Full title: Failure to detect bitemporal field defects due to chiasmal compression on a screening perimetry protocol

Short title: Bitemporal field defect in chiasmal compression

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Abstract:

Chiasmal compression can present with bitemporal decrease of colour and contrast sensitivity. Here we compare the results obtained by the Amsler grid, confrontation to show red desaturation, Tinsley suprathreshold and Humphrey 24-2 protocol in a patient with a pituitary adenoma. The initial Amsler chart was positive. The suprathreshold protocol, used as a screening method in many centers, gave a false negative result. We discuss this important practical point in relation to the different stimulus attributes.

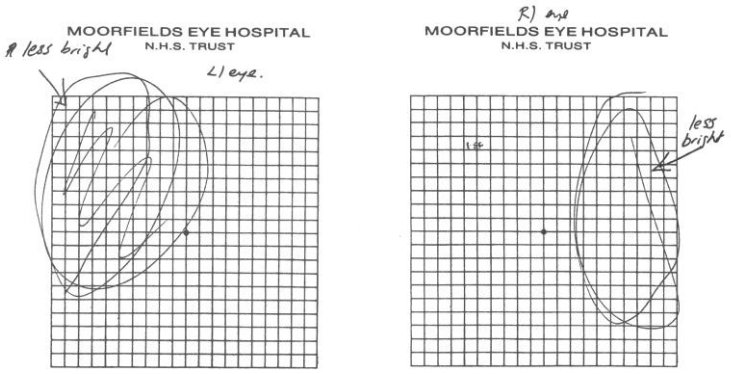
Key words: bitemporal field defect, chiasmal compression, perimetry.

Introduction:

Visual fields defects are one of the presenting signs of chiasmal lesions. Their early detection is of importance for surgery and postoperative outcome. Understanding the physiological basis of the different perimetric test is important for correct interpretation of contradicting results in clinical routine.

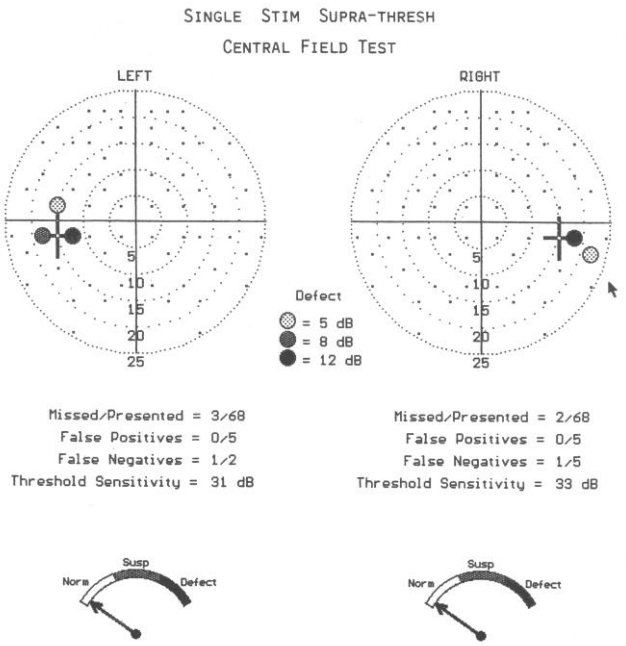
Case report

We report on a sixty year old art teacher with a two year history of visual symptoms. Initially she described disturbance of her vision which was attributed to stress. She was referred to Moorfields Eye Hospital. Visual acuity with spectacles was 6/9+3 in each eye without further improvement on pinhole test. Anterior segment, pupil reaction, intraocular pressures and fundi were entirely normal. The Amsler chart showed bitemporal fading of the grid lines (Fig. 1).

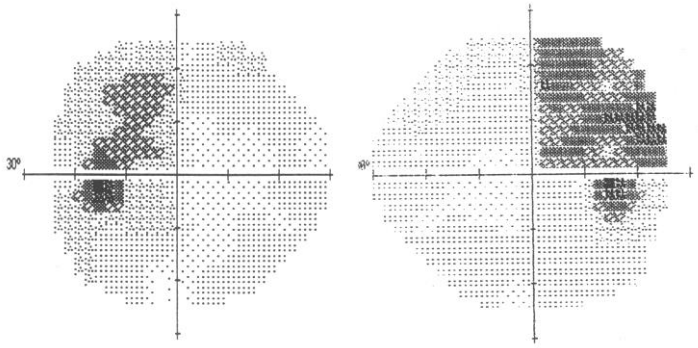


Visual fields on automated perimetry (Tinsley suprathreshold protocol) however were

normal (Fig. 2). The patient was reassured and discharged.

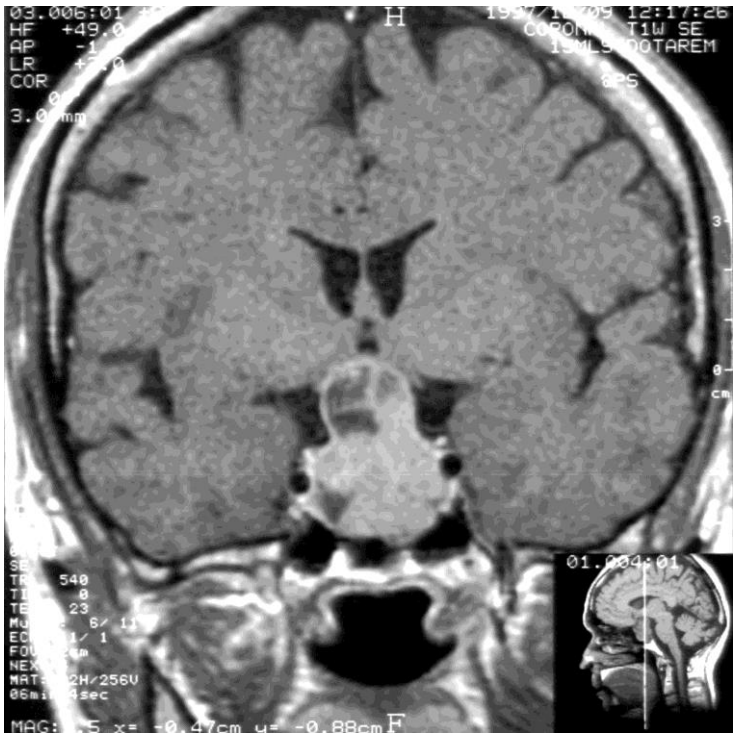


One year later she was referred back because she felt her left vision was still "odd" and sought reassurance that no brain tumor or anything serious was going on. The examination revealed relatively preserved visual acuity with 6/5 N5 and 6/12 N5 with correction (-0.5/-0.25x150, -0.25/-0.25x30). The patient noticed further disturbance of her vision and two months later her visual acuity was: 6/6 and 6/60 N8 (left). She read only 10/17 (right) and 4/17 (left) of Ishihara charts, had a mild left afferent pupillary deficit and a bitemporal hemianopia to red on confrontational testing. Optic discs, retinal nerve fibre layer and macula were normal on direct ophthalmoloscopy.



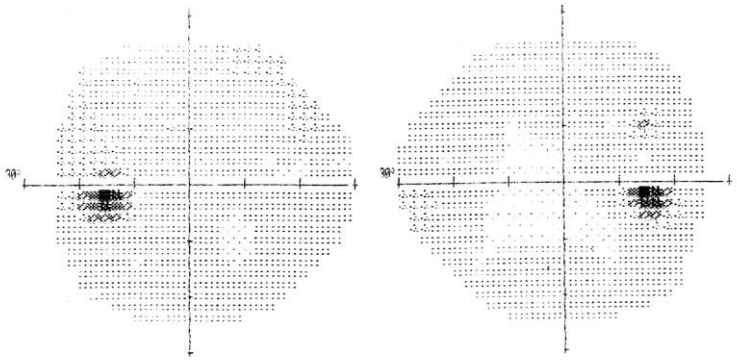
The 24-2 automated Humphrey field (Fig. 3) showed a superior bitemporal visual field defect.

The CT brain scan revealed a moderately large sellar and suprasellar mass compatible with a pituitary adenoma. On the MRI the superior region of the mass appeared cystic and the optic chiasm was stretched over the tumor (Fig. 4).



Prolactin levels were 1328 mU/L (14.7-399 mU/L), T4 5.2 pmol/L (normal range: 8.8-22 pmol/L) and TSH 6.8 mU/L (normal range: 0.25-5 mU/L), LH 1.4 U/L, FSH 8.3 U/L. Cortisol at 454 nmol/L was within the normal range.

The patient was transferred to the National Hospital for Neurology and Neurosurgery for transphenoidal hypophysectomy and her vision made a good recovery to 6/6 N5 in the left eye and 6/6-3 N5 in the right eye with full colour vision on the Ishihara charts. Her visual fields using the Humphrey 24-2 protocol returned to normal (Fig. 5).



Discussion

Visual field examination techniques should be used in a complementary manner. It is well known that the visual field sensitivity can be affected by many different stimulus attributes such as size, chromaticity, contrast, duration, background illumination and various other factors [1-3]. Stimulus size is the most important of these parameters for clinical perimetry [1]. For better comparison the stimulus size should be given in degrees of visual angle.

The Amsler grid is held at 30 cm from the eye, where each 5 mm square subtends 1° of visual angle. The line thickness of 0.2 mm corresponds to 0.076° (2*[tan-1

radius/viewing distance], with radius and viewing distance in cm). The Tinsley perimetry (suprathreshold testing) is used for screening purposes and has the advantage of a brief testing time. At a viewing distance of 30 cm each stimulus subtends 0.5° with a distance between adjacent stimuli of 3° on a square grid. Background luminance is 3.14 cd/m² and the stimulus intensity is set in the suprathreshold mode to a starting value of 5 dB above the threshold estimate. If missed they are automatically tested a second time and only marked as missed if not seen on both occasions. Those missed on both occasions at 5 dB are then further tested at 8 dB and 12 dB above threshold estimate. In the Humphrey 24-2 protocol a Goldmann No. III (0.481°) stimulus is used and the test grids subtend 6°.

The patient reported a subjective loss of suprathreshold contrast in both temporal fields which was not detected by a suprathreshold technique. It was however picked up on the very first visit by the Amsler testing. Interestingly, the patient reported fading of the lines plotted on the Amsler grid. Each of these lines is represented by about 0.076°, which is less than a fifth of stimulus size and about a third of the minimal stimulus distance tested in the Tinsley suprathreshold protocol. The failure to detect the bitemporal field defect by the screening perimetry protocol is thus a consequence of stimulus size (0.5° as opposed to 0.076°) and the fact that is a suprathreshold technique.

The visual field defect suggested by the Amsler chart was confirmed one year later by the 24-2 Humphrey threshold protocol. We would speculate that quantitative manual perimetry, colour perimetry or threshold static perimetry would have detected the abnormality at the initial presentation: certainly the patient's subjective report should have been taken more seriously.

Colour perimetry has been used to improve upon the early detection of optic nerve disease and glaucoma [3, 4]. In the presented case clinical examination revealed desaturation of a red stimulus corresponding to the bitemporal superior field deficit. Recent measurement techniques use blue-on-yellow, flicker, contrast sensitivity [6] and motion stimuli to improve the early detection of visual field loss [4,5]. Contrast sensitivity can be considerably decreased in the presence of normal visual acuity and visual fields as tested by the Humphrey 30-2 [6].

The early occurrence of a superior bitemporal field defect (Figure 1) caused by pituitary adenomas is the typical clinical presentation. It has been described as early as 1903 by the Swedish internist Arnold Josefson [7]. Recovery of visual fields (Figure 5) occurs during the first days or weeks following surgery and is the rule if surgery is performed early [8]. Peter and De Tribolet (1995) report in their study on 53 patients undergoing transphenoidal hypophysectomy improvement of visual fields in 89% and of visual acuity in 82% [9]. The outcome however depends upon the early detection of the pituitary tumor as delay can complicate the surgery and thus worsen the postoperative results or alternatively optic atrophy may occur and the visual deficit become irreversible. Powell (1997) shoed that the prognosis for visual recovery was worse in patients in whom visual acuity loss as well as visual field loss had occured [10].

This case emphasizes the importance to keep in mind the advantages and disadvantages of the various procedures used in routine clinical examination for evaluation of the visual fields. Amsler grid and confrontation fields (also to red)

should form part of each clinical examination and complement the automatic perimetry. Needless to say when an abnormality is detected by one method (in this case Amsler) and not by another (suprathreshold screening) an understanding of the physiological basis of the tests will clearly point to the likelihood of a false negative result.

Figure 1: The Amsler grid shows a superior bitemporal disturbance of the visual fields in a 60 year old woman complaining of visual impairment. The region of the grid indicated appeared less bright with "broken" lines. At a viewing distance of 30 cm one square subtends 1° and the line thickness is about 0.076° of visual angle. This is a third of the minimal stimulus separation and less than a fifth of stimulus size as used in the supratreshold protocol (Fig. 2).

Figure 2: Results of the Tinsley supratreshold protcol as taken at the same day as the Amsler grid shown in Figure 1. The blind spot is well defined and the visual fields appear normal. Visual angle of stimulus size is 0.431° and stimuli separation ranges from 0.2° in the upper viual field to 1.3° in the lower visual field. The area covered by the Amsler grid is shown superimposed on the left.

Figure 3: The Humphrey 24-2 protocol of the same patient one year later after the contradictory results of Figure 1 and 2. The superior bitemporal visual field loss extends from 100 to 7943 ASB on the right and from 100 to 2512 ASB. Stimuls size 0.431° and stimulus separation 6°.

Figure 4: The coronal and saggital T1 MRI scans show a large suprasellar gadolinium enhancing mass lesion with cystic components and an enlarged sella. The optic chiasm is stretched over the tumor.

Figure 5: The post operative Humphrey 24-2 protocol shows full recovery of the visual fields.

References

[1] Wall M, Kardon R, Moore P. Effects of stimulus size on test-retest variability. In: Mills RP, editor. Perimetry Update 1992/1993. Kugler, Amsterdam: 1993; 371-376.

[2] Flanagan JG, Hovis JK. Colored targets in the assessment of differential light sensitivity. In: Heijl A. Perimetry Update 1988/1989. Kugler, Amsterdam: 1989; 67-76.

[3] Genio C, Friedmann AI. A comparision between white light and blue light on about 70 eyes of patients with early glaucoma using the Mark II. Documn Ophthal Proc Ser 1981; 26: 207-214.

[4] Harwerth RS, Smith EL 3rd , Chandler M. Progressive visual field defect from experimental glaucoma: measurements with white and colored stimuli. Optom Vis Sci 1999; 76: 558-570.

[5] Fitzke FW, McNaught AI. The diagnosis of visual field progression in glaucoma. Curr Opin Ophthalmol 1994; 5: 110-115.

[6] Porciatti V, Ciavarella P et al. Losses of hemifield contrast sensitivity in patients with pituitary adenoma and normal visual acuity and visual fields. Clin Neurophys 1999; 110: 876-886.

[7] Bynke H. A Swedish thesis of 1903 dealing with bitemporal hemianopsia. Neuro-Ophthalmology 1999; 21: 123-129.

[8] Cohen AR, Cooper PR et al. Visual recovery after transsphenoidal removal of pituitary adenomas. Neurosurg 1985; 17: 446-452.

[9] Peter M, De Tribolet N. Visual outcome after transphenoidal surgery for pituitary adenomas. Br J Neurosurg 1995; 9: 151-157.

[10] Powell M. Recovery of vision following transsphenoidal surgery for pituitary

adenomas. Br J Neurosurg 1995; 9: 367-373.