Vitreopapillary Traction in Nonarteritic Anterior Ischemic Optic Neuropathy

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Purpose: To describe the association between vitreous traction on the optic disc and nonarteritic anterior ischemic optic neuropathy (NAION).
Methods: Eighty three eyes of 83 patients with NAION were evaluated by optical coherence tomography (OCT) for detecting vitreous adhesion to the optic nerve head with separation from the adjacent retina (partial posterior vitreous detachment). Eyes which were negative for such adhesion underwent ultrasonography to detect complete posterior vitreous detachment (PVD).
Results: Fifty male and 33 female subjects with mean age of 51.9±10 years were studied. Partial PVD with optic nerve head adhesion was found in 54 patients (65.1%) using OCT. Ultrasonography detected complete PVD in all other eyes with optically empty spaces on OCT.
Conclusion: Vitreous traction on the optic nerve head from partial PVD may play a causative role in some cases of NAION. This traction may impair vascular supply and/or axoplasmic flow leading to signs and symptoms of NAION.

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INTRODUCTION

The exact pathogenesis of nonarteritic anterior ischemic optic neuropathy (NAION) remains unknown.[1] Proposed mechanisms include vasculopathy within or distal to the paraoptic branches of the posterior choroidal arteries, circulatory compromise in the optic nerve head, vascular occlusion and mechanical axonal distortion.[2]

Posterior vitreous detachment (PVD) is an age-related change in human eyes and a cause of vitreopapillary traction. In an autopsy series, the prevalence of PVD has been reported less than 10% under the age of 50, 27% in age 60-69 and 63% in age 70 years or above.[3] The overall prevalence of different stages of PVD was reported to be 75% in eyes of healthy volunteers aged 31-74 years using optical coherence tomography (OCT).[4]

Several studies have described marked optic disc elevation and blurring, disc hemorrhage and impaired visual acuity in various combinations as a result of vitreous traction due to partial PVD.[5-10] Schepens[6] reported swelling of the optic disc due to vitreopapillary traction in PVD and named it pseudopapill-edema. Katz and Hoyt[7] described vitreopapillary traction with hemorrhage in and around the disc in young myopic patients. Cibis et al[8] reported two cases with acute partial PVD and massive retinal hemorrhage overlying the optic disc. Wisotsky et al[9] described two patients who had unilateral elevated optic nerve head

due to vitreopapillary traction with normal color vision, normal pupillary responses, and full kinetic perimetry. They suggested that the posterior hyaloid should be evaluated in cases of optic nerve head elevation. Kroll et al[10] reported 17 patients with proliferative diabetic vitreoretinopathy (PDVR) and traction on the nasal side of the optic disc, optic nerve head pallor and reduced visual acuity. They performed vitrectomy and observed improvement in optic disc appearance and visual acuity. They concluded that vitreopapillary traction may damage the anterior optic nerve via decreased axoplasmic flow in the optic nerve fibers and/or mechanical reduction of perfusion in the posterior ciliary arteries.

According to the above-mentioned studies, vitreopapillary traction can cause optic nerve head swelling, blurring of disc margin, intra- and peripapillary hemorrhages and visual loss. It is also possible that vitreopapillary traction play some role in the pathogenesis of NAION. In this study we evaluated eyes with NAION for vitreopapillary traction using ultrasonography (US) and optical coherence tomography (OCT) which facilitate evaluation of the posterior vitreoretinal interface and may be superior to biomicroscopic examination.[11,12]

METHODS

This cross sectional descriptive study was performed on 83 eyes of 83 patients with NAION which was diagnosed clinically based on typical signs and symptoms. Patients diagnosed with NAION in the past year were included in the study. In bilateral cases, the more recently involved eye was included. Patients with history of intraocular inflammation, vitreoretinal disorders, intraocular surgery, ocular trauma and high myopic eyes were excluded from the study. Informed consent was obtained from all patients.

All eyes underwent OCT using the Zeiss Humphrey OCT II instrument (Carl Zeiss, Jenna, Germany) which was performed by one of the authors (K.G.F). Linear scans were taken in 3 horizontal and 3 vertical cross-sections with equal distances and at least 7 mm in length. Radial scans were performed in consecutive sectors at an angle of 30 degrees from the optic disc center. The OCT instrument was regulated for maximum incident light and the best setting of focal planes, signal power and polarization to maximize the signal and facilitate evaluation of the fine reflex from the posterior aspect of the vitreous.

Partial PVD was defined as a sharp and discrete blue or blue-green linear image with focal attachments to the optic nerve head, reproducible on at least one other scan. All eyes with optically empty spaces on OCT underwent US to detect complete PVD. US was performed in axial, transverse and longitudinal cross-sections using a contact method by the same examiner.

RESULTS

Overall 83 patients including 50 male and 33 female subjects with mean age of 51.9±10 years were studied. Mean duration of NAION was 15 days (range 3-365).

OCT detected partial PVD in 54 eyes (65.1%) and optically empty spaces in 29 eyes (34.9%). The latter group underwent US which revealed complete PVD in all cases.

Mean age of patients was 52.8±9.5 years in the patients with partial PVD and 50±11.2 years in the patients with complete PVD (t test, P=0.29).

Complete PVD was significantly more frequent among cases with duration of NAION more than 15 days comparing to those with shorter duration of NAION (table 1).

Table 1 Distribution of patients regarding type of PVD and duration of NAION

PVD	Duration of NAION		Total
	≤15 days	>15 days	
Partial	34 (77.3%)	20 (51.3%)	54 (65.1%)
Complete	10 (22.7%)	19 (48.7%)	29 (34.9%)
Total	44 (100%)	39 (100%)	83 (100%)

PVD: posterior vitreous detachment, NAION: nonarteritic anterior ischemic optic neuropathy
• P= 0.01, Chi square test

DISCUSSION

In this study, all eyes with NAION had partial or complete PVD which is much more common than the rate of PVD in the normal population, as mentioned previously.[3,4] Furthermore, the frequency of complete PVD increased and that of partial PVD decreased with increasing duration of NAION in our series.

Vitreopapillary traction has previously been reported to play a role in the pathogenesis of a number of conditions such as optic disc edema, intra- and peripapillary hemorrhage and central retinal vein occlusion.[5,7-9,13]

It is well known that the size of the optic disc in eyes with NAION is small, these eyes have small or no physiologic cupping and the overall disc appearance has been described as crowded.[2,14] Vitreous traction on the optic nerve head by PVD may impair microcirculation and axoplasmic flow in an anatomically predisposed eye. Microangiopathic disorders such as diabetes mellitus and hypertension may accelerate this process.[1,2]

The results of present study suggest that early stages of NAION may be associated with partial PVD and that in at least some cases, traction by PVD on the optic disc may play a role in impairment of optic nerve head microcirculation leading to NAION. The major limitation of this study is the lack of a control group; we suggest performing further studies on a larger scale with a control group. One challenge would be to document the pre-NAION status of the posterior aspect of the vitreous and to compare it with the post–NAION appearance to establish a causative link.

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