Visual prognostic value of the pattern electroretinogram in chiasmal compression

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Abstract

Background/aims—The visual loss associated with compression of the optic chiasm by pituitary tumours may be transient or permanent, possibly related to the extent of irreversible retrograde degeneration to the retinal ganglion cells. The pattern electroretinogram (PERG) N95 component is thought to rise in relation to retinal ganglion cell function and hence may be a potential prognostic indicator for visual function following decompressive surgery.

Methods—The notes and electrodiagnostic records of 72 eyes from 36 patients with chiasmal compression were retrospectively analysed.

Results—The postoperative change in visual field was found to be associated with the PERG N95:P50 ratio (p=0.01). Improvement in visual field was shown by a greater proportion of eyes with a normal N95:P50 ratio (65%) than with an abnormal ratio (27%). No change in visual field occurred in 26% of the eyes with a normal N95:P50 ratio compared with 67% of those with an abnormal ratio. Only 8% of eyes showed a worsening of visual field following surgery, in similar proportions for eyes with normal and abnormal N95:P50 ratios. There was no significant relationship with visual acuity.

Conclusion—The PERG is a useful visual prognostic indicator in the preoperative assessment of chiasmal compression.

Methods—The checkerboard transient PERG was recorded in accordance with the guidelines of the International Society for Clinical Electrophysiology of Vision (ISCEV). Gold foil recording electrodes (CH Electronics, London) were placed in the fornix of the lower eyelid and referred to ipsilateral outer canthus silver-silver chloride electrodes with a mid forehead earth. In early patients the signals were processed by a Nicolet CA-1000 averaging computer with internal artefact rejection and a bandwidth of 1–100 Hz/3 dB. For later patients a Neuroscience recording system was used with similar characteristics. There were a minimum of 200 averages per trial with a minimum of two trials performed to confirm the reproducibility of the waveform. Checkerboard reversal was performed by a Digitimer moving mirror stimulator subtending a total field of 14 degrees at the eye with an individual check size of 34 minutes. The mean luminance was 400 cd/m² with 89% contrast (non-linear, retinal and macular dysfunction, whereas the negative N95 component is principally affected in optic nerve disease. Furthermore, the ratio between N95 and P50 has been shown to be an effective measure of retinal ganglion cell function; in more severe ganglion cell dysfunction P50 may also show reduction.

Compression of the optic chiasm by tumours such as pituitary adenomas can lead to compromised visual function that may be transient, but may persist following decompressive surgery. The degree of postoperative recovery is thought to depend in part on the degree of structural damage involving retrograde degeneration to retinal ganglion cells. While the visual evoked potential (VEP) enables an assessment of chiasmal function, it provides no indication of possible retinal ganglion cell degeneration secondary to tumour compression, and hence is of no prognostic value with regard to postoperative visual outcome.

The pattern electroretinogram (PERG) originates from the inner retinal layers, enabling an assessment of ganglion cell function, and is increasingly used in the assessment of anterior visual pathway dysfunction. The normal PERG consists of a prominent positive component, P50, with a later negative component, N95. The positive P50 component is invariably affected in retinal and macular dysfunction, whereas the negative N95 component is principally affected in optic nerve disease. Furthermore, the ratio between N95 and P50 has been shown to be an effective measure of retinal ganglion cell function; in more severe ganglion cell dysfunction P50 may also show reduction.

Structural damage which compromises retinal ganglion cell function could therefore be expected to lead to PERG abnormalities associated with a poor postoperative visual outcome. The aims of the present study was to ascertain the potential of the PERG for predicting postoperative visual outcome in chiasmal compression.
The main outcome variables were the intraocular N95:P50 ratio obtained from the transient PERG, change in visual acuity, and visual field. The lower limit of the N95:P50 ratio was taken as 1.1. The degree of visual field defect was estimated as a quadrantanopia, hemianopia, or central scotoma. A score of 1 was given for each quadrant of visual field loss, as well as for a central scotoma, up to a maximum of 5 representing total loss of visual field.

The extent of visual acuity loss was recorded by adding a score of 1 for each line of acuity lost after 6/5 (score=0) to NPL (score=11). For statistical analysis Fisher’s exact test (Statistical Software, Release 5.0, Texas, USA, 1997) was used.

Results
Table 1 shows the postoperative change in visual field for eyes with normal and abnormal (<1.1) preoperative N95:P50 ratios. These data provide strong evidence of an association between N95:P50 ratios and visual field change following surgery (p=0.01). A greater proportion of eyes with a normal N95:P50 ratio (64.91%) showed improvement in visual field than those with an abnormal ratio (26.67%). Only 8.33% of eyes showed a worsening of visual field following surgery, in similar proportions for eyes with normal (8.77%) and abnormal (6.67%) N95:P50 ratios. The percentage of eyes whose visual fields remained unchanged was much greater in those with an abnormal N95:P50 ratio (66.67%) than those with a normal N95:P50 ratio (26.32%).

Table 2 shows the change in visual acuity postoperatively for eyes with normal and abnormal (<1.1) preoperative N95:P50 ratios. Column percentages are shown.

Table 1  Change in visual field (VF) for eyes with normal and abnormal (<1.1) preoperative N95:P50 ratios. Column percentages are shown.

<table>
<thead>
<tr>
<th>VF</th>
<th>Abnormal N95:P50</th>
<th>Normal N95:P50</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worse</td>
<td>1 (6.67%)</td>
<td>5 (8.72%)</td>
<td>6 (8.33%)</td>
</tr>
<tr>
<td>No change</td>
<td>10 (66.67%)</td>
<td>15 (26.32%)</td>
<td>25 (34.72%)</td>
</tr>
<tr>
<td>Improved</td>
<td>4 (26.67%)</td>
<td>37 (64.91%)</td>
<td>41 (56.94%)</td>
</tr>
<tr>
<td>Total</td>
<td>15 (100.00%)</td>
<td>57 (100.00%)</td>
<td>72 (100.00%)</td>
</tr>
</tbody>
</table>

Fisher’s exact test (p=0.01).

Table 2  Change in visual acuity (VA) for eyes with normal and abnormal (<1.1) preoperative N95:P50 ratios. Column percentages are shown.

<table>
<thead>
<tr>
<th>VA</th>
<th>Abnormal N95:P50</th>
<th>Normal N95:P50</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worse</td>
<td>4 (26.67%)</td>
<td>13 (22.81%)</td>
<td>17 (23.61%)</td>
</tr>
<tr>
<td>No change</td>
<td>2 (13.33%)</td>
<td>21 (36.84%)</td>
<td>23 (31.94%)</td>
</tr>
<tr>
<td>Improved</td>
<td>9 (60.00%)</td>
<td>23 (40.35%)</td>
<td>32 (44.44%)</td>
</tr>
<tr>
<td>Total</td>
<td>15 (100.00%)</td>
<td>57 (100.00%)</td>
<td>72 (100.00%)</td>
</tr>
</tbody>
</table>

Fisher’s exact test (p=0.224).
abnormalities of the PERG reflect dysfunction at a more distal site, specifically the retinal ganglion cells, and enable an assessment of visual prognosis.

In conclusion, the results confirm that the PERG may be a useful prognostic indicator in the preoperative assessment of chiasmal compression. An eye with demonstrable retinal ganglion cell dysfunction, as shown by an abnormal N95:P50 ratio, is less likely to be associated with clinical improvement following surgery than an eye with a normal PERG. A prospective study may assist in the identification of the exact parameters to provide a more accurate prognosis in an individual patient.