Aphasia Recovery of a Right-Handed Individual with Right Cerebral Hemisphere Infarction

Robert A. Lozano
and
Carol A. Clark
Speech and Hearing Department
Rehabilitation Institute
Detroit, Michigan

Several cases of aphasia resulting from right cerebral hemisphere lesions in right-handed individuals have been described in the literature (Brown & Wilson, 1973; Clarke & Zangwill, 1965; Holmes & Sadoff, 1966; Kreindler, Fradis, & Sevastopol. 1966). Persisting, nontransient aphasia from right hemisphere lesions occurs in between 1 to 3% of the right-handed population (Geschwind, 1971; Gloning, Gloning, Haub, & Quatember, 1969; Ludwig, 1939; Zangwill, 1967). While some case presentations have mentioned the changes seen in speech and language abilities over a period of time (Botez & Wertheim, 1959; Hécaen, Mazars, Ramier, Goldblum, & Mérienne, 1971), there are no case reports which provide repeated evaluations over the entire acute aphasia recovery period.

It is the intent of this paper to illustrate these changes in speech and language, describe some techniques used in therapy intervention, and relate the recovery pattern to Porch's predictive methods.

Case History

The patient is a 52-year-old, right-handed Caucasian male. He holds a master's degree and works in an executive level position. He suffered a stroke which precipitated a communication disorder and a degree of left hemiparesis. Further medical diagnosis with brain scan and computerized transverse tomography (EMI scan) indicated a right cerebral hemisphere lesion. Specifically, the lesion was located in the right posterior frontal temporal region. No lesion in the left hemisphere was found. Cerebral angiography revealed an occlusion of the right internal carotid artery and again the left hemisphere appeared intact.

The initial referral and evaluation was conducted 11 days post stroke. The Porch Index of Communicative Ability (PICA) (Porch, 1967) was administered and the overall score placed the patient at the 52nd percentile for aphasic individuals and indicated that the patient had a moderate to marked communication deficit. It should be pointed out that all the percentile scores that I will be discussing are taken from the PICA tables for aphasia from left hemisphere lesions since there are no tables for aphasia from right discrete hemisphere damage and the patient does present with aphasia from unilateral hemisphere involvement. The PICA yielded a pattern of subtest scores typical of aphasia. Verbal responses were fluent but frequently interrupted by word finding difficulty and articulation errors. Articulation errors consisted principally of phonemic substitutions, omissions and additions. The patient's articulatory performance was consistent with the definition of literal paraphasias (Goodglass & Kaplan,

1972) or apraxia of speech (Johns & Darley, 1970). Confrontation naming and word repetition were marked by both literal and verbal paraphasias. The patient expressed awareness of his verbal errors. The PICA also revealed some dyslexic problems. Spontaneous written responses were marked by severe dysgraphia which was composed of "words" made up of seemingly random, jumbled letters. In copying printed words, iterations of upward and downward strokes of letters were prominent. Constructional apraxia was found in the copying of geometric figures. The patient performed all graphic tasks with his right hand. A neglect of the upper left visual field was noted during testing.

The patient was observed to have difficulty dressing himself (e.g., reversing his pajama top and then buttoning it inside out). He also could not tell time and frequently became disoriented in the hospital halls.

Further speech and language evaluation involved the Boston Diagnostic Aphasia Examination (Goodglass & Kaplan, 1972). Spontaneous speech revealed that the patient's phrase length was six words and contained a wide variety of grammatical structures. The profile of test scores and ratings indicated that the patient should be classified as a conduction aphasic with a component of anomia.

Two subtests from the Neurosensory Center Comprehensive Examination for Aphasia (Spreen & Benton, 1969), the Token Test and the Word Fluency Test, were also administered to further assess auditory comprehension, auditory retention, and lexical retrieval abilities. The patient ranked above the 90th percentile for aphasic individuals, or at the 18th percentile for normals, on the Token Test. On the Word Fluency Test, he ranked at the 8th percentile for aphasic individuals. These test results confirmed the clinical impression of good auditory comprehension and demonstrated the severity of the lexical retrieval or wordfinding problem.

Handedness in this patient was confirmed by a handedness questionnaire constructed by Benton (1967). The results of the questionnaire indicated that the patient was strongly right-handed. It should be pointed out that through history interviews with the patient and his wife, it was determined that both his parents were right-handed and one of his three siblings was left-handed.

Treatment

The patient was seen intensively during the initial period of recovery. He was seen for two hours a day, five days a week, for the first month of therapy. The motivation of the patient was very high and he worked on speech and language skills as often as he could.

It should be pointed out that for the treatment regimen outlined for this patient, several speech and language skills were worked on at the same time. However, for discussion purposes, these are presented separately here.

In the area of verbal output, initial work was targeted on articulation and repetition. This included mirror work, stressing visual feedback of sound production, and increasing auditory awareness of errors. Initially, simple monosyllabic words were used and eventually, as criteria levels were met, more complex polysyllabic words were introduced. Drills using the EFI Audio flash card reader were prepared so that the patient might independently work on his verbal skills away from the therapy sessions.

The tasks on the flash cards included repetition, sentence completion, and sentence repetition.

Writing skills were also emphasized, first on the level of copying. A phonetic approach to spelling errors was also begun. This progressed into writing simple words to dictation. Copying tasks became more complex (whole sentences) and eventually writing sentences to dictation was used. The EFI Audio flash card reader was also used for this task. It was after this stage that the more difficult graphic task of rewriting, in paragraph form, stories read in the newspaper was initiated. During all the work on writing, proofreading and visually inspecting for errors was constantly stressed.

There were also, as part of the therapeutic regimen, lessons dealing with numbers. This began with clock setting and "telling time" when the clinician set the clock. This was followed by writing numbers to dictation and reading numbers out loud, progressing from simple, small numbers to large numbers. Tasks stressing the quick recall of numbers (e.g., phone numbers) were also given. It should be mentioned that in this individual's job position, dealing with large numbers and figures was virtually an everyday occurrence.

Since reading skills were impaired, therapeutic tasks were also directed toward reading for comprehension. It was found that when reading time was slowed, comprehension tended to increase. Stories were given and as criterion levels were met, the difficulty of the reading material was increased. Getting the Facts proved to be an important resource material for this therapy activity. Eventually, selected newspaper articles were silently read and then summarized either graphically or verbally by the patient.

The visuospatial impairment presented a confounding factor relative to stimuli which were presented in the visual modality, and therapeutic intervention was attempted. First, the patient's attention was drawn to the problem by pointing out the deficit and instructing him to be more cautious about neglecting that visual area. Then tasks involving visuo-spatial abilities were used. These included Frostig materials, connect-the-dots drawings, and visual search tasks in a visually confusing field.

Treatment was ended at five months post onset when the patient returned to work on a full-time basis. His specific employment duties have been altered somewhat and there have been some special considerations given to him which allow him to function productively despite his communication problems which are still in evidence.

Recovery

During aphasia recovery this patient has been carefully followed by repeated PICA and Word Fluency testing (Table 1, 2). The PICA recovery curve will be considered first. Porch describes aphasia recovery from a thrombus as having: 1) a negative function curve, 2) a wide dynamic range, and 3) a closing range at six months. In this patient a so-called "negative function curve" is not seen, while the dynamic range and closing of the curve fluctuate. It can be said that the recovery curve plateaued at two months post onset of the aphasia. However, this is not to say that there was not continued clinical improvement in the patient (Figure 1). Although gestural scores remained stable after one month post onset, improvement beyond the levels measured at two months post onset were

obtained in both the verbal and graphic modalities. Total testing time also decreased between tests, indicating improved, decreased processing time.

One manipulation with PICA scores that is possible is the prediction of the "six-month keyhole" or predicted range of response levels which the patient should attain at six months post onset. Using the HOAP Slope (Figure 1), you can see that the "six-month keyhole" for this patient, based on his overall PICA score at one month post onset, ranges from the 90th to 96th percentile. However, the patient's actual overall score at six months post onset was at the 88th percentile, just below the predicted outcome. These were calculated using left hemisphere data.

Since the patient had demonstrated good auditory skills and impaired visuospatial abilities, comparing him to the "bilateral" PICA data might not be unreasonable. When the recovery curve and HOAP Slope are determined using data for bilateral lesions, quite different results from those of the left hemisphere data are discovered (Figure 2). First, the "bilateral" recovery curve is in higher percentile points than the "left hemisphere" recovery curve. The dynamic range varies but does close at six months post onset. Then, when the HOAP Slope is drawn (Figure 2), it correctly predicts the PICA overall score at six months post onset, which is at the 95th percentile.

The Word Fluency measure was periodically administered during the recovery period (Table 2). This test shows a general plateauing at one and one-half months post onset (Figure 3). There are some fluctuations in scores between one and one-half and six months post onset, but they are not dramatic. The results of this test are surprising because, clinically, the word finding problem which the patient had improved greatly over the same period of recovery.

Conclusions

The recovery pattern of this aphasic individual is not typically what one would expect, according to Porch's etiologic differentiation of aphasia recovery curves. This possibly could be due to the array of cerebral dominances found in this patient. Here, the patient is left hemisphere dominant for handedness while his right hemisphere appears dominant for both visuospatial abilities and language. Another reason for this different recovery pattern could be the initial period of intensive therapy given the patient at a relatively early point in his recovery.

It is sometimes said that left-handed individuals with aphasia resulting from left hemisphere damage make better than usual recovery (Subirana, 1969). That cannot be said for the "crossed aphasia" seen in this right-handed man. He scored just below his predicted recovery level when calculated using left hemisphere data, and right on his predicted recovery level when calculated using bilateral data.

The accuracy with which the "six-month keyhole" was predicted using the data for bilateral lesions should be specially noted. Perhaps the presence of both aphasia and visuospatial impairment make the bilateral data applicable for prediction in this patient. It appeared that accuracy of prediction was slightly depressed when using the data which is based on aphasia after unilateral hemisphere involvement, or the left hemisphere data.

The shape of the Word Fluency measure recovery curve has some similarities to the shape of the PICA recovery curves (Figure 3). However, the percentile scores for this measure are strikingly below the PICA overall percentile scores. This could be due to the different aphasic samples upon which these percentiles were derived, or to a selective deficit particular to this specific case.

Further reports and data on the aphasia recovery of right-handed persons after right hemisphere damage is needed to realistically understand, evaluate, and effectively intervene in this form of language pathology.

So that you can get a better idea of the overall recovery of this patient, his spontaneous speech recovered in somewhat the following manner.

14 days post onset
Patient displayed severe word finding difficulties and articulation errors.

Two months post onset
Patient indicated he could not remember having much difficulty with the PICA although he did recall not being able to name objects on earlier tests. Articulation errors were prominent.

Four months post onset
Patient exhibited word substitutions with immediate self-corrections. Wordfinding difficulty showed delays but successful retrieval.

Six months post onset
Patient spoke with slower rate and improved articulation. There was some residual wordfinding difficulty.

Discussion

Was it mostly the graphic scores which were depressing the overall PICA score at six months post onset? Both the graphic and verbal scores were contributing to the lowering of the overall score. The gestural scores were high and stable after one month post onset.

After examining the table of PICA scores, it can be seen that there was quite a jump in verbal modality percentile scores between the tests at five and six months post onset. A closer examination of the actual tests is needed to explain these differences. Although subtest I (Statement of Function) had remained stable, subtest IV (Spontaneous Naming) received a higher mean score on the later test partially because of fewer delays and partially because a "repeat" had been needed during the earlier test. Further, subtest IX (Sentence Completion) showed improvement in speed and completeness of response on the six months post onset test, and subtest XII (Repetition) showed improvement in articulation on the last test. The jump in modality scores between the tests is indicative of some improvement in performance and perhaps some inconsistency in articulatory performance.

Does the Word Fluency Test have "norms"? Spreen and Benton in their Neurosensory Center Comprehensive Examination for Aphasia present percentile ranges for both aphasic and normal adult populations.

Was the slower speaking rate seen at six months post onset a self-generated compensatory strategy? Basically, yes; the rate change was the patient's own strategy. It seemed to have a positive effect on his articulation and made the word finding difficulty less noticeable in his speech.

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SIX MONTHS TESTING OF A RIGHT HANDED INDIVIDUAL
WITH A RIGHT CEREBRAL HEMISPHERE LESION

WORD FLUENCY TEST

Post Onset	Number of Words	Aphasics %tile
17 days	3	8
1 mo	3	8
1 mo 14 days	6	22
2 mos	6	22
3 mos	8	32
4 mos	6	22
5 mos	8	32
6 mos	6	22

SIX MONTHS TESTING OF A RIGHT HANDED INDIVIDUAL
WITH A RIGHT CEREBRAL HEMISPHERE LESION

PORCH INDEX OF COMMUNICATIVE ABILITY

Post Onset	Overall %tile	Gestural %tile	Verbal %tile	Graphic %tile	Total Time Mins
11 days	52	79	44	49	60
1 mo	68	95	54	63	44
1 mo 14 days	74	94	65	70	41
2 mos	86	96	78	82	37
3 mos	86	96	75	85	29
4 mos	81	95	68	79	33
5 mos	86	95	69	87	29
6 mos	88	96	85	86	25

From Left Hemisphere Data

Porch Index of Communicative Ability

APHASIA RECOVERY CURVE

(Percentiles)

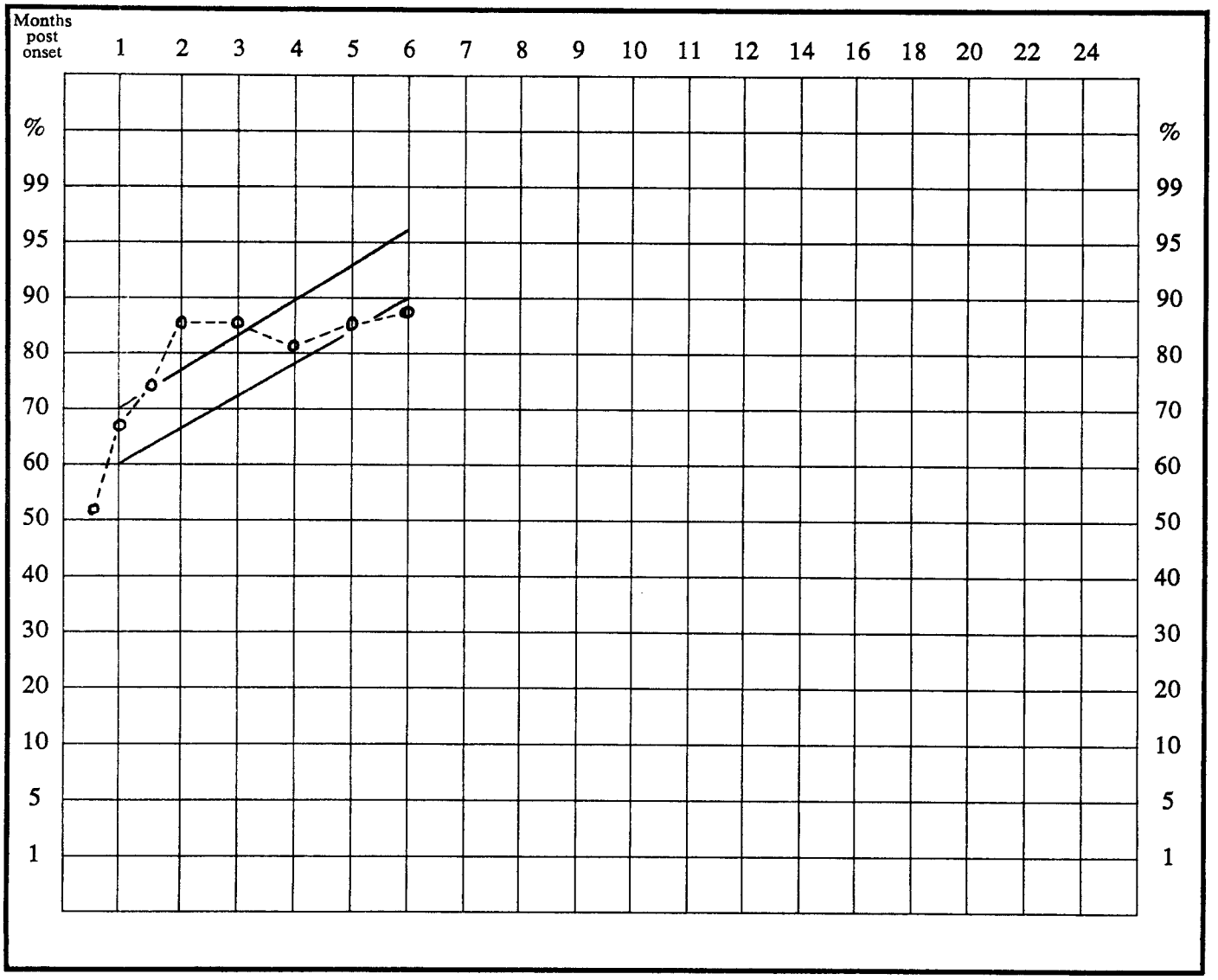
Name _____ Case No. _____

Birthdate _____ Race _____ Onset _____

DX. Type THROMBOSIS Site RT. INTERNAL CAROTID

RIGHT POSTERIOR FRONTAL TEMPORAL REGION (E M I SCAN)

Test Date



LEFT HEMISPHERE DATA

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Porch Index of Communicative Ability

APHASIA RECOVERY CURVE

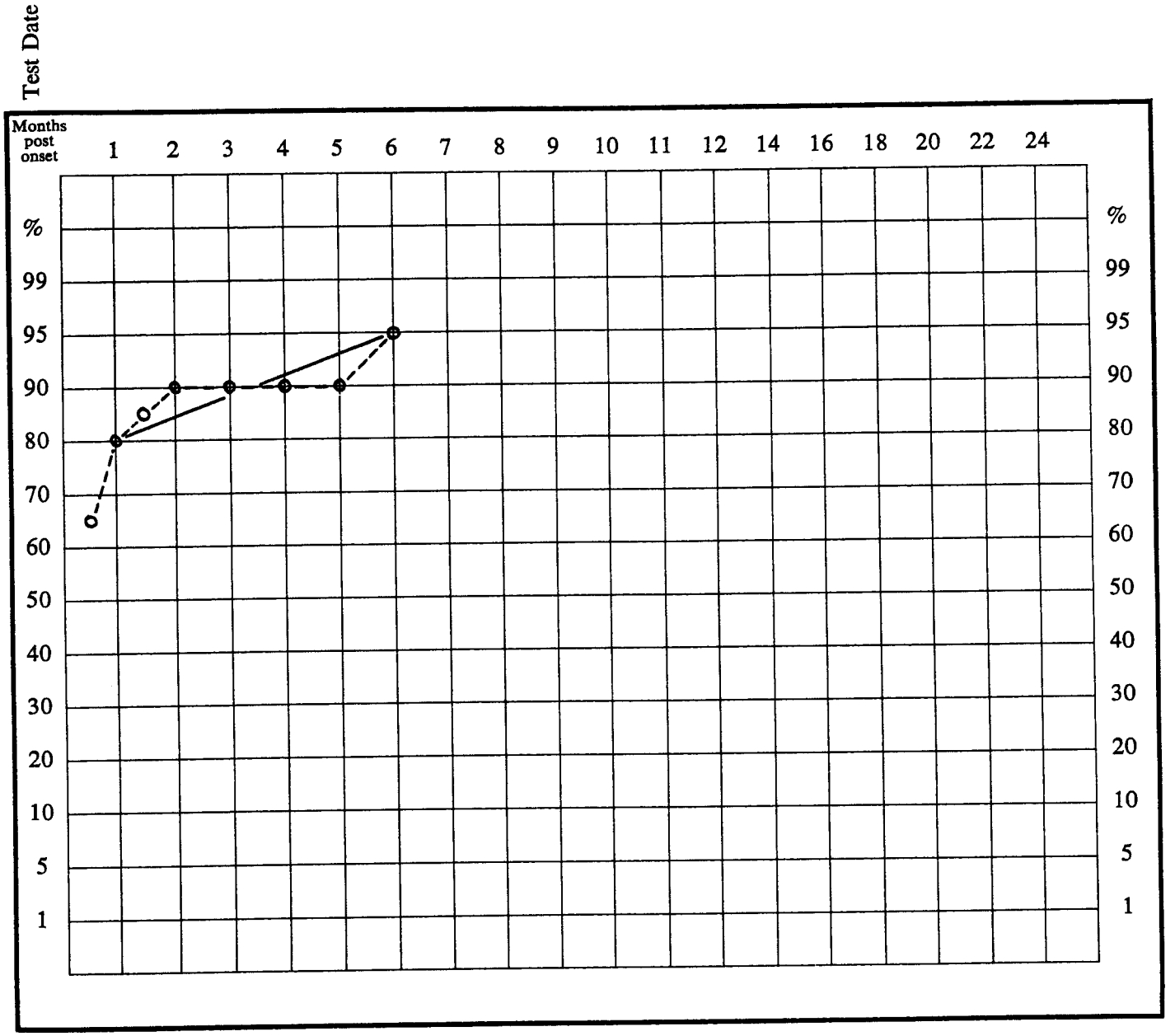
(Percentiles)

Name _____ Case No. _____

Birthdate _____ Race _____ Onset _____

DX. Type THROMBOSIS Site RT. INTERNAL CAROTID

RIGHT POSTERIOR FRONTAL TEMPORAL REGION (E M I SCAN)



BILATERAL DATA

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Figure 2

Porch Index of Communicative Ability

APHASIA RECOVERY CURVE

(Percentiles)

Name _____ Case No. _____

Birthdate _____ Race _____ Onset _____

DX. Type THROMBOSIS Site RT. INTERNAL CAROTID

RIGHT POSTERIOR FRONTAL TEMPORAL REGION (E M I SCAN)

Test Date

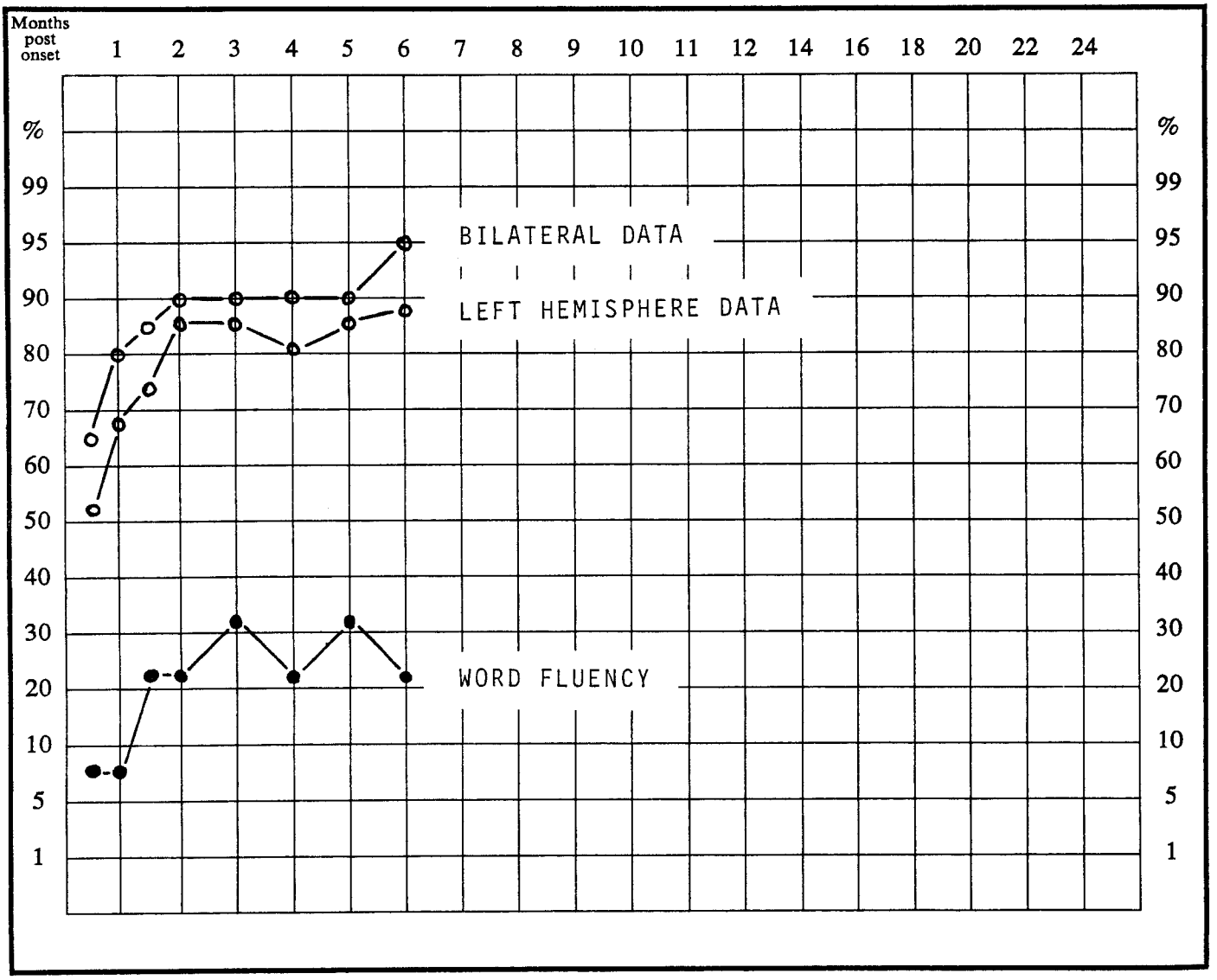

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Figure 7