False Positive Hemianopia

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Abstract
A 70-year-old woman was urgently referred for neuro-ophthalmic evaluation when a routine visual field test demonstrated a pattern of bilateral nasal hemianopia. Detailed inspection of the visual field study revealed the hemianopias to be artifactual for the following reasons: (1) it was performed with an excessive number of false positive responses; (2) the grey scale plot had white patches, consistent with abnormally high sensitivity; (3) the total deviation probability maps were normal, indicating that no tested points had poor scores. Confrontational visual field testing was normal in all zones for both eyes. Repeated visual field testing showed no evidence of a true hemianopia. Even automated visual fields with highly specific abnormalities can merely be testing artifact. Scrutinize all components of the report before determining the clinical implications.

Introduction

Binasal hemianopia is an uncommon abnormality that is most often due to bilateral ocular disease such as keratoconus, ischemic optic neuropathy, optic nerve head drusen, glaucoma, bilateral optic nerve pits, and retinitis pigmentosa sine pigmento [1, 2]. Binasal hemianopia is rarely attributable to neurological etiologies, including bilateral internal carotid artery aneurysms, hydrocephalus, intracranial mass lesions, and pituitary apoplexy [1].

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Case Report

A 70-year-old woman presented to a community ophthalmologist due to eye discomfort when reading. On exam, she was noted to have large optic disc cups. She was, therefore, referred for an automated visual field and OCT study to rule out glaucoma. While the OCT demonstrated a normal retinal nerve fiber layer for both eyes, the visual field was concerning for a bilateral hemianopia that respected the vertical midline (Fig. 1). She was immediately referred for emergent neuro-ophthalmological evaluation.

The patient had no ocular or systemic complaints. Medical history included hypothyroidism, hypertension, and hypercholesterolemia with compatible medical treatment. Ocular history included left eye cataract surgery and LASIK surgery on both eyes. Best-corrected visual acuity was 6/12 in the right eye and 6/7.5 in the left eye. The pupils were equal with no relative afferent pupillary defect. Ishihara testing was normal for both eyes. Intraocular pressure was 10 mm Hg in both eyes. No abnormalities were found in the anterior segment. Fundus examination revealed bilateral optic disc cupping of approximately 0.7. Confrontational visual field testing was normal in all zones for both eyes. Detailed inspection of the visual field study suggested that the result was artifactual. The automated visual field test was repeated with no signs of a hemianopia.

Discussion

Detailed consideration of the case presents a series of reasons to regard the automated visual field report with skepticism:

1. The automated visual field suggests a binasal hemianopia, an uncommon abnormality most often a result of such bilateral ocular diseases as optic nerve pathologies – ischemic optic neuropathy, optic nerve head drusen, glaucoma, bilateral optic nerve pits, papilledema, or optic atrophy [1, 2]. Retinal diseases, including retinitis pigmentosa sine pigmento [1] or corneal pathology as keratoconus [3], have also described as possible
causes of binasal defect. In rare cases, binasal hemianopia has been attributed to neurological etiologies, including bilateral internal carotid artery aneurysms or atherosclerosis [4], hydrocephalus [5], olfactory groove meningioma [5], intracranial mass lesions, and pituitary apoplexy [1].

Pringle et al. [6] reported a case of progressive binasal visual field loss due to neurosyphilis. Also described are binasal hemianopia caused by pneumosinus dilatans of the sphenoid sinuses [7] and, recently, incomplete binasal visual field defects secondary to bilateral optic perineuritis due to sarcoidosis [8]. Several reported cases of idiopathic binasal hemianopia where no identifiable ocular or intracranial etiology were found [1, 9, 10] or which were defined as secondary to functional visual loss [11, 12].

2. The study was performed with poor technical reliability (gaze tracking, fixation losses, false positives, and left eye false negatives). While this does not rule out the possibility of a true visual field defect, it is a reason to suspect it.

3. Sensitivity to stimuli on the grey scale plot is inversely proportional to the darkness of the area. The better the patient’s sensitivity to the test stimuli, the fainter the corresponding area will appear on the grey scale plot. In an extreme case, where the scores are “superhuman”, the given area in the grey scale plot becomes so faint that it appears completely white [13]. Indeed, scores above 40 dB would be essentially impossible for the patient in question (Fig. 2).

4. The total deviation probability maps were normal, indicating that no tested points had poor scores.

5. The pattern deviation probability maps give a mistaken impression of hemianopias. The pattern deviation plot serves to identify areas in which the score is particularly poor for the eye being examined. Consider our patient’s right eye. The scores in the temporal field were extraordinarily high, while the scores in the nasal zone were essentially normal. Thus, when the nasal zone scores are compared with the average overall score for the eye, they are regarded as being relatively poor, and therefore highlighted in black. Thus, the areas of the visual field appearing to constitute a hemianopia from the pattern deviation plot in actuality possess normal scores. They have been incorrectly represented as abnormal due to the high false positive (“trigger-happy”) behavior occurring by chance in the temporal zones of each eye.

Where doubt exists concerning Humphrey visual field testing, confidence may be gained by utilizing such methods as examination by confrontation or by using Goldmann Visual Fields. Binasal visual loss, in a case of absence of ocular, retinal, or neurological lesion, might be confirmed or excluded by objective assessment of the visual pathway using visual electrophysiology [12]. Visual evoked potentials, using Hemifield or multifocal technique, can help detect post-chiasmal visual loss, while documenting the degree of functional deficit and may also be useful in cases when nonorganic visual loss is suspected [14]. Where unexplained progressive visual field loss in repeated perimetry testing occurs, other techniques might be employed [15].

This case illustrates that even highly specific visual field abnormalities can be testing artifact. It emphasizes the importance of scrutinizing all components of the report before determining the clinical implications.

**Statement of Ethics**

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. Ethical approval is not required for this study in accordance with local guidelines.
Conflict of Interest Statement

The authors report no conflict of interest.

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Author Contributions

Ravid Ben-Avi: manuscript writing and editing. Addy Nahum: patient management and data collection. Joshua M. Kruger: patient management and data collection, manuscript writing, and editing. All coauthors read and approved the final version of the manuscript.
Data Availability Statement

All data generated or analyzed during this study are included in this article.

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