may be used to detect and quantify intracranial flow abnormalities. RGA is then employed if there are still unanswered questions or when a patient's clinical presentation, DS or RNA findings indicate need for surgery.

References


Quantitative Study of the Rate of Recovery From Aphasia Due to Ischemic Stroke

G. DEMEURISSE, M.D., O. DEMOL, M.D., M. DEROUCK, M.A.,
R. de BEUCKELAER, M.A., M.-J. COEKAERTS, M.A., AND A. CAPON, M.D.

ASSESSMENT of the rate of recovery is important in the study and management of aphasia. The rate of recovery in a population of patients with stroke was studied with particular attention to the correct patient classification and to a precise quantification of the disorders.

Patients and Methods

Seventy-five patients with aphasia following stroke were studied (mean age 67 years). There were 34 males aged 53 to 85 years (mean 66) and 41 females aged 27 to 88 years (mean 68).

All patients had a cerebral infarction (none had hemorrhage); all were right-handed (handedness determined according to Bryden1); all had an infarction in the left hemisphere as determined by EEG, ⁹⁹mTc pertechnetate scan and, in some, by angiography and CT scan.

Nine patients were classified as having total or global aphasia, 46 Broca's aphasia and 20 Wernicke's aphasia. Patients with anomic aphasia, conduction aphasia or agrammatism were infrequently found and were not included in the study.

Classification of aphasia was based on verbal expression. In the patients classified as having Broca's aphasia, verbal expression was initially characterized by mutism or speech limited to one or more syllables, one or more words always the same, or by sentences involving the following abnormalities: omission of words, dysarthria, perseveration, paraphasia, iteration (repetition of a phoneme, a syllable, or a word, without completion of the message), palilalia (repetition of words, phrases or sentences, with completion of the message), echolalia, agrammatism, dyssyntaxia. In the patients believed to have Wernicke's aphasia, neologisms were present as well as phonemic deformations, indeterminate, semantic and morphological paraphasias, dyssyntaxia, leading to a dysphonic (predominance of phonemic errors), dyssemant-
tic (predominance of paraphasias) or mixed jargon. Total or global aphasia was diagnosed when language was initially characterized by the absence of comprehension and by mutism or when verbal expression was limited to a few stereotyped sounds. Disorders of verbal comprehension and expression were analyzed separately. Both were studied during spontaneous speech and during a set of special tests.

For spontaneous speech, the severity of comprehension impairment was assessed on a 5-point scale and for expression a 7-point scale which differed according to the type of aphasia (see appendix). Five tests were used for comprehension: comprehension of 10 instructions involving body movement (raising arm, closing fist, etc.), 10 instructions involving material aids (giving a box, pointing to a window etc.), 3 semi-complex instructions involving body movement (shaking hand, turning head etc.), 3 semi-complex instructions involving material aids (picking up toothbrush, putting it into glass etc.) and one designation test (pointing out specific objects in sets of pictures). Nine tests were used to test expression: naming 10 familiar objects, reciting automatic sequences (figures from 1 to 20, days of the week, months of the year), 2 repetition tests (repetition of words and sentences), and 3 semantic categories tests (reciting 8 names of colors, animals and garments).

The assessment was quantified with 3 indices ranging from 0 (indicating maximal disorder) to 100 (indicating normality). "E" denotes the degree of expression disorder, "C" that of comprehension and "G," a global index, is the mean of "E" and "C."

The first assessment was made on admission (on average, 16 days after the stroke) and again every month for 6 months. During this observation, all patients had daily sessions of speech therapy adapted to their type of aphasia. Results were statistically analyzed by the Student's t-test and χ² method.

Results

The patterns of evolution of the expression and comprehension indices are shown in the figure. Progress clearly slows with time and becomes negligible after 3 to 4 months. Comprehension indices are generally higher than the expression indices. As shown in table 1 the rate of evolution of both indices is similar for the same type of aphasia. Improvement of both indices is slightly better for Wernicke's than for Broca's aphasia but the difference is not significant. Improvement is better for either of these 2 categories than for total aphasia (table 1).

The correlation between the initial severity of the disorder and the degree of ultimate recovery was investigated with the least affected patients compared to the most disabled. Those patients with Broca's aphasia with an initial "G" index under 30 were compared to those with an index above 70. Those with Wernicke's aphasia with an index under 30 were compared to those above 30. No patient with Wernicke's aphasia had an initial score above 70. As shown in table 2, the degree of improvement between the initial and the final assessment is independent of the initial severity of the aphasia.

Discussion

Numerous factors are likely to influence improvement from aphasia. Patients with post-traumatic aphasia have a better outcome than those who have aphasia after a stroke. Sex of a patient seems to play no part in the prognosis, but age may be of importance. Advancing age is reported to indicate a poor prognosis, but others report it has no influence. In this series the possible role of these factors was automatically excluded as all 3 groups of patients were similar in etiology, age, side of lesion, handedness, and treatment.

FIGURE Evolution of the indices of comprehension (C) and expression (E) according to time in the 3 categories of aphasia.
In aphasia due to stroke, a marked recovery can occur during the first 6 months of evolution, but the greatest improvement is usually observed during the first 3 months. Some reports conclude that spontaneous and rapid recovery of speech is limited to the first month after onset of a stroke. Others indicate a slight degree of recovery continuing after several years. The observations from our series of patients confirm the general opinion that the greatest improvement occurs in the first 3 months and that the rate of recovery decreases with time.

Our results stress the importance of the type of aphasia in the rate of recovery. The prognosis of Wernicke's aphasia is similar to that for Broca's aphasia but it is notably different for total or global aphasia where improvement is rare. Despite the report of Vignolo, who found that "expressive aphasia" has a poor chance of improvement, our study agrees with others that there is no statistically significant difference in improvement between these 2 types of aphasia, although our results are slightly better for Wernicke's. Yarnell et al. mentioned that patients who have global aphasia with large lesions in the dominant hemisphere have a poor prognosis. Maly et al. showed that the lowest regional blood flows are observed in total aphasia.

Our 3 groups of patients, verbal comprehension is systematically better than verbal expression during the entire period of observation, but the rates of evolution of the 2 are parallel. In this, our results agree with those of Sarno and Levita although other authors observed a greater improvement in comprehension than in expression. For both Broca's and Wernicke's aphasia the severity of the initial disturbance has no influence upon the subsequent rate of evolution. Thus we do not confirm the observation of Kertesz and McCabe that in Wernicke's aphasia the rate of evolution is different depending on the initial disturbance.

### Conclusion

In aphasia due to ischemic stroke the most marked improvements of oral speech are observed during the first 3 months after onset. The rate of recovery is similar for expression and for comprehension but comprehension is always less disturbed than expression. Two important elements of prognosis are the type of aphasia and the severity of the initial disturbance. Total aphasia has a poor rate of recovery compared to other types. In the same type of aphasia, the rate of recovery being always equal, the final state depends on the initial score.

### TABLE 1

**Evolution of the Expression and Comprehension Indices Between the First and the Last Assessment in the 3 Groups of Patients**

<table>
<thead>
<tr>
<th>A E AC</th>
<th>Total aphasias (n = 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Broca's aphasias (n = 46) (t = 2,58) xxx</td>
</tr>
<tr>
<td></td>
<td>Wernicke's aphasias (n = 20)</td>
</tr>
</tbody>
</table>

(A E for expression and A C for comprehension)

xx (t = 2,30) N.S.

(t = 1,91)

N.S. non significant.

### TABLE 2

**Rate of Recovery According to the Initial Severity of the Disease**

<table>
<thead>
<tr>
<th>A G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broca's Aphasia</td>
</tr>
<tr>
<td>Initial 'G' index &lt; 30 (N = 28)</td>
</tr>
<tr>
<td>Initial 'G' index &gt; 70 (N = 4)</td>
</tr>
<tr>
<td>Wernicke's Aphasia</td>
</tr>
<tr>
<td>Initial 'G' index &lt; 30 (N = 12)</td>
</tr>
<tr>
<td>Initial 'G' index &gt; 30 (N = 8)</td>
</tr>
</tbody>
</table>

(Δ G = difference between first and last "G" index)
References


APPENDIX

EVALUATION OF SPONTANEOUS SPEECH

Scale for comprehension
0: no impairment of comprehension.
1: slight impairment of comprehension.
2: moderate impairment of comprehension.
3: severe impairment of comprehension.
4: no comprehension.

Scale for expression
For Broca’s aphasia
1: mutism or some stereotyped sounds.
2: a few automatic phrases, sentences or words.
3: a few sentences with omission of words, dysarthria, perseverations, paraphasia, iteration, palilalia, echolalia, agrammatism, dyssyntaxia.
4: more numerous sentences with persistence of the preceding disorders but vocabulary fairly satisfactory.
5: disorders less marked.
6: slight impairment of expression.
7: normal expression.

For Wernicke’s aphasia
1: Dyssyphonic, dyssemantic or mixed jargon with speech totally unintelligible.
2: Persistence of jargon, but appearance of intelligible words or phrases.
3: Less jargon. Longer and more frequent intelligible passages.
4: Speech intelligible as a whole but persistence of neologisms, phonemic deformation, paraphasia and dyssyntaxia.
5: Fewer abnormalities.
6: Infrequent abnormalities.
7: Normal expression.
Quantitative study of the rate of recovery from aphasia due to ischemic stroke.
G Demeurisse, O Demol, M Derouck, R de Beuckelaer, M J Coekaerts and A Capon

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