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How Long Is the Recovery of Global Aphasia? Twenty-Five Years of Follow-up in a Patient With Left Hemisphere Stroke

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Abstract

Background. Current knowledge regarding the time course of aphasia recovery is based on observations limited to the first years after stroke. *Objective*. The authors studied long-term outcome (25 years) of language in a patient with global aphasia. *Methods*. A 37-year-old man with global aphasia from a large ischemic lesion in the left middle cerebral artery territory was tested 9 times between 3 weeks and 25 years poststroke by means of the Milan Language Examination, Token Test, Raven Test, and apraxia tests. *Results*. Three main periods of recovery were identified. The first year after stroke was characterized by recovery of verbal comprehension and word repetition. From 1 to 3 years, naming and reading improved. From 3 to 25 years, progressive improvement of previously emerged functions was found, as well as the appearance of spontaneous speech. *Conclusions*. This unique long-term follow-up shows that the time span for recovery of language functions in global aphasia after stroke may be much longer than previously documented.

Keywords

language, outcome, rehabilitation, cerebrovascular disorders

Introduction

Studies on aphasia recovery report that the greatest degree of language recovery takes place in the first months after stroke.[1] Although the rate of recovery drops after 3 to 6 months, evidence of language improvement even 1 or 2 years after stroke have been reported in the literature.[2,3] Only a small number of studies have followed patients with aphasia longer than 2 years poststroke.[1,4-6] Therefore, current knowledge on the potential recovery of chronic aphasia is not sufficient.

In this article, we report the case study of a patient with global aphasia who was tested in a wide range of language, intelligence, and praxic abilities for 25 years after stroke. Information drawn from this study may have important implications for aphasia therapy.

Case Report

In 1983, a 37-year-old man presented with acute onset of right hemiplegia, hemianesthesia, and language disturbances. He was admitted to the Neurology Unit of the GB Rossi University Hospital, Verona, Italy. The computed tomography scan of his brain revealed a large ischemic cortical and subcortical lesion in the left middle cerebral artery territory. The patient had no risk factors for cerebrovascular disease and no previous history of cerebrovascular attacks. He was right handed and had 13 years of education. He underwent language rehabilitation for 2 years, 5 times per week in the first 6 months and then 3 times per week until the end of the second year. For many years, his only speech production was the nonsense word "musi." Details of his brain lesion are presented in Figure 1. He was tested with the Milan Language Examination (MLE), the Token Test,[8] the Raven Test,[9] and tests for oral, ideational, and ideomotor apraxia[10] at 3 weeks, 2 and 6 months, and 1, 2, 3, 10, 21, and

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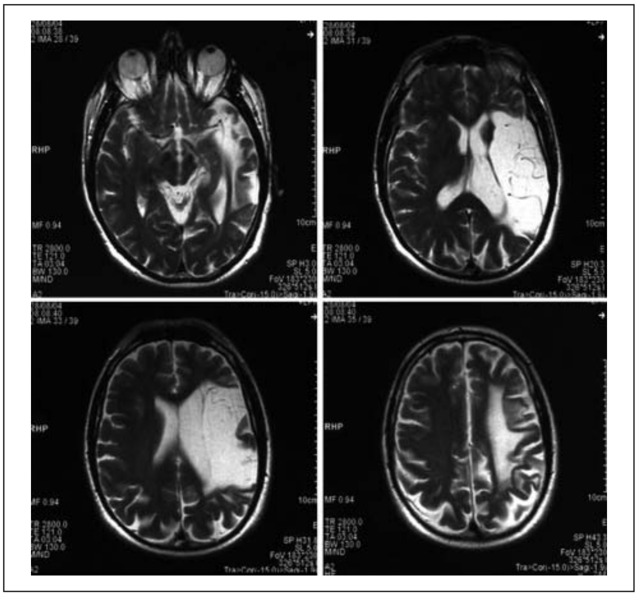

Figure 1. Brain magnetic resonance imaging performed 21 years after stroke. Lesion mapping showed involvement of Brodmann's areas 22, 21, 20, 37, 44, 6, 6s, 4, 40, 39, 3, 1, 2, 5, and 7 (MRIcron software, see http://www.mricro.com/mricron)

25 years poststroke. An additional examination performed 3 years after stroke showed that spatial memory (Corsi Block-Tapping test,[11] span = 5, supraspan = 8) and selective attention (Attentional Matrices Test,[12] total score = 42/60) were within normal ranges. Verbal memory was not testable because of the severity of his aphasia.

MLE data were analyzed by means of descriptive analysis and a linear regression model (score = $\alpha + \beta$ log(time)) to estimate the trend of the MLE data over time. Spearman's test between the main language functions (comprehension, repetition, naming, event description, reading) was performed by computing the raw scores of speech naming and event description and the mean scores of comprehension, repetition, and reading items of the MLE ($P < .05$). Statistical analysis was performed with R Package 2.8.1.

Results

MLE and other neuropsychological test data are given in Table 1. The MLE linear regression model showed a significant improvement in each language function (Comprehension $R^2 = 81.85$, Repetition $R^2 = 96.67$, Naming $R^2 = 79.13$, Reading $R^2 = 78.68$, Event description $R^2 = 60.36$) over time. The rate of improvement was estimated at 1 year (Comprehension 70%, Repetition 50%, Naming 0%, Reading 0%, Event description 0%), 3 years (Comprehension 84%, Repetition 62%, Naming 24%, Reading 25%), and 25 years after stroke (Comprehension 100%, Repetition 85%, Naming 45%, Reading 46%, Event description 15%). Significant correlations were found between time changes in these language functions: Comprehension–Repetition ($r = .928$, $P < .001$), Naming–Reading ($r = .994$, $P < .001$), Repetition–Naming ($r = .867$, $P < .001$), and Repetition–Reading ($r = .874$, $P < .001$).

Discussion

Results showed that recovery of global aphasia after stroke is not limited to just the first years following onset but can extend for even more than 1 decade. Overall, 3 main periods of recovery could be identified (Figure 2). The first period (first year after stroke) was characterized by recovery of verbal comprehension and word repetition, the second (1-3 years) by emergence of naming and reading, and the third (3-25 years) by a progressive improvement of previously emerged functions, as well as the appearance of spontaneous speech (event description).

To illustrate the time course of recovery found in our patient, we will discuss each main language function tested by the MLE separately (Figure 2).

Auditory comprehension was the first function to show recovery, in particular in the first years.[2] However, different patterns of comprehension recovery were evident, depending on the contextual content of the tasks used. In the MLE comprehension subtests, in which the patient was challenged with simple and contextualized tasks (eg, to indicate which figure represents the everyday object verbalized by the speech therapist), the patient showed a rapid recovery, approaching normal performance in a 1-year time frame. On the contrary, a slower and more progressive recovery of performance occurred in the Token Test,[3,13] which consists of very decontextualized and unusual verbal comprehension tasks (eg, to touch 1 or more tokens of different sizes and/or colors; Table 1).

Repetition also had its greatest rate of recovery in the first year, paralleling the trend of comprehension improvement. After the first year, repetition continued to slowly improve, reaching its highest level after 10 years.

Naming of a visual item, which implies the ability to autonomously transform a visual–structural representation into a phonological output,[14] emerged between 1 and 3 years after stroke and progressively improved, reaching 45% of performance in 25 years. It should be noted that reading had a trend of recovery equivalent to that of naming (Figure 2), suggesting that reading and naming may share elements of their neural substrates.[15] Spontaneous speech ("Event description" in Table 1) emerged many years after stroke, first documented at 10 years, and then slightly improved over time. Although spontaneous speech production was limited to a few high-frequency words (house, bread, beard, etc), this complex language task implies that the patient reached the skill of autonomously selecting a lexical representation from

Table 1. Results of Neuropsychological Examination

Milan Language Examination	Time From Stroke 3 Weeks	2 Months	6 Months	1 Year	2 Years	3 Years	10 Years	21 Years	25 Years
Speech									
Event description	0	0	0	0	0	0	1	2	2
Naming	0	0	0	0	10	20	35	55	50
Comprehension									
Words	40	55	80	95	100	100	100	100	100
WSR	10	40	80	80	90	90	100	100	100
Sentences	10	10	45	90	75	100	100	100	100
Repetition									
Letters	0	80	90	100	100	100	100	100	100
Syllable	80	80	70	90	100	100	100	100	100
Words	0	0	35	35	50	70	80	95	95
Neologism	0	0	20	50	30	30	50	80	80
Sentences	0	0	0	20	0	0	30	60	40
Writing									
Text (letter)	Unable	Unable	Unable	Unable	Unable	Unable	Unable	Unable	Unable
Naming	0	0	10	15	25	25	25	30	40
Reading comprehension									
Words	0	75	100	100	100	100	100	100	100
SWR	0	70	70	75	90	95	100	100	100
Sentences	0	0	80	80	80	80	80	80	100
Reading									
Letters	0	0	10	20	20	20	40	75	60
Syllable	0	0	0	0	15	50	50	70	70
Words	0	0	0	0	0	15	50	70	70
Neologism	0	0	0	0	0	0	20	20	30
Sentences	0	0	0	0	0	0	20	40	40
Dictation									
Letters	0	90	80	100	100	80	90	100	100
Syllable	0	20	0	70	90	60	80	100	100
Words	0	0	0	10	10	10	30	50	35
Neologism	0	0	0	0	0	10	10	10	10
Sentences	0	0	0	0	0	0	10	10	10
Copying									
Words	0	70	100	100	100	100	100	100	100
M-m	0	10	50	95	100	95	100	100	100
Other neuropsychological tests									
Token Test	7	7	10	14	18	22	26	29,5	30
Raven's Test	ND	ND	ND	17	ND	18	ND	26	28
Oral apraxia	ND	15	15	20	16	20	20	20	20
Ideational apraxia	ND	6	12	14	14	14	14	14	14
Ideomotor apraxia	ND	63	60	69	65	52	ND	70	72

Abbreviations: *SRW, semantically related word;* ND, no data.

semantics, accessing the phonological word form, motor programming, and planning of articulation to say the word.[14]

The most challenging question is to understand why this patient demonstrated such improvements in the long-term. In the first years after stroke, we hypothesize that improvements may have been influenced by language rehabilitation, which took place 5 days per week in the first 6 months and then 3 times per week until the end of the second year.[16] With regard to the progressive recovery seen in the long term, other factors, such as the patient's strong motivation and active social participation,[17] may also have played an important role. Indeed, motivation may have continuously stimulated the patient to

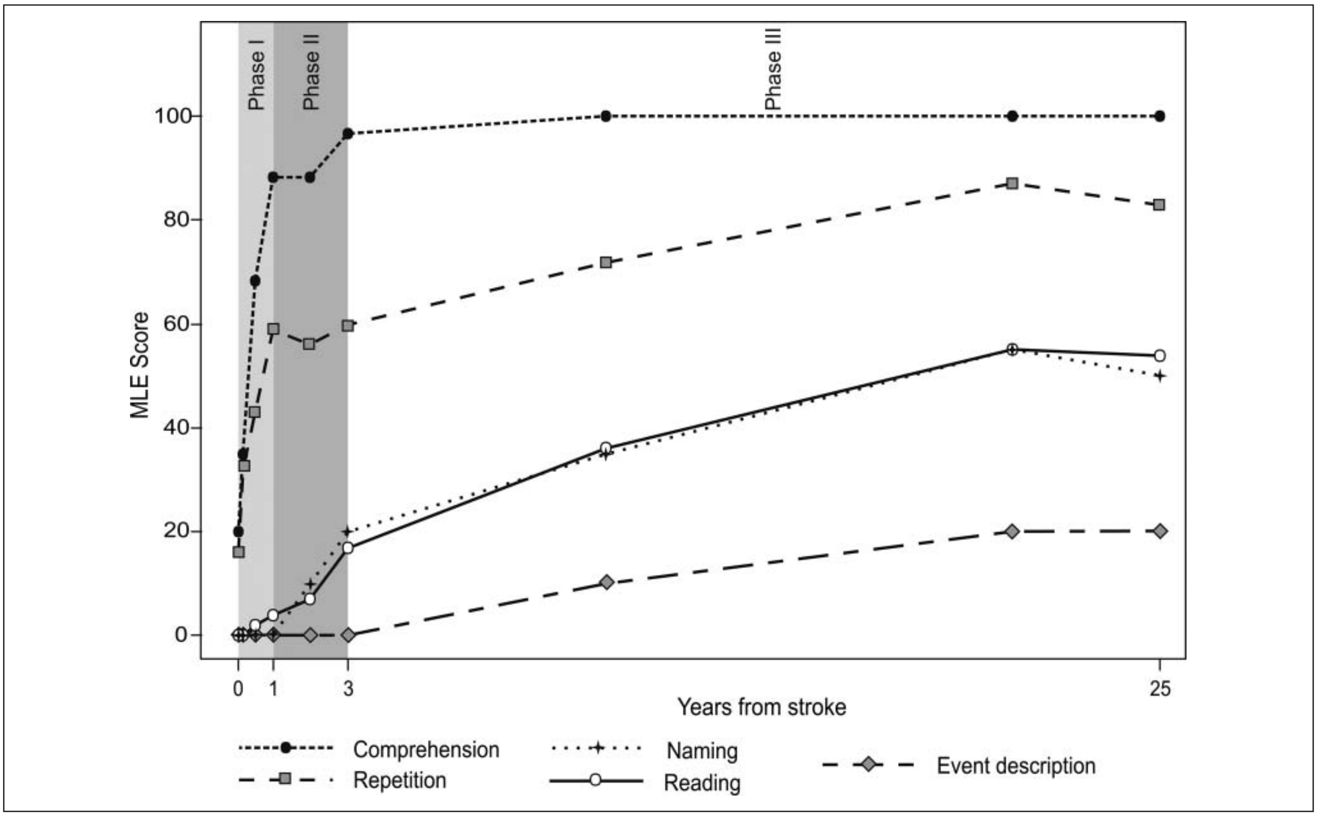

Figure 2. Time course of recovery of language function over 25 years. MLE indicates Milan Language Examination

express himself and to practice his linguistic abilities outside of a rehabilitative context.[17] Further important factors possibly contributing to the recovery process may be the patient's young age[1,18] and the presence of relatively spared residual cognitive functions, such as memory and attention.[19,20] This condition may have produced a favorable foundation for continued acquisition of new language abilities.

Evidence emerging from the present case report may have implications for rehabilitation of language disorders after stroke. First, the results suggest that the time window for possible improvement in global aphasia may be much wider than previously believed. Based on this, it could be hypothesized that patients may benefit from language stimulation over the long term. Moreover, the behavioral changes seen in our patient suggest that possible care programs in chronic aphasia should take into account not only conventional aphasia training approaches but also other kinds of stimulation such as the stimulation of various nonlinguistic cognitive abilities[19,20] and the creation of a context within a person's everyday life that provides a sense of motivation and permits social interaction.[17] The main limit of the present case report is that because this study was based only on clinical examination, it is not possible to identify how functional brain changes were involved in the process of long-term language recovery.

In conclusion, the present study highlights that in patients with global aphasia there may be some potential for the emergence and improvement of linguistic functions even many years after stroke.

Declaration of Conflicting Interests

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