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Rehabilitation and Outcome of Right-Hemisphere Stroke Patients: Challenges to Traditional Diagnostic and Treatment Methods

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Abstract *Only within the last 10 years have the importance and contribution of the right hemisphere to the integrity of a patient's functioning become the subject of increased clinical research, debate, and publication. In this study three cases were examined involving right-hemisphere brain injury in terms of vocational, behavioral, and social outcomes following the rehabilitation process. The results of this examination indicate that standard neuropsychological tests and other measures of cognitive and speech and language function tend to underestimate the impact of right-hemisphere syndrome on a patient's judgment and social skills, relationship to the family system, ability to perform functional living activities, and ultimately the ability to return to productive work.*

Keywords: Rehabilitation, RCVA, neuropsychology, behavioral adjustment.

Today it is generally recognized that right-hemisphere brain injury results in some of the most complex and perplexing syndromes known to medical science. Historically, there has been slow recognition of the importance of the right hemisphere—consequently, its labeling as the "minor," "silent," or neglected hemisphere (Springer & Deutsch, 1985). In 1861 Paul Broca had observed that left-sided lesions produced aphasia and right-sided

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lesions did not. Thus, throughout much of the nineteenth and twentieth centuries, the left hemisphere was thought to be dominant for most intellectual functions.

In 1874 John Hughlings Jackson first proposed that the two cerebral hemispheres served several different functions, the left being responsible for verbal activity and the right for the recognition of objects, places, and people. These ideas did not gain universal recognition until the 1960s and the split-brain studies of Ronald Myers and Roger Sperry (Burns, Halper, & Mogil, 1985; Springer & Deutsch, 1985). Even now the disabilities resulting from lesions in the right hemisphere are not as easy to analyze or label as those associated with the left hemisphere. Right-hemisphere injury seems not to eradicate any obvious human abilities in an all-or-none fashion, but rather to disrupt behavior in subtle but significant ways (Springer & Deutsch, 1985).

Over the last decade there has been increased clinical research, debate, and publication about right-hemisphere syndromes and the contribution of the right hemisphere to the integrity of a patient's overall functioning (Pimental & Kingsbury, 1989; Ross & Mesulam, 1979). The clinical picture that results from damage to the right hemisphere shows it to have a specialized role in at least four major areas of behavior: spatial distribution of attention, nonlinguistic perceptual skills, emotional behavior, and paralinguistic behaviors of communication, including pragmatics (Mesulam, 1985; Pimental & Kingsbury, 1989). Damage to the right hemisphere may result in neglect of the left half of space, lack of awareness of deficits, impulsivity, memory disturbances, poor time management, and difficulty with planning, organizing, and integrating information; verbal skills are generally spared (Burns et al., 1985; Pimental & Kingsbury, 1985).

Despite these advances, there are still many aspects of hemispheric specialization that remain largely unknown. Right-hemisphere syndromes are better identified and described by utilizing measures specifically designed for that purpose, such as the Mini Inventory of Right Brain Injury (Pimental & Kingsbury, 1989) and the Rehabilitation Institute of Chicago Evaluation of Communication Problems in Right Hemisphere Dysfunction (Burns et al., 1985). However, studies of outcome after right-hemisphere injury are rare, and those that have appeared involve patients who are either aged or still in the acute stages of recovery (Carter, Howard, & O'Neil, 1983; Henly, Pettit, Todd-Pokropek, & Tupper, 1985; Thames & McNeil, 1987).

Other outcomes cited in the literature have focused on a specific disability or a group of disabilities associated with right-hemisphere involvement (Egelko et al., 1988; Messner & Messner, 1988; Novack, Haban, Graham, & Satterfield, 1987; Wolfe & Ross, 1987). One study (Howard, Till, Toole, Matthews, & Truscott, 1985) surveyed almost 400 patients to determine what factors influenced their ability to return to work. They found that 22% of the patients with right-hemisphere strokes returned to work, compared to 17% of those with left-hemisphere infarctions. These data appear to be consistent with an earlier study by Coughlan and Humphrey (1982), which concluded that patients with right-hemisphere lesions showed better long-term outcomes than those with left-hemisphere lesions. However, both studies reported modest results for return to work.

Overall, there seems to be a paucity of published studies that address outcome in terms of behavioral, social, and vocational adjustment following significant right-hemisphere brain injury. No published papers have described the process of intensive rehabilitation with these patients. The present study attempts to expand current knowledge about the rehabilitation process and outcome with right-hemisphere stroke patients, using a case study approach. This includes the vocational, behavioral, and social out-

comes of three patients, following participation in a formal outpatient rehabilitation program. The results of neuropsychological tests and other measures of communicative and cognitive function are compared with functional, social, and vocational outcomes.

It was questioned whether standard neuropsychological tests and measures of communication abilities accurately estimate the impact of right-hemisphere syndrome on a patient's ability to perform functional living tasks, relate to the family system, and ultimately return to productive work. The rehabilitation process for the three patients is described, and questions are raised regarding the assessment and rehabilitation of right-hemisphere stroke patients.

Case Descriptions

A.B.

A.B. is a married, right-handed male with a doctoral degree in the social sciences. Prior to his stroke at the age of 47, he had been a very successful administrator for a large school district and lectured at a community college and various workshops. He was also deeply involved in a variety of other vocational, avocational, and church-related activities.

On the evening before his admission to the hospital, A.B. experienced an episode of euphoria, followed by sensations of tingling and numbness on the left side of his body and decreased consciousness. Admission computed tomography (CT) scan revealed a 2 × 2.5 × 1.5 cm zone of low density in the right anteromedial thalamus consistent with an acute infarction. There was no evidence of left-hemisphere damage. His CT scan is shown in Figure 1. His medical history is significant for long-standing diabetes mellitus and hypertension.

A.B. entered a rehabilitation program 5 months after his stroke and participated approximately 15 months. He underwent neuropsychological testing prior to his formal admission to the program and again approximately 12 months later. These results have been summarized in Table 1. Because of his extensive background in the field of psychology and his familiarity with intelligence tests, A.B. was given alternate measures with which he was not familiar.

On formal testing, A.B. exhibited moderate impairments of visual scanning, speed of thinking, rate of learning, delayed recall of verbal and visual information, abstract thinking, maintaining cognitive set, impulsive responding, left-sided motor-slowing, copying, and awareness of deficits. Given his educational and vocational history, however, his test scores were thought to underestimate his impairment in comparison to premorbid levels.

Results of repeat testing upon discharge indicated some improvement in his rate of verbal learning, visual scanning, and abstract thinking, although he continued to exhibit difficulties in the latter two areas. In general, his profile of relative strengths and difficulties remained unchanged from the preadmission evaluation.

A.B. was evaluated by the speech and language pathologist following his admission to the program. He presented with no apparent deficits of receptive or expressive language in informal conversation. The initial evaluation therefore excluded aphasia testing, but consisted of other standardized measures of language (Boston Naming Test, Test of Language Competence) and academic abilities (Wide Range Achievement Test) and informal measures designed for right-hemisphere dysfunction (RIC Evaluation of Com-

munication Problems in Right Hemisphere Injury). Selected test results are summarized in Table 2.

A.B. scored at the upper limits on tests of confrontation naming, word fluency, and higher level language skills, and within normal limits on tests of reading and academic skills. His scores on two portions of these tests, including reading comprehension and inferential reasoning, though within normal limits, were lower than would have been expected, given his level of educational achievement. It is thought that A.B.'s visual field

Figure 1. CT scan of patient A.B.

Table 1
Neuropsychological Findings for Patient A.B.

Variable/Task	Prerehabilitation	Postrehabilitation
Age	48	49
Education	Ph.D.	Ph.D.
Time since injury	5 months	14 months
WAIS-R (age-corrected scores)		
Digit Span	—	13 (8/5)
Arithmetic	—	11
Block Design	—	12
Digit Symbol	—	10
RAVEN's Matrices	45 [82%]	44 [85%]
WMS form	—	Form II
MQ or General index	—	126
I/O/MC	—/—/—	6/5/8
Logical Memory—Immediate	—	10.0
Logical Memory—Delayed	—	5.5
Visual Reproduction—Immediate	—	9
Visual Reproduction—Delayed	—	5
Paired Associate		
Easy	—/—/—	6/6/6 (6)
Hard	—/—/—	2/4/4 (3)
Rey Complex Figure	—	—
Copy	31 [30%]	27 [<10%]
Delay	20.5 [35%]	17.5 [25%]
Rey AVLT	6-5-6-7-10/8//7	7-9-10-11-15/6//13
Trails A, s	52 (moderate)	60 (moderate)
Trails A, errors	0	0
Trails B, s	94 (mild)	84 (WNL)
Trails B, errors	1	2
Finger Tapping		
Right hand	56.6 (WNL)	51.4 (WNL)
Left hand	33.2 (moderate)	30.6 (moderate)
WCST	5 Categories	6 Categories
Porteus Mazes		
Route errors	Discontinued	Discontinued
Qualitative errors	Discontinued	Discontinued
Category test	62 errors (mild)	56 errors (mild)

disturbances contributed significantly to his difficulty with these subtests, which required more extensive reading than the others. His writing reflected moderately severe deficits in visuospatial organization and left neglect, but none in spelling, grammar, or legibility.

Moderate difficulties were noted in attention, awareness of illness, and orientation to time. Impairments of communication pragmatics were in the moderately severe range

Table 2
Speech and Language Test Results

Test	Patient		
	A.B.	C.D.	E.F.
RIC Evaluation			
Behavioral Observations (total = 45)	29	36	36
Visual Scanning (number of errors)	33	12	45
Writing (total = 55)	46	53	51
Pragmatics (total = 60)	41	47	47
Boston Naming Test (total = 60)	60	59	43
Test of Language Competence (percentile rank)	95	72	N/A

and especially affected eye contact, conversational initiation, verbosity, and topic maintenance.

C.D.

C.D. is a right-handed, single male with a master's degree in the life sciences. Before his stroke at the age of 47, C.D. held full-time teaching and administrative responsibilities at a junior college. He also participated in recreational activities, including hunting and fishing. He spent his summers working as a tour guide in a large national park.

At the time of his stroke, C.D. experienced sudden onset of left hemiplegia after jogging. He was intubated prophylactically and transferred by air to a regional hospital. Admission CT scan indicated a large (6 × 5 × 6 cm) zone of low-density acute infarction in the right anterior and middle temporal lobe, as well as the ipsilateral basal ganglia. A smaller (2 × 1 × 3 cm) zone of low-density acute infarction was identified in the right medial frontal lobe. There was no evidence of left-hemisphere damage. His CT scan is shown in Figure 2. He had no previous history of vascular disease.

C.D. began our program 6 months after his stroke and was formally discharged 3 months later. He was evaluated neuropsychologically just before beginning our program and again upon discharge. The results of both evaluations have been summarized in Table 3.

On formal testing, C.D. exhibited difficulties in the following areas: speed of thinking, rate of learning, delayed recall of visual information, abstract thinking, copying, visual scanning, and limited awareness of some deficits.

Following his formal discharge, repeat testing showed improvement in several areas. Although some of these scores were within normal limits, they remained lower than expected, given his premorbid history. Overall, mild to moderate difficulties persisted in copying, visuoperception, visuospatial problem solving, delayed recall of complex visual information, and verbal learning. Moderate to moderately severe impairments remained in abstract reasoning and left-sided motor slowing.

C.D. was administered a speech and language evaluation following his admission to the program. He obtained scores in the average and above-average ranges on tests of word fluency, confrontation naming, and higher level language skills. Writing was found

to be within normal limits, except for evidence of mild to moderate left neglect. Test results are summarized in Table 2.

As part of an informal speech assessment, the speech pathologist viewed videotapes of C.D. delivering lectures before his CVA. Comparison of these with C.D.'s speech since his stroke revealed significant changes in vocal and prosodic features, including a mildly lowered habitual pitch, moderately reduced ranges of loudness and intonation, and a moderately increased rate of speech with a tendency for run-on phrasing. C.D.

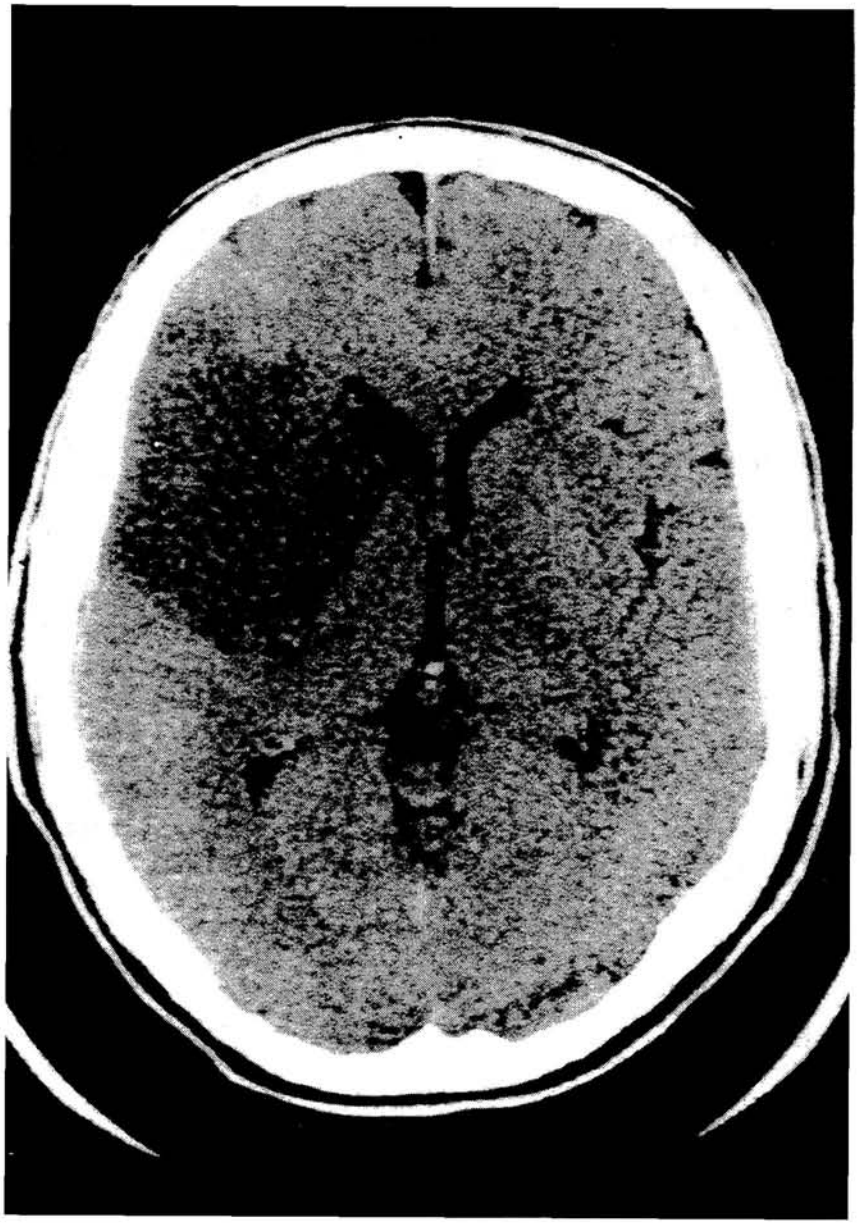

Figure 2. CT scan of patient C.D.

Table 3
Neuropsychological Findings for Patient C.D.

Variable/Task	Prerehabilitation	Postrehabilitation
Age	48	48
Education	M.S.	M.S.
Time since injury	2.5–4.5 months	9 months
WIAS-R (age-corrected scores)		
Information	12	13
Digit Span	9 (6/4)	11 (7/6)
Vocabulary	12	12
Arithmetic	9	10
Similarities	15	13
Picture Completion	8	8
Picture Arrangement	10	11
Block Design	6	9
Digit Symbol	8	9
VIQ/PIQ	108/85	113/93
FSIQ	97	104
RAVEN's Matrices	49 [95%]	—
WMS form	Form II	Revised
MQ or General Index	116	108
I/O/MC	6/5/7	[14/6]
Logical Memory—Immediate	11.00	38 [97%]
Logical Memory—Delayed	10.75	29 [89%]
Visual Reproduction—Immediate	10	39 [98%]
Visual Reproduction—Delayed	7	35 [81%]
Paired Associate		
Easy	5/5/6 (6)	4/4/4 (4)
Hard	1/3/4 (4)	1/3/4 (4)
Complex Figure	Rey	Taylor
Copy	36 [100%]	32 [40%]
Delay	14.5 [<10%]	14.0 [<10%]
Rey AVLT	8–8–10–10–9/6//9	7–8–12–14–15/9//10
Trails A, s	53 (moderate)	38 (mild)
Trails A, errors	0	0
Trails B, s	160 (moderate)	87 (WNL)
Trails B, errors	2	0
Finger Tapping		
Right hand	—	58.4 (WNL)
Left hand	—	31.3 (moderate)
WCST	6 Categories	6 Categories
Porteus Mazes		
Route errors	7	0
Qualitative errors	25	4
Category Test	—	33+ errors (discontinued)

presented with a mild asymmetry of the lips, but no perceptible signs of dysarthric articulation. Moderate impairments were noted in several pragmatic communication skills, including eye contact, facial expression, and gesture.

E.F.

E.F. is a divorced, Asian female with a high school education. Although born abroad, she has lived most of her life in the United States and is fluent in English. Before her stroke at the age of 45, E.F. was a department manager in a retail store and functioned very successfully, according to her family.

On the day of her admission to the hospital, E.F. was awakened by a severe burning sensation in the right occipital area and later displayed slurred speech and left-sided weakness. During admission she collapsed and required nasotracheal intubation. CT scan revealed a large (7 × 3 × 4 cm) acute hematoma within the right basal ganglia and insular cortex, with sparing of the thalamus. Subsequent cerebral angiography was negative for any associated aneurysm or arteriovenous malformation to account for the hemorrhage. There was no evidence of left hemisphere damage. Her CT scan is shown in Figure 3. She subsequently underwent a craniotomy for removal of a right intracerebral hemorrhage.

E.F. entered our program 13 months after her stroke and was discharged approximately 6 months later. She underwent neuropsychological testing 11 months after her stroke, 2 months before beginning our program. She was reevaluated at discharge, approximately 6 months later. Her test results are summarized in Table 4.

On formal testing E.F. exhibited moderate to moderately severe impairment in the following areas: abstract reasoning, flexibility of thinking, visuospatial problem solving, immediate and delayed recall of complex visual information, right-sided motor slowing, left hemiparesis, and a lower-than-expected rate of verbal learning.

At the time of her formal discharge, repeat testing showed improvement in several areas, including immediate and delayed recall of verbal and visual information, rate of verbal learning, bilateral motor speed, left-sided hemiparesis, abstract reasoning, and speed of double mental tracking. Performance in the latter two areas was considered moderately impaired. Moderately severe difficulties continued to be observed with visuospatial problem solving.

E.F. was evaluated by the speech pathologist following her admission to the program. Her scores on tests of word fluency and confrontation naming were below the normal range. It is thought that these scores may be attributable to E.F.'s having learned English as a second language, despite her fluency in spoken English. Writing was within normal limits, except for the displacement of the left-hand margin to the right. On a test of right-hemisphere dysfunction, E.F. displayed moderate impairment of eye contact, awareness of deficits, and ability to monitor the passage of time. Some of these test results are summarized in Table 2.

Rehabilitation Process

All patients participated in an outpatient rehabilitation program based on a systematic, intensive, and interdisciplinary treatment model. It utilizes a psychoeducational approach, in which patients and their families are educated about the nature and extent of

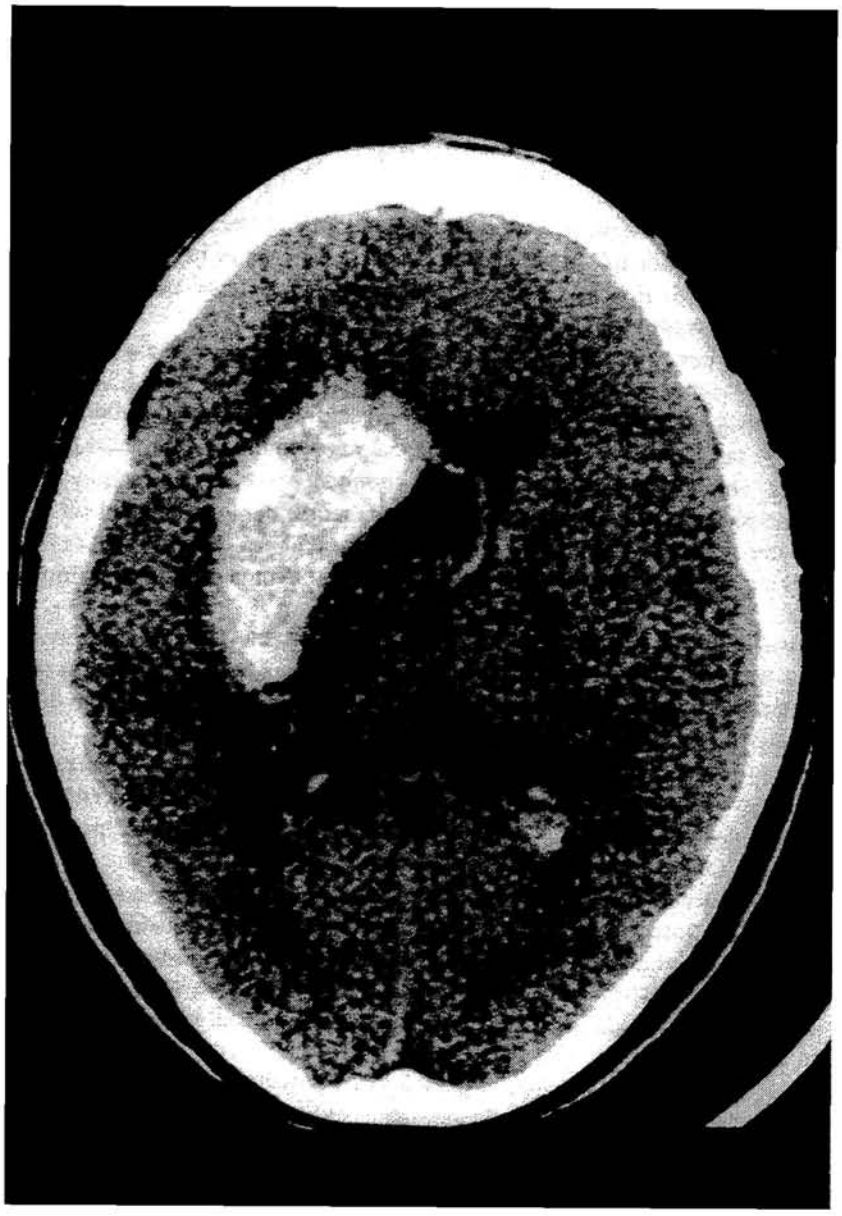

Figure 3. CT scan of patient E.F.

the brain injury and are helped to reestablish meaning in the patients' lives. They attended 5 days a week, receiving therapies generally from 8:15 am to 2:30 pm. A.B. and E.F. participated in volunteer work trials in the afternoon as a part of their treatment. C.D. participated in an off-site volunteer work trial in his previous summer position at a national park. Goals of rehabilitation were to achieve independence in the home and community and to return to productive work.

Therapy hours consisted of individual and group sessions addressing cognitive,

Table 4
Neuropsychological Findings for Patient E.F.

Variable/Task	Prerehabilitation	Postrehabilitation
Age	47	47
Education	12	12
Time since injury	11 months	20 months
WAIS-R (age-corrected scores)		
Information	—	9
Digit Span	7 (5/3)	10 (7/4)
Vocabulary	—	7
Arithmetic	8	9
Similarities	11	8
Picture Completion	9	—
Picture Arrangement	—	8
Block Design	6	6
Digit Symbol	11	12
VIQ/PIQ	94/83	91/94
FSIQ	88	92
RAVEN's Matrices	27 [25%]	32 [47%]
WMS form	Form II	Form I
MQ or General Index	87	103
I/O/MC	8/5/4	6/4/6
Logical Memory—Immediate	5.50	9.25
Logical Memory—Delayed	4.50	7.75
Visual Reproduction—Immediate	10	6
Visual Reproduction—Delayed	10	6
Paired Associate		
Easy	3/6/6 (5)	6/6/6 (6)
Hard	0/1/1 (1)	1/2/4 (4)
Complex Figure	Rey	Taylor
Copy	27 [<10%]	33 [60%]
Delay	12.0 [<10%]	17.5 [25%]
Rey AVLT	5-7-7-9-11/5//7	6-8-12-14-12/5//12
Trails A, s	46 (mild)	32 (WNL)
Trails A, errors	0	0
Trails B, s	206 (moderate)	153 (moderate)
Trails B, errors	4	2
Finger Tapping		
Right hand	37.4 (moderate)	44.6 (mild)
Left hand	(hemiparesis)	34.5 (mild)
WCST	3 Categories	5 Categories
Porteus Mazes		
Route errors	Discontinued (4+)	4
Qualitative errors	Discontinued	18
Category test	—	89 Errors (moderate)

physical, emotional, speech, and language functioning. Group activities included communication pragmatics, education about the nature of their injuries, cardiovascular conditioning, group psychotherapy, and community outings. All patients and staff participated in daily milieu meetings, to review the business of the program and discuss areas of progress and concern. Group-oriented therapies were designed to address personality and psychosocial changes resulting from the brain injury and to promote the patients' effective functioning at home and in society.

Education and support for family members was an integral part of the rehabilitation program and consisted of individual family meetings, weekly attendance at Relatives' Group, monthly invitations to observe the treatment program, and home visits to address the patient's independent functioning. Further explanation of the philosophy and structure of the program is provided elsewhere (Prigatano & Others, 1986; Klonoff, O'Brien, Prigatano, Chiapello, & Cunningham, 1989).

Behavioral Observations

In addition to the neuropsychological and language findings described above, these patients presented with other deficits that interfered with various aspects of independent living and productive work. Some of these deficits were not readily measured on formal tests; other were identified during testing, but their impact on daily functioning tended to be substantially underestimated. The significant behavioral observations are described below.

Left-Sided Neglect. Although neuropsychological testing was sensitive to the presence of left-sided neglect, it did not predict the impact it would have on the patients' daily functioning. The patients often arrived at the unit adequately groomed on the right side but disheveled on the left. A.B. and C.D., the two professors, lectured only to the right side of their classrooms. All three had a great deal of difficulty using bus schedules, telephone directories, and other common reading materials whose formats they found visually confusing. Grocery shopping became a frustrating ordeal, owing to visual scanning deficits as well as left neglect. In the community, these patients often collided with objects to their left, making them unsafe in restaurants, on sidewalks, and in other busy areas. C.D. told us that when walking to his bus stop, he passed several stops before finally finding one many blocks further down the street.

Planning and Organization. Many instances of organization and planning difficulties were observed during the treatment day, particularly in the cognitive retraining session, which involves a variety of paper and pencil thinking tasks, including a substantial amount of record-keeping. These patients experienced severe difficulty following three-step procedures in sequence and carrying out the scoring and record-keeping functions. Even with repeated practice and the use of checklists, errors abounded, and therapists found the need for close monitoring.

The patients kept their program notebooks in states of disarray, intermixing notes from different treatment groups and often writing on scraps of paper. At least once a week, the notebooks needed to be reorganized so that they could be used more effectively. A.B. and E.F. misplaced their notebooks almost daily. Similar problems affected

the use of datebooks and prevented the patients from efficiently and independently keeping track of appointments and other responsibilities.

Time management was a severe problem for all three. They were often distracted from their morning routines and arrived late to the program. In fact, punctuality for therapy sessions was a common problem throughout the day for A.B. and E.F. A.B. and C.D. were seldom able to deliver familiar, well-rehearsed class lectures within the allotted time; to modify a lecture, integrating new material or adapting it to different time constraints, was virtually impossible.

Impulse Control. Problems with impulse control were prominent in all three patients. They had difficulty controlling their eating and weighed substantially more poststroke than before. According to their spouses' reports, two of the patients had less control of libido and experienced other forms of sexual dysfunction as well. A.B. and E.F. spent money impulsively and found it difficult to adhere to a budget. Impulsivity was a major difficulty in cognitive retraining tasks and work trial activities and caused unacceptably high error rates.

Pragmatics of Communication. Despite their articulate verbal skills, all three patients exhibited impairments of communication pragmatics, especially in unstructured social situations. Instances of hyperverbality, tangentiality, inappropriate comments and humor, poor eye contact and turn-taking skills, and general disinhibition were frequently observed.

These patients appeared to have a poor sense of their "stimulus value," that is, the impact of their behavior in social situations. Family members complained of a childish quality to the patients' communication style. The patients were often blaming of others during disagreements and failed to see how their own behavior contributed to interpersonal tensions. Despite practice in role-playing exercises and the use of videotaped feedback, the patients' self-monitoring skills remained very limited.

Unawareness of Deficits. Despite intensive education during rehabilitation, problems of unawareness persisted to some degree in all of the patients. While they learned to acknowledge discrete impairments, such as left neglect and impulsivity, they tended to underestimate their severity and to minimize their impact on daily functioning. They overestimated their capacity to function independently in the home and resented our recommendations for supervision. Family conflict developed from the patients' loss of autonomy in paying bills and handling their own checking accounts. All three maintained that they could return to their former levels of employment, without the need for significant modifications in their job duties. These patients displayed a general tendency to "bite off more than they could chew," both at home and at work.

"Seeing the Big Picture." The patients' difficulty with abstract attitude and flexible thinking resulted in strained relationships with family members, especially with their children. They often locked onto small details of a discussion and were unable to adopt a wider perspective or another person's point of view. Missing the "big picture" also affected safety judgment, as in the insistence by all three that they should be allowed to drive, despite their acknowledged problems with left neglect. A.B. and C.D., avid marksmen before their strokes, insisted they were safe to resume this hobby.

Outcome

Psychosocial and Emotional Functioning. All three patients have reported problems with social isolation and family conflict. C.D. and E.F., who live alone, report reduced social contact compared to preinjury levels. A.B. lives with his wife and children but remains a substantial burden, primarily because of his problems with social judgment and impulsivity. All have struggled with extended depressive reactions and have reported instances of suicidal ideation. Each has received psychiatric intervention and is taking antidepressant medication.

Independent Living and Driving. An area of progress for all patients was improvement in their ability to function more independently in the home environment. C.D. and E.F. progressed to a level that enables them to live alone. C.D. initially failed his driving test, but he subsequently retook the state exam, passed it and is currently driving. Although concerns about his left neglect remain, driving has enhanced his independent functioning in the community. E.F. functions relatively well at home. She has been unable to resume driving, but is able to use the bus independently and otherwise relies on friends and family to assist her with transportation needs. A.B. has also shown improvement in home independence, but his gains have been more modest. He is better able to use a checklist to organize his day and perform simple cleaning and cooking tasks, substantially increasing his productivity in the household. However, we feel that because of A.B.'s difficulties with initiation, impulse control, and awareness, he and his family will require ongoing counseling for him to maintain the gains he has made.

Work. All three patients have resumed some form of productive work, albeit with significant modifications from prestroke levels. About 16 months after his stroke, A.B. returned to the community college where he had lectured and began doing part-time team teaching with a colleague. After a few months, it was clear that he would be unable to function satisfactorily in that capacity. His colleagues identified significant problems with integrating new material, maintaining rapport with his students, and communication pragmatics. Therefore, his participation in lecture activities has been reduced to a few well-rehearsed, stable presentations, which he will do as an occasional guest lecturer. A.B. is also unable to return to his administrative position and has resigned from his other community involvements.

C.D. is teaching at the college level, but is able to manage only one course per semester with no administrative responsibilities. He reports that he experiences persistent difficulties with stamina. His lecture topics focus on old, well-learned material, to minimize his problems with new learning and organization. It is anticipated that he will collect long-term disability until retirement age.

E.F. is not gainfully employed, but works part-time as a volunteer for the local symphony orchestra association doing simple clerical duties, such as photocopying and stuffing envelopes. Her work productivity has been affected most by her problems with left neglect, organization, and memory.

Discussion

Through the rehabilitation process, these three patients show better (though not full) awareness of their strengths and difficulties, have improved in their independent functioning in the home and community, and are better able to manage their emotional

reactions to their injuries. Although they have all achieved some form of productive work, substantial modification in job responsibilities and status were necessary. The rehabilitation process was believed to be instrumental in guiding them toward appropriate work placement. It also helped families better cope with and manage these patients.

These case studies demonstrate that patients with significant right-hemisphere damage pose a challenge to traditional rehabilitation methods. Despite the relative preservation of many higher cognitive functions, particularly language, these patients presented with a variety of cognitive deficits that interfered with independent living and work, but that were not readily apparent in neuropsychological and speech/language assessments. For example, the behavioral manifestations of "organizational deficits" were multifarious, and their ramifications for recovery of independence were sometimes underestimated, if not unforeseen.

Some aspects of these outcomes are sobering, especially in light of previous reports (Howard et al., 1985; Coughlan & Humphrey, 1982), which appear to indicate that outcome will be more favorable in patients whose language is intact. Indeed, these patients suffered profound effects on their emotional, psychosocial, domestic, and vocational functioning. In this respect, the consequences of impaired pragmatic communications skills are liable to be underestimated. Moreover, the persistence of the patients' unawareness seemed to perpetuate the effects of their cognitive and communicative impairments. Even when patients learned to recognize certain deficits, modifications of behavior were difficult to achieve. Often, a glaring discrepancy between "knowing and doing" was noted.

Despite the small number of patients in this study, the results suggest that the impairments typical of right-hemisphere stroke may affect outcome to a greater degree than expected. It is thought that with traditional rehabilitation methods, the effects of these impairments might not be fully considered or addressed.

In our milieu-based program, the variety of structured and unstructured activities comprising the treatment day, and weekly community outings in particular, provided the staff invaluable opportunities for observation. Group-oriented therapies, especially for psychotherapy and communication pragmatics, seemed to be important adjuncts to one-on-one treatment. They provided a supportive environment in which the patients could become better educated about their stimulus value. For example, if a patient were to make an inappropriate remark, the incident could be discussed in communication group or in milieu, affording the patient helpful feedback from his peers regarding his social impact and the opportunity to practice more effective communication.

Another integral part of the rehabilitation process proved to be the education and support of the patient's family. Family contact is not always fully incorporated into rehabilitation. However, given these patients' difficulties with self-awareness and social judgment, a close working relationship with the family members was essential. For example, families would disclose problems that were not fully obvious to the patient. At times, behaviors observed in the rehabilitation, work, or community settings were even more prevalent in the home, where the patients were less inhibited. It often took several months for family members, work supervisors, and co-workers to fully understand the implications of the patients' deficits. Families often observed significant behaviors that were not seen outside the home. Many of the patients' difficulties became clear to family members and individuals in the community and at work only with time passage following the stroke.

The experience with these patients has underscored the importance of careful observation of patients in "real life" environments and cautious interpretation of seemingly

adequate performance on neuropsychological tests (Prigatano, Pepping, & Klonoff, 1986). It has also demonstrated the value of a holistic view of each patient, including an appreciation of the total impact of their impairments on independent living and work. The apparently subtle deficits of higher cognitive functions may have a profoundly debilitating effect on overall brain integrity. Right-hemisphere stroke patients may truly represent a subset of the "walking, talking" brain-injured population, who show problematic psychosocial and vocational outcomes.

Based on these case studies, further research is needed to delineate the long-term outcomes of right-hemisphere patients in regard to home and community independence and vocational, psychosocial, and emotional adjustment. Future studies should include comparisons with other treatment groups, such as those with left-hemisphere stroke or diffuse brain injury. It might also be questioned whether difficulties arising from organic unawareness of deficits are more prevalent in this population than in other brain-injured groups. Further research is needed to identify and develop more sophisticated diagnostic and rehabilitative methods, which the successful management of the right-hemisphere stroke patient requires.

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