Case Report

Diagnostic of Sellar Tumors Using Optical Coherence Tomography and Magnetic Resonance Imaging

Alicia López-de-Eguileta[*]**, Alfonso Casado**

Department of Ophthalmology, Hospital Universitario Marqués de Valdecilla-IDIVAL, Santander, Spain

*Corresponding Author: Dr Alicia López-de-Eguileta, Ophthalmology Department, Hospital Marqués de Valdecilla. Av. Valdecilla, 25, 39008 Santander, Cantabria, Spain, Tel: +34942202520; E-mail: alicialeguileta@gmail.com

Abstract

Purpose: The aim of this article is to raise awareness of the diagnosis utility of optical coherence tomography (OCT) in hemianopia as the first examination test.

Methods: Two patients with bitemporal hemianopia and progressive decrease in visual acuity underwent scanning by Spectralis OCT (Heidelberg Engineering, Dossenheim, Germany) and lately, by Humphrey field test and magnetic resonance imaging (MRI).

Results: Both patients showed retinal nerve fiber layer (RNFL) and ganglion cell layer (GCL) damage. Interestingly, GCL was reduced in nasal section in both eyes, whilst visual field showed bitemporal damage in both cases. MRI displayed sellar tumors, a craniopharyngioma and an hypophysis adenoma.

Conclusions: These cases and previous studies suggest that OCT analysis might be used as the first test in a hemianopic visual defect in addition to visual field testing and neurological exams to evaluate patients with lesions compressing the chiasm. GCL analysis might be consider as a neurological screening test to use at the onset of diagnosis process.

Keywords: Sellar tumor; Optic neuropathy; Retinal nerve fiber layer; Visual field test; Optical coherence tomography; Ganglion cell layer

1. Introduction

Sellar tumors represent a complex and wide group tumors which usually cause progressive decrease of visual acuity and/or constriction of the visual fields. Indeed, chiasmal compression typically produces a progressive bitemporal hemianopia which remains undetected by most patients until it is either dense or involves central vision [1]. However, it is difficult to predict visual compromise purely on the basis of magnetic resonance imaging (MRI) [2]. Therefore, the recent evidence-based guidelines added neuro-ophthalmology assessment with automated perimetry such as Humphrey visual fields (VF) and optical coherence tomography (OCT) [1, 3]. OCT technology is an inexpensive, reproducible, high resolution imaging technique and it has demonstrated to be useful for assessing optic nerve and macular thickness in vivo in several diseases [4]. In the present report, we describe two patients with hemianopia, which initial diagnostic suspicion was made through OCT before VF test and MRI.

2. Methods

We conducted a case review of two patients with hemianopia defect due to sellar tumors with MRI evidence of optic chiasm compression recruited from the Ophthalmology department of the University Hospital Marqués de Valdecilla (UHMV). Informed written consent were obtained from both patients. Patients underwent a detailed neuroophthalmologic evaluation, including measurements of best corrected visual acuity, color vision, pupillary and eye movements examinations, dilated funduscopic examination, automated perimetry with Humphrey visual field analysis [Swedish Interactive Thresholding Algorithm (SITA) 24:2 protocol], and OCT RNFL and GCL analysis.

Retinal thickness was measured with Spectral Domain (SD) Spectralis SD-OCT (Heidelberg Engineering, Heidelberg, Germany) using the images obtained by posterior pole analysis scan. Using this protocol, the OCT instrument automatically delineates a line joining the center of the fovea and the center of the optic disc as a reference line. Thereupon, 61 line scans (1024 A scans/line) parallel to the central reference line are recorded. The quality of the scans is indicated on a color scale at the bottom of the scanned images. Only scans in the green range were considered of sufficiently good quality for inclusion in this study. A masked investigator (ALE) examined all images of each eye to identify any segmentation or centered errors in the images. Segmentation analysis was performed using Heidelberg segmentation software (version 1.10.2.0) to calculate thickness of the GCL. RNFL thickness measurements of each individual eye were normalized for anatomic orientation of the fovea to optic nerve to an accurate and consistent positioning of the RNFL thickness measurement across eyes. Six sector areas (superotemporal, superior, superonasal, inferonasal, inferior, and inferotemporal) and the average were measured in both analyses.

3. Case Presentation

A 27-year-old and a 71-year-old men were admitted to our hospital with progressive decrease in visual acuity and bitemporal hemianopic defect. Visual exploration disclosed a mild reduction visual acuity in both cases, 20/20 in right eye (RE) and 20/25 in the left eye (LE), and 20/40 RE and 20/50 LE respectively. Slit-lamp examination

revealed no abnormal findings and dilated fundoscopic examination pale optic nerve with no apparent cupping in both eyes.

The patients underwent scanning by Spectralis OCT (Heidelberg Engineering, Dossenheim, Germany) and it showed retinal nerve fiber layer (RNFL) thinning in almost all sectors and ganglion cell layer (GCL) reduction in nasal sectors of both eyes. After this result, MRI and VF tests were obtained. Figure A represents the first patient, which MRI showed a sellar tumor, specifically a craniopharyngioma. The perimetry evidenced bitemporal hemianopia as the patient described, showing mirror defect when is compared with GCL damage. Figure B represents the second patient, with similar images. MRI showed a sellar tumor: hypophysis adenoma. Visual field test reported bipolar hemianopic damage in temporal region, the opposite defect displayed by GCL in OCT scan. GCL analysis showing predominantly binasal thinning consistent with chiasmal compression (the corresponding anatomical substrate underlying bitemporal hemianopia on visual field testing).
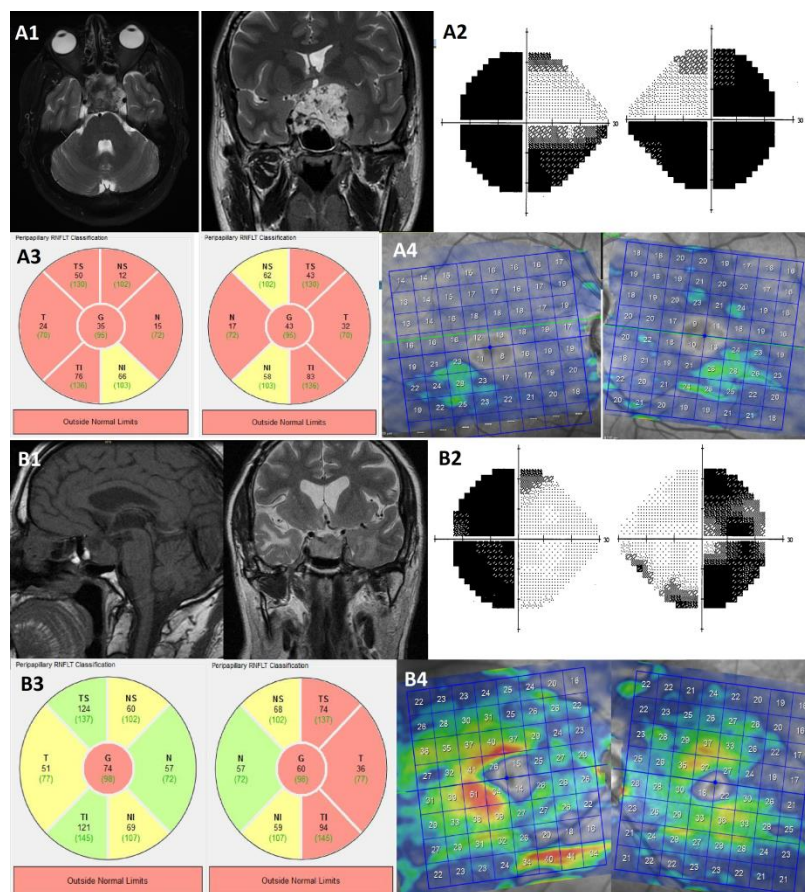

Figure A: A 27 years-old male which MRI showed a craniopharyngioma (A1) in both transverse and coronal slides. The perimetry evidenced bitemporal hemianopia (A2) and the OCT showed RNFL (A3) and GCL damage (A4).

Figure B: A 71 years-old patient whose MRI showed an hypophysis adenoma (B1). Visual field test depict bipolar hemianopic damage (B2), with the opposite defect displayed by GCL in OCT scan (B4) and RNFL atrophy (B3).

4. Discussion

OCT is routinely used in ophthalmology and is widely available to diagnose and follow retinal and optic nerve disorders. Different articles have provided further scientific evidence of direct application of RNFL to assess axonal injury for glaucoma disease, optic nerve inflammation, demyelinating and compressive optic neuropathies [5]. More recently, macular thickness measure was described as indicator of neural damage [6], due to retinal ganglion cells´ bodies and dendrites accounts for up to 40% of the thickness in the macular area in retina.

In the present article, RNFL and GCL analysis was affected significantly in both patients. Interestingly, GCL was damaged in nasal section in both eyes, whilst visual field showed bitemporal damage in both cases. Just through this examination we might elucidate there could be compression damage in the optic chiasm. Automated visual field testing supported this diagnosis. OCT assesses retinal structure damage, which generally correlates well with retinal function [7]. However, visual dysfunction may happen out of proportion to structural changes [8] and functional deficits such as bitemporal hemianopia, due to acute chiasmal compression, generally occur before structural damage colud be demonstrated. Thus, detectable GCL loss is delayed several weeks and it is captured by OCT only when retrograde degeneration has occurred. Acute compression affects visual fields before any GCL loss is apparent, reinforcing the importance of visual field assessment in these patients.

On the other hand, GCL is more sensitive for detection chronic chiasm compression or optic neuropathy as in glaucoma, where OCT detects retinal ganglion cell death before visual field defects occur (pre-perimetric glaucoma) [9]. In addition, OCT objectively measures retinal thickness and it is not as subject to patients' performance as visual field exam could be. Hence, OCT is useful to measure GCL looking for binasal defect when there is a question of chiasmal compression in patients with unreliable automated perimetry [10,11]. Even more, recent publications have reported abnormal GCL in patients with radiographic chiasmal compression but normal visual fields [10-12], hypothesizing GCL analysis might be more sensitive to detect compressive damage.

On the other hand, optic nerve pallor on funduscopic examination is subjective, whereas OCT allows objective measurement of optic atrophy, and provides reliable and reproducible measures of damage progression. In conclusion, GCL analysis might be considered as a neurological screening test in the detection of chronic compressive chiasmopathy, and should be routinely employ in addition to automated perimetry.

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