, C') The OCT showed total resolution of subfoveal fluid and oedema in the head of optic nerve.

Macular OCT scans revealed subfoveal fluid with intraretinal fluid extending from the optic disc margin (Figure 4A). Laboratory tests were within normal limits. The diagnosis of NAION was established and treatment with 1 g/day intravenous prednisolone was initiated and continued with an oral dose of 60 mg/day afterwards. After 1 week, submacular fluid resolved and the BCVA was improved to counting fingers at 2m (Figure 4B). Optic atrophy was developed in the left eye and the BCVA remained unchanged (Figure 4C).

DISCUSSION

Anytime subretinal fluid accumulates in the space between the neurosensory retina and the underlying retinal pigment epithelium (RPE), a retinal detachment under the fovea occurs. Depending on the mechanism of subretinal fluid accumulation, retinal detachments in the macula have been classified into different groups. Several inflammatory, infectious, vascular, degenerative, malignant, or genetically

determined pathological conditions have been recognised to cause exudative retinal detachments in the macula. In addition, an overload of fluid to the RPE obstructs the pumping action of fluid and can lead to fluid accumulation in the subretinal space. Subretinal fluid in patients with optic nerve disorder was shown by some studies^{3–5} and it is compatible with the results supported by histopathological studies. Samuels reported that, in the presence of severe optic disc swelling, fluid can travel between the retina and the retinal pigment epithelium.⁶ Previously Hoyer *et al.* reported separation of the retina from the underlying choroid by subretinal fluid in association with decreased visual acuity in their large papilloedema series.⁴ Similarly Hedges *et al.* provided the evidence of subretinal fluid due to NAION with OCT findings.³ They followed 76 patients with NAION during a 3-year period and 8 patients had apparent subretinal fluid at the macular region.

Subretinal fluid that involves the fovea develops in some patients with optic nerve disorders and this may cause visual deterioration.^{4,7} Ischaemia of axons in anterior NAION patients results in axoplasmic flow

stasis, which in turn causes axoplasmic accumulation and consequent axonal swelling of the optic nerve head; that manifests as optic disc oedema.² In NAION, loss of visual acuity from optic nerve head oedema due to ischaemia is commonly seen.² However, subretinal fluid might contribute to reduced visual acuity in these cases.

The submacular fluid appears to arise from the peripapillary area and the patients may show improvement of visual acuity when the fluid resolved. Hedges *et al.* reported that this condition seems to occur in approximately 10% of cases and visual acuity improved in five of the eight patients as the subfoveal fluid resolved.³ In accordance with these previous studies, in our study both of the cases with manifest subretinal fluid had poor visual acuity at the initial examination. The absence of fluorescein accumulation in the macular region indicated that it did not come from the retinal or choroidal vasculature and it indicates that the origin of subretinal fluid was optic nerve. After immediate treatment with systemic corticosteroid, the submacular fluid resolved promptly and the patients had some visual acuity improvement. Hayreh and Zimmerman reported that patients treated with corticosteroid therapy within 2 weeks after onset of NAION had significantly faster optic disc oedema resolution than the untreated cases.⁸ This would suggest reduction in capillary leakage with corticosteroid therapy, which may also be beneficial in resolution of submacular fluid as well as optic disc oedema. Although the exact mechanism by which steroids bring about an improvement in this disease is not known, it seems most probable that they alter capillary permeability and reduce fluid leakage.⁹ Although spontaneous visual acuity improvement has been reported in large studies,¹⁰ prompt resolution of the submacular fluid after the initiation of corticosteroids may contribute to this improvement. However, a double-blind NAION study comparing steroids versus placebo will be needed.

In conclusion, subretinal fluid may develop in some patients with NAION and contribute the visual loss associated with this condition. OCT allows us to demonstrate macular involvement and should be

performed to follow these patients and to monitor patients' response to treatment.

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

Note: Figures 1, 2, 3 and 4 of this article are available in colour online at www.informahealthcare.com/oph

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