Visual Field Defects and the Prognosis of Stroke Patients

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Abstract:
Visual Field Defects and the Prognosis of Stroke Patients

The prognosis of stroke patients is related to the presence or absence of homonymous hemianopia at time of admission to a stroke center. Two hundred thirty-four patients were followed for an average of 15 months. In patients with nonhemorrhagic strokes in the middle cerebral artery territory the presence of a dense homonymous hemianopia lasting for more than 24 hours, together with any degree of motor, sensory or speech defect, seemed to affect adversely the potential for rehabilitation and survival. Data were insufficient to draw similar conclusions with other types of cerebrovascular lesions. The pertinent literature is briefly reviewed.

Additional Key Words: homonymous hemianopia, rehabilitative potential, stroke center, middle cerebral artery territory, thrombosis, survival

Stroke centers are an increasing and somewhat controversial phenomenon in American medicine. They may be primarily research or patient-care oriented. One of the problems in a patient-care oriented stroke center is that of selection of patients for admission. This work represents an initial attempt to identify some of the factors which might help the physician determine which patients would benefit most from admission to a stroke center of limited size which is thus unable to accommodate all referred patients.

Can the prognosis and rehabilitative potential of patients with various types of cerebrovascular disease reasonably be predicted from some of their initial or presenting clinical findings? While it is obvious that a 99-year-old, comatose, quadriplegic, severely diabetic, hypertensive and uremic patient has a poor rehabilitative potential, it is not as obvious which conscious patients without other serious disease may have reasonable rehabilitative potential.

Therefore, it was decided to evaluate the possible prognostic significance of visual field defects at the time the patient is first presented for admission to a stroke center.

Methods
The records of 265 consecutive patients admitted to the University of Mississippi Medical Center Stroke Unit, Jackson, Mississippi, were reviewed. Of these, 234 had definite diagnoses of various types of cerebrovascular disorders and thus were included in the present evaluation. Their neurological findings on admission were reviewed and categorized according to the presence or absence of aphasia, mild or marked motor deficit, marked sensory deficit, and the presence or absence of homonymous visual field defects to confrontation testing. Patients were arbitrarily defined as having a definite visual field defect only if they had homonymous hemianopia (or, rarely, homonymous quadrantanopia) persisting for more than 24 hours and which was not solely detectable by extinction testing. Formal detailed visual field examinations usually were not done on these patients and therefore were not included in the analyses. The neurological findings were then related to the patient's discharge diagnosis, in some instances to the patient's age, and to the patient's status after an average follow-up time of 15 months. Patients were classified at the time of follow-up as ambulatory without aid, ambulatory with aid, bedridden or dead. The diagnoses of the various types of cerebrovascular disorders were made in accordance with the definitions given in an earlier communication.1 Reasonably reliable follow-up information could be obtained for over 95% of the stroke patients.

Results
Table 1 presents an overall summary of the results. The patients with all types of cerebrovascular disorders were included in this table to permit inspection for any prognostic clues which might relate the presence or absence of visual field defects to the patient's rehabilitative potential. As expected, the largest group had middle cerebral artery territory infarctions. This group was further divided into those below the age of 65, those aged 65 and over, and those comatose at the time of admission. Of course, the comatose patients could not be included in analysis of the presence or absence of visual
TABLE 1

Follow-up Data on Stroke Patients With or Without Field Defects on Admission. Average Follow-up 15 Months

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No</th>
<th>% Died</th>
<th>% Bedridden</th>
<th>% Ambulatory with aid</th>
<th>% Ambulatory without aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle cerebral territory infarction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age &lt; 65 No field defects</td>
<td>47</td>
<td>15</td>
<td>9</td>
<td>51</td>
<td>25</td>
</tr>
<tr>
<td>With field defects</td>
<td>24</td>
<td>33</td>
<td>25</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Age + 65 No field defects</td>
<td>14</td>
<td>14</td>
<td>22</td>
<td>43</td>
<td>21</td>
</tr>
<tr>
<td>With field defects</td>
<td>16</td>
<td>63</td>
<td>25</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Comatose on admission</td>
<td>3</td>
<td>67</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Anterior cerebral territory infarcts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(no field defects)</td>
<td>11</td>
<td>0</td>
<td>9</td>
<td>55</td>
<td>36</td>
</tr>
<tr>
<td>Carotid occlusions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No field defects</td>
<td>5</td>
<td>20</td>
<td>0</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>With homonymous defects</td>
<td>2</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Posterior cerebral territory infarcts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(all had field defects)</td>
<td>3</td>
<td>33</td>
<td>0</td>
<td>33</td>
<td>34</td>
</tr>
<tr>
<td>Lateral medullary infarcts</td>
<td>6</td>
<td>33</td>
<td>0</td>
<td>17</td>
<td>50</td>
</tr>
<tr>
<td>Pontine infarcts</td>
<td>5</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>Midbrain infarcts</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Basilar territory infarctions (unclassified)</td>
<td>5</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Embolism</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No field defects</td>
<td>6</td>
<td>50</td>
<td>0</td>
<td>17</td>
<td>33</td>
</tr>
<tr>
<td>With field defects</td>
<td>6</td>
<td>17</td>
<td>17</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td>Comatose on admission</td>
<td>2</td>
<td>50</td>
<td>50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Intracerebral hemorrhage or</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hemorraghic infarction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No field defects</td>
<td>7</td>
<td>14</td>
<td>29</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>With field defects</td>
<td>7</td>
<td>43</td>
<td>0</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>Comatose on admission</td>
<td>14</td>
<td>93</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Transient ischemic attacks</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>92</td>
</tr>
<tr>
<td>Aneurysms, ruptured</td>
<td>13</td>
<td>46</td>
<td>15</td>
<td>0</td>
<td>39</td>
</tr>
<tr>
<td>Other subarachnoid hemorrhages</td>
<td>8</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>75</td>
</tr>
</tbody>
</table>

field defects. In the middle cerebral territory infarction group, both young and older patients without visual field defects on admission seemed to have a better prognosis for improvement. On the other hand, the prognosis for recovery seemed dismal in the patients aged 65 or more who presented with visual field defects. None of the 16 patients in this group were ambulatory without aid on follow-up. As expected, the prognosis was poor in the patients that were comatose on admission.

The patients with anterior cerebral territory infarcts of course had no visual field defects and are merely included for the sake of completeness in table 1. The prognosis in this type of stroke seemed generally fairly good.

Of seven patients with carotid occlusions, two had homonymous field defects; both were dead at the time of follow-up. Three out of five patients without field defects were ambulatory without aid at the time of follow-up. All of these patients had marked neurological deficits on admission and did not simply have silent carotid occlusions, and all had demonstrated carotid occlusions on angiography.

Patients with posterior cerebral territory infarcts, all of whom had visual field defects, had a one-third mortality rate and the remainder were ambulatory on follow-up.

Table 1 also lists patients with lateral medullary, pontine, midbrain and other vertebral-basilar territory infarctions, none of whom had visual field defects. The prognosis as expected was worse in the basilar thrombosis group.

In the group with cerebral embolism there was an equal number with and without field defects, but the number of patients was small and the data thus are not conclusive. It would be difficult to state whether the presence or absence of visual field defects influenced the prognosis in this group.

The group with intracerebral hemorrhages or hemorrhagic infarcts who were not comatose and were testable seemed to have a mortality rate somewhat higher if a visual field defect was present, but again the patient groups were small (seven in each category) and the same number of patients were ambulatory with or without aid in each group on follow-up. As expected, the mortality rate was very high in patients with hemorrhages who were comatose at the time of admission.
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The last three categories of patients included in table 1 for the sake of completion included transient ischemic attacks and various subarachnoid hemorrhages, none of which had field defects on admission.

Figures 1 through 3 present graphic analyses of the largest patient group, that with middle cerebral territory infarcts. It was felt that the number of patients with this diagnosis was large enough to permit division into groups showing or lacking certain other neurological findings that might have a bearing on their rehabilitative potential.

Figure 1 categorizes patients as having marked or minor motor deficits on admission, either with or without field defects. As one might reasonably expect, the prognosis seemed to be poorer in those patients who had marked motor deficits plus field defects and best in those with mild motor deficits without field defects. However, the prognosis did seem to be considerably better in the group having marked motor deficits without field defects than in the same group with field defects.

Figure 2 presents a similar analysis comparing patients with or without sensory deficits and with or without homonymous visual field defects. Again, the prognosis seemed better in those who had no sensory deficit and no visual field defect than in other groups. It would seem that the presence or absence of a field defect had more bearing on the prognosis than the presence or absence of a sensory deficit as judged by this crude type of analysis.

Figure 3 includes only patients with left middle cerebral territory infarcts and compares the presence or absence of aphasia and visual field defects. Most of the patients with aphasia plus field defects died or were bedridden on follow-up. Those aphasic without field defects seemed to have a considerably better prognosis. However, there were few nonaphasics with field defects.

An attempt to relate brain scan data to the neurological findings and to the prognosis of these stroke patients (positive versus negative scans, size and location of uptake) was inconclusive due to the variable times at which brain scans were obtained after admission of the patient and after the onset of his stroke.
Followup data of patients with "middle cerebral territory" infarcts presenting with sensory deficits and/or visual field defects (average followup 15 months)

On admission:
- Sensory deficit plus field defect
- Sensory deficit without field defect
- No sensory deficit but with field defect
- No sensory deficit but, without field defect

FIGURE 2

Comments
A preliminary conclusion from the data presented here is that the presence on admission of a dense homonymous hemianopia lasting for more than 24 hours together with any degree of motor, sensory or speech deficits adversely affects the potential for successful rehabilitation and survival. The presence of a visual field defect thus may have some usefulness as a "triage" device in selecting patients for admission to maximum rehabilitative facilities, when the capacity is smaller than the demand. The data presented here are insufficient to permit any conclusions of the effect of visual field defects on the prognosis of strokes in other cerebral territories or due to other causes.

Of necessity, patients comatose on admission could not be evaluated in the fashion necessary for this study. Also excluded were a few patients who were too demented to permit any reliable neurological assessment at the time of admission or who had had multiple and obviously devastating strokes.

The limitations of the present type of study are obvious. Looking only at field defects as a prognostic factor is probably an oversimplified approach. The study also does not take into detailed account the presence or absence of other serious disease which might influence long-term survival.

The confrontation method of visual field testing is not very accurate. The present study should be repeated with more sophisticated neuro-ophthalmological examinations in the future. On the other hand, detailed ophthalmological evaluation of patients with acute cerebrovascular episodes is frequently difficult.

An obvious explanation of the significance of visual field defects in relation to the prognosis would be the fact that the presence of a homonymous
Follow-up data of patients with "left middle cerebral territory" infarcts presenting with aphasia and/or visual field defects (average follow-up 15 months)

On admission:
- aphasic with field defect
- aphasic without field defect
- not aphasic, with field defect
- not aphasic, without field defect

FIGURE 3

visual field defect implies a larger lesion and therefore a poorer rehabilitative potential. Visual field defects may represent simply another sensory modality that is impaired in the patient. The presence of significant sensory loss with a cerebrovascular episode has been quoted as having a negative effect on the rehabilitative potential. The present study points out that this is indeed so, but adds that visual field defects may have an additional negative effect on outlook for long-term survival. Stern and co-workers also state that the poorest functional outcome in patients with strokes was seen in patients who had hemisensory losses in addition to hemiplegia.

Van Buskirk and Webster also assessed the prognostic value of sensory defects in the rehabilitation of hemiplegics. They found that evidence of persistent sensory loss could be correlated with a poor prognosis for rehabilitation and length of hospitalization. Visual field defects were not studied by these authors.

A review of the literature revealed several oblique references to a relationship between visual field defects and prognosis or rehabilitative potential of the patient with a cerebrovascular episode, but no detailed study of the subject was discovered. It seems nearly inconceivable, however, that such a study has never been done and possibly it has simply been overlooked.

Toole and Patel state that disorders of spatial relations caused by hemianopia and hemisensory defects hinder recovery from strokes. They do not give any specific data, however. Bourestom lists a number of predictors of recovery from hemiplegia, without attempting to subdivide the diagnosis further. He makes no comments on visual field defects in his analysis.

Lorenze in discussing ambulation problems in hemiplegia, states that out of six instances of patients with visual problems only one had the visual problem as a cause of failure of ambulation. This is in direct contrast to the findings in the present study.

In another study the same author states that a high percentage of hemiplegics have visual perceptual disturbances. The most striking findings in patients with severe visual perceptual disturbances were that these patients failed particularly in the activities of daily living. While this study does not deal with simple visual field defects, its results are more consistent with the findings in the present study.

In a third paper the same author concludes that a positive relation exists between severity of dysfunction of visual perception and dressing and grooming failure in hemiplegics.

Bach, in evaluating the use of a self-portrait method in hemiplegic patients, concluded that patients with hemiplegia from cerebrovascular accidents who lack body image are incapable of being independent in dressing and ambulation. The self-portrait method was felt to be a good tool for
evaluating body image and demonstrating confusion or denial that is not superficially apparent. This method was felt to be useful in predicting which patients were capable of achieving independence. One might suggest that checking for visual field defects by simple confrontation may accomplish almost as much, if not as much, as this more cumbersome method of study of patients with hemiplegia in assessing their rehabilitative potential.

Peszczynski,11 in a general discussion of the prognosis for rehabilitation of the older adult and the aged hemiplegic patient, states that his review is based mainly on clinical impression and points out that statistically founded prognostic information in this area was only slowly forthcoming and thus far of limited value. He does state that hemianopia presents additional complications and risks, especially because of the patient's unawareness of the existence of loss of some portion of his visual field and because it is difficult for the older brain-damaged patients to learn to take that loss into consideration when performing their normal activities. Yet, he feels that with patience on the part of the staff and an adequate opportunity to learn to walk, the hemianopic patient eventually may do fairly well in ambulation. The present study confirms that an occasional younger hemianopic patient with a middle cerebral territory infarct may become ambulatory but that the older patients have great difficulty in ever achieving independent ambulation. 

Bruell and Simon12 discuss the development of objective predictors of recovery in hemiplegic patients. They point out that hemiplegic patients who fail to recover from effects of their cerebrovascular accident tend to be older, tend to have higher systolic blood pressures, and tend to enter physical therapy later than the patients who recover. While they make no comment about the effects of visual field defects on recovery, they do point out that a composite of several factors is the best predictor of a rehabilitative potential. The present author agrees with their statements. The presence of a visual field defect on admission should be used with caution as a predictor of the rehabilitative potential of a patient with a cerebrovascular accident, and a number of additional useful predictors also should be searched for.

References
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