HOMONYMOUS VISUAL FIELD DEFECTS
Perimetric findings and corresponding neuro-imaging results

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Abstract

Selected neuro-ophthalmological cases demonstrate the diagnostic capabilities of adequate perimetric techniques: centripetally condensed stimulus arrangement and threshold-oriented, slightly supraliminal perimetry revealed even very small homonymous visual field defects, resulting from a small cortical lesion not exceeding the extent of the calcarine fissure. Subtotal bilateral superior altitudinal scotomata without any corresponding ophthalmological pathologies in a 'pseudo-retinal nerve fiber layer patient' were attributable to a bihemispheric infarction in the inferior posterior cerebral artery circuit occurring at two separate dates. Two cases with infarctions in the superior region of one cerebral hemisphere, and involving the inferior parts of the other, leading to checkerboard defects, demonstrate another type of bilateral pathology. Structural and functional MRI demonstrated that macular sparing in one quadrant of the visual field is combined with contralateral and 'contra-altitudinal' structural and functional sparing of the occipital pole, whereas macular splitting is characterized by a structural and functional lesion of the matching occipital pole. Similar neuro-imaging techniques identified combined infarctions within the region of the geniculate body and of the very rostral part of the visual cortex to be the cause of a nearly unilateral hemianopic scotoma, considerably exceeding the temporal crescent. In conclusion, adequate application and interpretation of perimetric techniques in patients with presumed lesions of the post-chiasmal visual pathways are an essential neuro-ophthalmological diagnostic tool, as confirmed by corresponding neuro-imaging results.

Introduction

Homonymous visual field defects are caused by post-chiasmal lesions of the visual pathway. In the very frequent cases of post-geniculate localization, there will be no visible funduscopic counterpart, giving no indication of a morphological diagnosis. Thus, only functional involvement will supply the ophthalmologist with specific information about the type and localization of the lesion. In this context, the topo-diagnostic capability of perimetric procedures, especially in cases of lesions near the occipital

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pole due to the cortical magnification factor, is an important tool in determining the correct localization of the defect.

The aim of this report was to provide some examples of the wide variability within this group of lesions in the post-geniculate pathway, and to offer some solutions for coping with the difficulties occurring in these cases.

Reports and comments

Reading disturbances without a funduscopic correlate – highly indicative of circumscribed visual field defects

On examination with a centripetally condensed perimetric grid in threshold-oriented slightly supraliminal perimetry, a patient with acute worsening of her reading performance and missing morphological substrate in the fundus showed a homonymous visual field defect which was additionally demarcated by the horizontal as well as by the vertical meridian (Fig. 1). Such a perimetric finding is typical of small cortical lesions which pass over neither the calcarine fissure nor the interhemispheric fissure. Due to alteration in the immediate paracentral parts of the visual field, the reading performance of such a patient is affected[1]. Even though the defect is comparatively small, it can lead to appreciable restrictions in everyday life, also a problem for patients with macular splitting (see below).

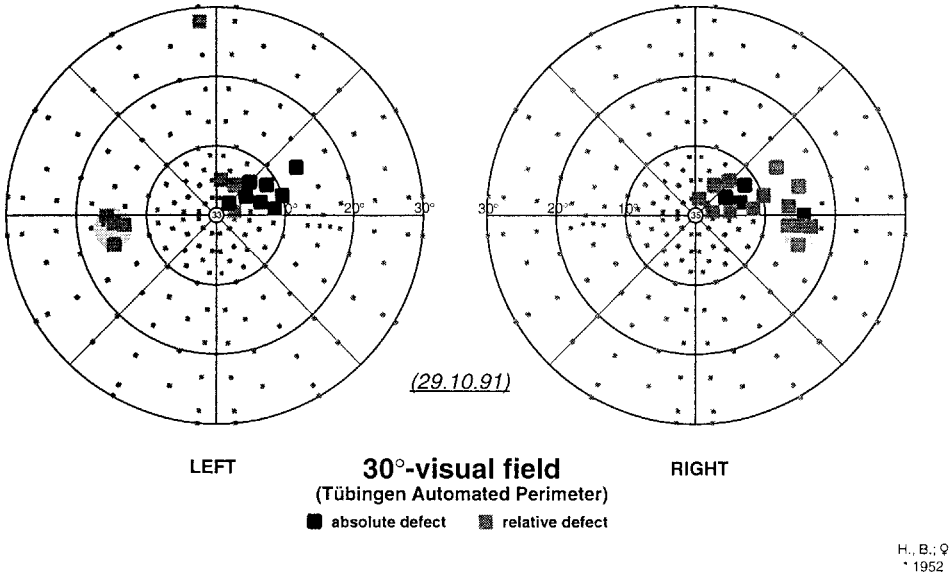

Fig. 1. Small visual field defects affecting the central visual field.

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acute vascular onset with the help of the CT in the beginning of such a process is not reliable at every stage, the examiner should consider it in patients with visual field defects without a morphological substrate in the fundus.

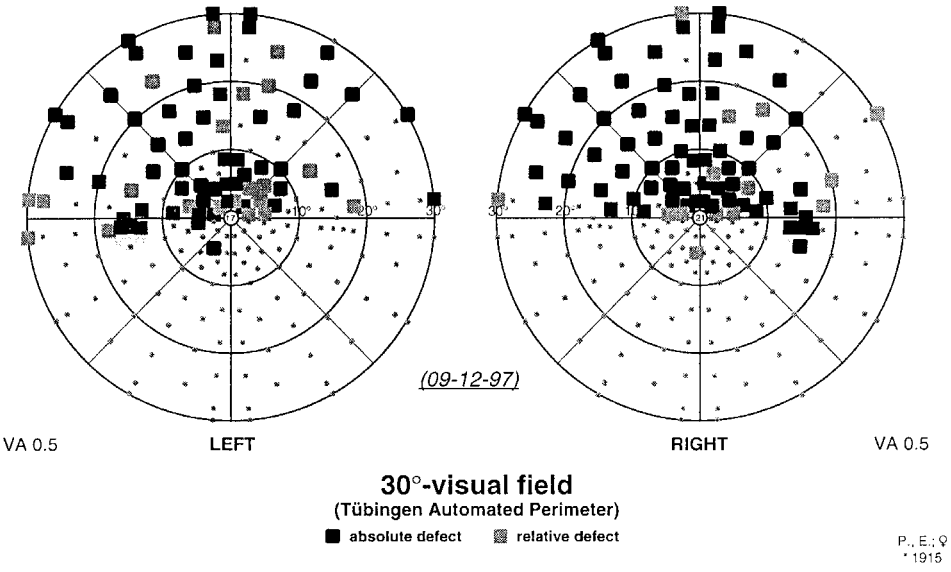

Fig. 2a. Subtotal superior altitudinal visual field defect of a patient with no morphological substrate in the fundus.

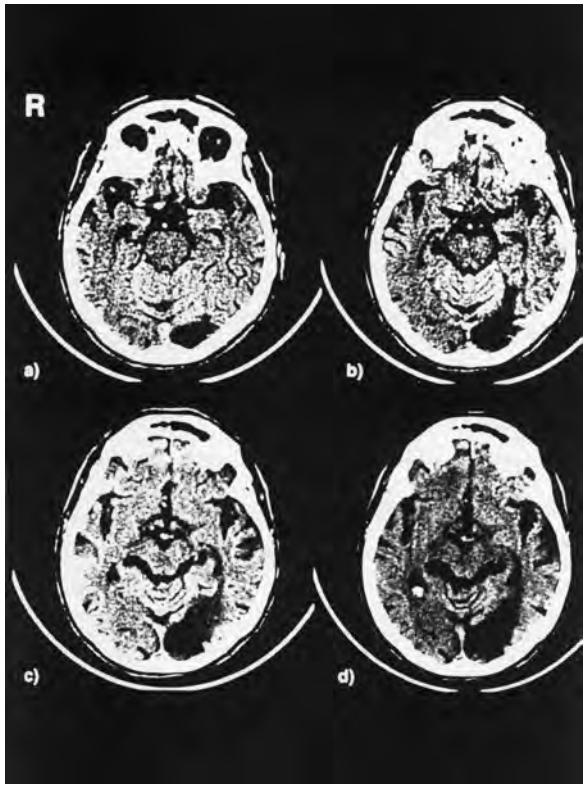

Fig. 2b. CT scan showing an older infarction of the lower left occipital pole and an acute infarction of the lower right occipital pole, which is not clearly visible at this early stage. Although the diagnosis of an

Bilateral lesions of the posterior visual pathways resulting in altitudinal or checkerboard visual field defects

Patients with an altitudinal visual field defect are highly likely to have advanced glaucoma (Fig. 2a). However, acute onset and missing corresponding findings in the fundus do not match a chronic retinal nerve fiber layer defect. In such cases, bilateral infarction of the upper/lower occipital pole should be considered (Fig. 2b).

Bilateral infarctions of the occipital pole can lead to another type of homonymous visual field defect by being not only opposite with respect to the interhemispheric bank, but also located in the upper and lower bank of contralateral hemispheres. Accordingly, the checkerboard lesion affects the upper occipital pole on one side and the lower occipital pole on the other[2]. However, in most cases, the remaining two quadrants are also affected, but to a lesser degree[3] (Fig. 3a). In extreme cases, the perimetric findings may lose much of their similarity to a checkerboard and resemble the findings demonstrated in Figure 3b.

Macular splitting/macular sparing – topographic correlation and consequences for reading performance

The question of whether patients with a homonymous hemianopia have macular sparing or not is not purely academic, but rather is extremely important for their reading performance[4]. Patients with complete macular splitting are clearly more handicapped than those presenting with macular sparing.

The origin of these phenomena can be explained by the neurovascular anatomy of the occipital pole[5] which is supplied by the calcarine artery and its branches. Unilateral involvement of a branch of the calcarine artery, and sparing of others, may lead

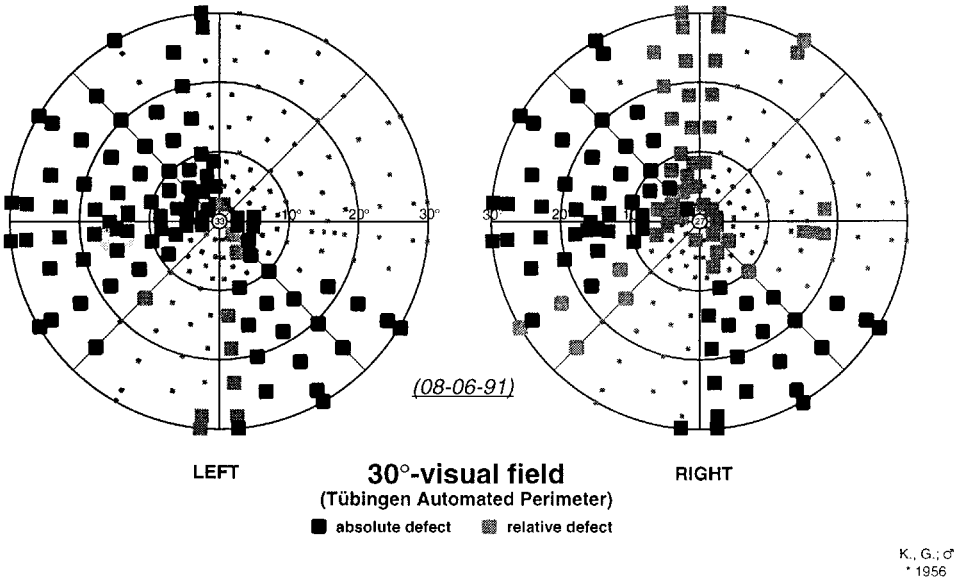

Fig. 3a. Typical checkerboard defects in a patient with bilateral infarctions of the posterior cerebral arterial circuit.

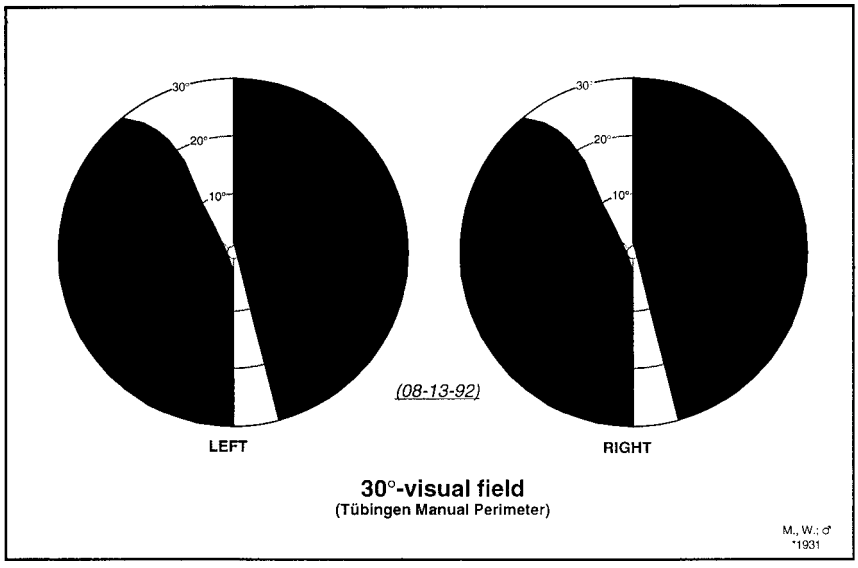

Fig. 3b. Extreme checkerboard defect in a patient with advanced bilateral infarctions of the posterior cerebral circuit.

to the interesting finding of a combination of macular splitting and sparing, with better reading capabilities than the patient would have if more branches, or the calcarine artery itself, were affected. In the latter case, complete macular splitting would be the consequence. If the entirely occipital pole is not involved in the infarction of the posterior arterial circuit, there should be complete macular sparing with preserved reading capabilities.

Incongruous homonymous lesions which seem to be unilateral at first glance

Extremely incongruous homonymous lesions (Fig. 4) can be due to unilateral involvement of the most anterior parts of the post-geniculate pathway. The lesion may be located in the very anterior parts of the optic radiation. On the other hand, unilateral involvement of the very rostral apex of the calcarine cortex will also result in a defect of the contralateral temporal crescent.

Involvement of the temporal crescent might be due to a lesion in the area of Meyer's loop or to damage to the very rostral parts of the striate cortex.

Discussion

The cases selected demonstrate that appropriate perimetric techniques provide the examiner with sufficient topo-diagnostic information[6]. This is important, not only for the initial diagnosis or for the documentation of the status quo of a patient, but also for adequate follow-up. In this context, it is important to remember that post-geniculate lesions are usually characterized by absolute scotomata. Thus, time-consuming thresholding methods can be replaced by supraliminal strategies with comparatively

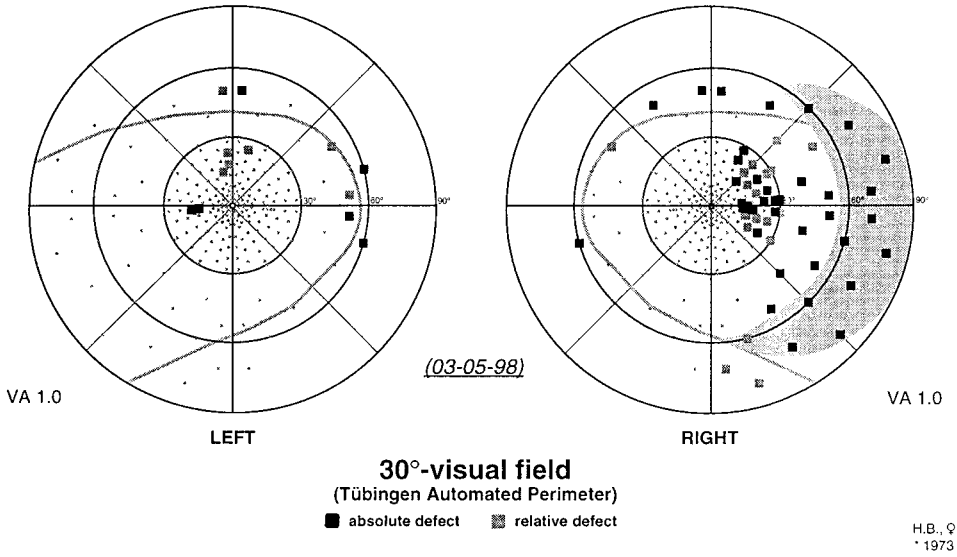

Fig. 4. Incongruous homonymous lesion in a patient with an infarction of the peripheral and central branches of the posterior cerebral artery.

high stimulus densities. Centripetal stimulus condensation maps the physiological cortical magnification[7] better than an equidistant rectangular grid, and thus is more effective. In this connection, test points should not be located directly on the vertical meridian, but rather to either side of it in order to enhance the hemianopic character of a visual field defect.

Perimetry is one of the most powerful non-invasive ophthalmological diagnostic tools, enabling the examiner to cope with the great variation in the appearance of lesions in the area of the postgeniculate pathway.

Acknowledgment

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