

Retinal optical coherence tomography showing optic disc changes in low intracranial pressure headaches: a case report

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Introduction

The optic disc is examined at the bedside as a simple and non-invasive indirect indicator of potentially elevated intracranial pressure. There is a large degree of physiological variation of optic disc appearance, but optic disc swelling (also called optic disc edema) typically prompts further investigations for a cause of potentially raised intracranial pressure [1]. In fact, it is the change of the trans-laminar pressure gradient at level of the lamina cribrosa which is a sensitive interface between cerebrospinal fluid (CSF) pressure and intraocular pressure (IOP) [2]. Minor pressure changes on both sides can lead to optic disc shape changes, as for example shown for increased intracranial pressure in idiopathic intracranial hypertension (IIH), for increased IOP in glaucoma or even with low ICP in patients with normal tension glaucoma and primary open angle glaucoma [3, 4]. However, the literature on the contribution of ICP in glaucomatous optic nerve damage is controversial [3, 5] and optic disc imaging in patients affected by low ICP state is lacking.. Here we utilise optical coherence tomography (OCT), a non-invasive high-resolution technique, to show the changes in the optic disc in one patient with a low pressure state [4]. To the best of our knowledge this is the first case report of OCT documented optic disc excavation in a patient with a low intracranial pressure state due to a CSF leak.

Clinical Description

A 54-year old female patient was referred with a two-year history of headache and diplopia. She was originally suspected to suffer from IIH, but the CSF opening pressure has been normal at 14 cmH₂O, as was her MRI brain and the MRI venogram. Clinically, the history of her headaches with reported relief by horizontal positioning was typical for low pressure headaches; the site of leak has not been identified. On examination, there was monocular diplopia, with no metamorphopsia. Other causes of monocular diplopia had been excluded. Visual acuities were 1.2 (6/5 Snellen equivalent) in each eye, with normal colour vision and normal visual fields. Retinal OCT (Spectralis SD-OCT, Heidelberg, Germany) did show remarkable concavity of both optic discs with a concave pattern of Bruch's membrane opening. The symmetric appearance of a deep optic disc cavity is shown for her right eye (figure 1A) and left eye (figure 1 C), where maculae appear normal (right: 1B; left: 1D) compared to a healthy control (1E and 1F). Quantitative analysis of segmented retinal layers was normal.

In conclusion, she has a clinical diagnosis of a low pressure headaches and bilateral symmetric optic disc concavity on OCT images. She has been offered positional treatment aiming at spontaneous CSF leak closure. Also, she has been advised to have sufficient hydration and caffeine intake for symptom relief.

Discussion

Optic disc excavation is important for the diagnosis of glaucoma presenting with loss of neuroretinal rim, increased cup/disc ratio and a denuded Bruch's membrane [2]. Our case of bilateral optic disc concavity associated with low CSF pressure state differs anatomically from the changes known in glaucoma: the neuroretinal rim is not lost but rather pulled inwards by the low intracranial pressure in upright position. Also the Bruch's membrane is retracted towards the CSF space and shows a remarkable concave opening. In contrast to glaucoma and IIH there has been no structural damage to the retinal axons in this patient with a clinical diagnosis of low pressure headaches [3, 4]. An experimental study by Morgan et al. focusing on elevated IOP and CSF pressures suggests, that there is no optic disc change when CSF pressure and IOP are increased equally and that small pressure differences induce relatively greater structural alterations than higher ranges [6]. Even though similar experimental studies have not yet been conducted for low pressure states, we would assume a potential benefit from reduced IOP in patients with low CSF pressure. A major limitation of our case presentation is therefore the lack of longitudinal ICP measurements with changes of position with an ICP bolt and the effect of a Valsalva manoeuvre.

Low pressure headache with associated bilateral symmetric optic disc excavations is an interesting observation which will require longitudinal assessment in a larger cohort of patients to better understand translaminar pressure related pathology in the eye. Such longitudinal studies would be particularly helpful to monitor response to treatment. An interesting question such studies may discuss is to determine if these patients may potentially benefit from IOP lowering eye drops in order to normalise the trans-laminar pressure gradient.

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Legend

Figure 1: Retinal OCT images showing a deep optic disc cavity for the patient’s right eye (A) and the patient’s left eye (C) while presenting with unaffected foveal and parafoveal regions of the right eye (B) as well as of the left eye (D). *Abbreviations* OCT: Optical Coherence Tomography (arrows: Bruch’s membrane opening).

Compliance with Ethical Standards

Disclosure of potential conflicts of interest:

The authors report no potential conflict of interest regarding this case report. Axel Petzold was supported by the National Institute for Health Research (NIHR) Biomedical Research Centre based at Moorfields Eye Hospital NHS Foundation Trust and UCL Institute of Ophthalmology. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health.

Research involving human participants and/or animals:

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

This article does not contain any studies with animals performed by any of the authors.

Informed consent:

The OCT images showing a fraction of the retina do not permit to identify the patient, no extra procedures were performed and therefore requirement for informed consent was waived by the institutional review board (Reference ROAD17/011).