

EFFECTIVENESS OF A COMPREHENSIVE DAY TREATMENT PROGRAM FOR REHABILITATION OF PATIENTS WITH ACQUIRED BRAIN INJURY IN JAPAN

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Objective: To assess the effectiveness of a day treatment program with a comprehensive team approach for treating outpatients with acquired brain injury, which is offered by the Kanagawa Rehabilitation Hospital.

Design: Non-randomized controlled study.

Subjects: Twenty-five program graduates and 12 control patients with acquired brain injury.

Methods: A prospective study using 25 brain-injured patients with cognitive dysfunction who were provided with a comprehensive day treatment program at Kanagawa Rehabilitation Hospital. The 25 enrolled patients had treatment sessions lasting 2–4 hours for 2 days a week over a 3–6-month period. Functional Independence Measure/Functional Assessment Measure (FIM/FAM) and the Community Integration Questionnaire (CIQ) were administered before and after the program to compare outcomes between the 25 program participants and the 12 control patients who did not receive the day treatment program.

Results: Significant improvements in speech intelligibility, problem solving, memory, attention and social integration scores in the FIM/FAM and scores in social integration and productive activity in the CIQ were evident in the enrolled subjects. In addition, 9 of the 25 patients returned to work or school.

Conclusion: These results demonstrate the effectiveness of this program in helping to rehabilitate patients with acquired brain injury.

Key words: traumatic brain injury, day treatment program, rehabilitation, Japan.

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INTRODUCTION

Traumatic brain injury (TBI) has recently become a major topic in rehabilitation medicine. In the USA, a nationwide research project has been underway since 1987 (1–4). Interest in the rehabilitation of patients with TBI became a matter of concern

in Japan in the 1990s. Patients with TBI are not only physically impaired, but have impairment of higher cortical functions, exhibiting cognitive dysfunction and abnormal behaviour. Hence, both physical and cognitive rehabilitation are very important for patients with TBI (5, 6).

The authors' hospital, the Kanagawa Rehabilitation Hospital, was established in 1973, and since that time has practised rehabilitation medicine mainly for people injured in traffic accidents, sports, or industrial accidents, with the goal of facilitating early re-entry into society.

Every year, about 100 patients with TBI are admitted to the hospital's rehabilitation program, which has a comprehensive, holistic approach. In this program, transdisciplinary team members are oriented to each patient's goals, support the patient's re-entry into society and provide rehabilitation activities according to the patient's stage in life. However, in many patients, hospital treatment alone is insufficient to resolve all of the patients' problems, and most of the team members perform subsequent outpatient treatment. Many reports show the effectiveness of group-style outpatient rehabilitation programs (7–13); in every report one of the goals was to enable the patient to return to work or school.

In September 2001 the Kanagawa Rehabilitation Hospital initiated a comprehensive day treatment program for outpatients who had been discharged from the hospital. These programs have been held 4 times: in the periods September 2001 to February 2002, July–October 2002, February–April 2003 and July–October 2003. The goals of the program were: (i) continuation of medical treatment for post-subacute TBI; (ii) establishment of closer co-operation between medical care providers and welfare, labour and educational services in the local community; and (iii) improvement of patients' skills in maintaining good interpersonal relationships.

Watanabe et al. (14) and Hashimoto et al. (15) have reported the outcome and problems of the first 3 groups participating in the first 3 programs, respectively. In this paper, we present our experience in providing support for re-entry into society of 25 patients with acquired brain injury, including the experience of all 4 groups of participants. We compared the outcome for these 25 patients with the outcome for 12 control patients with regard to independence in activities of daily living (ADL) and changes in social participation.

METHODS

Subjects

Twenty-five patients with acquired brain injury took part in the study. A total of 6–7 subjects participated in each session of the comprehensive day treatment program. Criteria for participation were: (i) near independence in ADL irrespective of ability to walk or wheelchair use; (ii) the goal of returning to work or school; and (iii) having no place they were required to visit frequently except for our outpatient clinic. Table I provides a profile of the participants. Except for cases 6 and 20, who were each 56 years of age, subjects were 19–48 years of age, and therefore relatively young. Cases 7, 16 and 25 used a wheelchair and needed some help in ADL. The other 22 patients were independent with regard to walking and ADL. Each subject experienced acute stage hospitalization after the injury and then hospital inpatient rehabilitation in the Kanagawa Rehabilitation Hospital. Patients continued individualized rehabilitation at the outpatient clinic of the Kanagawa Rehabilitation Hospital and wanted to return to their job or school.

In 19 of 25 patients, consciousness disturbance at the time of injury was 8 points or less on the Glasgow Coma Scale (GCS) or 3 decimals on the Japan Coma Scale (JCS). Eighteen of the 22 patients with TBI had severe brain damage according to Gennarelli's classification of severity (16). And 17 of 25 program participants scored less than 80 in the Full Intelligence Quotient (FIQ) using Wechsler Adult Intelligence Scale-Revised (WAIS-R).

As a control group, 12 outpatients with TBI were selected. They were patients at our hospital at the same time as the participants. As control subjects, they were required to meet the same selection criteria as participants, but they did not join the day treatment program. There was no statistically significant difference between the participant group and control group with regard to age, time since injury, percentage of severe TBI cases and summed score of Functional Independence Measure/Functional Assessment Measure (FIM/FAM) (Table II). Prior to the study, all subjects including controls gave informed consent to participate in the research, which had been approved by the institutional review board of the hospital.

Outcome measures

To evaluate ADL we used the FIM™ version 3.0 and FAM (17, 18) and to evaluate societal participation we used the Community Integration Questionnaire (CIQ) (19).

Procedures

In the first group, participants in the comprehensive day treatment program received 4 sessions a day for 4 hours from 11.00 h to 15.00 h over a period of 6 months. The second, third and fourth groups received 4 sessions for 2 hours from 13.00 h to 15.00 h twice a week over a period of 4 months (2nd), 3 months (3rd) and 4 months (4th), respectively.

Table III summarizes the content of each session and the profession of the team members in charge. A rehabilitation doctor was the director, and for efficient management, a clinical psychologist, medical social worker and physical therapist were assigned as coordinators.

Usually, a doctor and nurse checked the vital signs of the participants and explained the various kinds of dysfunction that could occur after brain injury to help the patients understand their disability. Social skills training (SST) by a clinical psychologist and speech therapist was designed to improve interpersonal communication skills and malleability. All of the programs that included SST were based on the positive behavioural support paradigm. Positive behavioural support focuses on enhancing an individual's quality of life by teaching useful and effective behaviours and by redesigning the subject's environment so that it is possible to achieve meaningful goals in a way that is efficient and also consistent with the needs of others. For positive behavioural support, we provided a variety of programs, for example, horticultural therapy with a vocational rehabilitation counsellor, boccia and mini-volleyball with a rehabilitation gymnastic trainer, ceramic art with an occupational therapist, hiking and visiting welfare facilities with those in charge of the program. All programs were provided in a group setting.

Data analysis

To assess the effectiveness of the program, the FIM/FAM improvement ratio (quantity of change), which was determined from the FIM/FAM at the end of program compared with the FIM/FAM at the start of program, was evaluated and compared between program participants and controls. The CIQ score also was compared between the participant group and the control group. A significant difference between program participants and controls in quantity of change before and after a program was used as a criterion for success on the assumption that the difference between these groups was statistically insignificant at the beginning of the program. Therefore, the Mann-Whitney *U* test was used. For comparison of the rate of severe TBI, the χ^2 test was used.

The data were analysed using SPSS 12.0 J software. The accuracy of the performed analysis was evaluated by a power calculation using the Power Calculator software provided by the UCLA Department of Statistics (<http://www.stat.ucla.edu/>). Values greater than 0.70 were considered significant.

RESULTS

ADL status

Items related to communication and social cognition were selected from 18 items on the FIM and from 12 items on the FAM. Total score of communication was unchanged in 5 cases and was improved in 20 cases and total score of social cognition was improved in all cases. In no case did the score worsen.

Societal participation status

Of the 25 program participants, the total score for the CIQ improved in 23 cases (92%) whereas only 5 of 12 controls (42%) showed an improvement. Nine of the 25 participants (36%) returned to work or school while only 2 of 12 (17%) controls did so (Tables IV and V). In this case, the definition of going to work or school means full-time work, school attendance or staying at a welfare facility for 5 days or more a week.

In the participant group, all subjects decided upon a plan to participate in society after going through the entire day treatment program, whereas 7 of 12 patients (58.3%) of the control group decided to do so. In this case, "plan" means a concrete goal of going to work, school or to a welfare institution.

Statistical comparison between participants and controls of improvement in FIM/FAM and CIQ

Among items on the FIM/FAM, improvement in speech intelligibility, problem solving and memory/attention/social integration was greater in the participant group than in the control group ($p < 0.05$) (Table IV).

Results of analysis of the CIQ scores showed that the summed improvement of social integration and productive activity was significantly greater in the participant group than in the control group ($p < 0.05$) (Table V).

DISCUSSION

This report is a description of a comprehensive day treatment program for patients with acquired brain injury. The circumstances behind the initiation of the comprehensive day

Table I. *Profile of program participants*

Case	Age at start (years)	Gender	Occupation	Cause of injury	At time of injury		Time after injury (days)	At start of program	
					Severity	Diagnosis		FIM	WAIS-R
1	23	Female	Office worker	Traffic accident Rear seat	Severe JCS = 100	DBI	163	Motor 91 Cognition 31 Total 122	VIQ 69 PIQ 64 FIQ 61
2	34	Male	Office worker	Traffic accident Pedestrian	Severe JCS = 200	DBI rt.AEDH	326	Motor 88 Cognition 32 Total 120	VIQ 91 PIQ 67 FIQ 79
3	30	Male	Self-employed	Traffic accident 4-wheel car driver	Severe GCS = 6	DBI	287	Motor 91 Cognition 27 Total 118	VIQ 71 PIQ 63 FIQ 65
4	19	Male	Student	Traffic accident Bike riding	Severe JCS = 100	DBI lt.ASDH	288	Motor 84 Cognition 23 Total 107	MMSE 26
5	19	Male	Student	Traffic accident Bike riding	Severe GCS = 7	DBI rt.ASDH	1123	Motor 91 Cognition 28 Total 119	VIQ 68 PIQ 77 FIQ 89
6	56	Male	Self-employed	Fall	Moderate JCS = 30	DBI Contusion	308	Motor 91 Cognition 29 Total 120	VIQ 91 PIQ 76 FIQ 84
7	21	Female	Job-hopping part-timer	Traffic accident Bike riding	Severe JCS = 200	DBI	595	Motor 71 Cognition 31 Total 102	VIQ 71 PIQ 64 FIQ 63
8	19	Female	Student	Traffic accident Bike rear seat	Severe GCS = 8	DBI rt.ASDH	779	Motor 91 Cognition 26 Total 117	VIQ 79 PIQ 65 FIQ 68
9	41	Male	Office worker	Traffic accident Bike riding	severe JCS = 200	DBI	509	Motor 91 Cognition 31 Total 122	Estimated FIQ = 70–79
10	32	Male	Office worker	Traffic accident Pedestrian	Severe JCS = 200	DBI	273	Motor 90 Cognition 29 Total 119	VIQ 84 PIQ 85 FIQ 85
11	23	Male	Office worker	Traffic accident Pedestrian	Severe JCS = 100	DBI rt.AEDH	391	Motor 89 Cognition 32 Total 121	VIQ 87 PIQ 47 FIQ 67
12	23	Male	Student	Traffic accident Bike riding	Severe JCS = 100	DBI	200	Motor 91 Cognition 29 Total 120	VIQ 101 PIQ 85 FIQ 94
13	20	Female	Dropout technical school	Traffic accident Fellow passenger	Severe JCS = 200	DBI	448	Motor 91 Cognition 32 Total 122	VIQ 83 PIQ 55 FIQ 65
14	23	Female	Student	Traffic accident Pedestrian	Severe GCS = 4	DBI	423	Motor 91 Cognition 34 Total 125	VIQ 92 PIQ 56 FIQ 77
15	30	Male	Self-employed	Traffic accident Bike riding	Moderate JCS = 10	DBI	423	Motor 91 Cognition 34 Total 125	VIQ 93 PIQ 79 FIQ 86
16	23	Male	Student	Traffic accident Bike riding	Severe JCS = 200	DBI	2365	Motor 64 Cognition 24 Total 88	PIQ 46
17	21	Male	Student	Traffic accident Bike riding	Severe JCS = 200	DBI	340	Motor 91 Cognition 29 Total 120	VIQ 67 PIQ 79 FIQ 62
18	19	Male	Student	Traffic accident Fellow passenger	Severe JCS = 100	DBI	250	Motor 91 Cognition 32 Total 123	VIQ 79 PIQ 59 FIQ 65
19	48	Male	Office worker	Cerebral aneurysm	Severe JCS = 200	SAH	455	Motor 91 Cognition 17 Total 108	VIQ 116 PIQ 125 FIQ 123

Table I (Continued)

Case	Age at start (years)	Gender	Occupation	Cause of injury	At time of injury		Time after injury (days)	At start of program	
					Severity	Diagnosis		FIM	WAIS-R
20	56	Female	Office worker	Fall	Moderate JCS = 30	rt.AEDH	780	Motor 91 Cognition 31 Total 122	VIQ 102 PIQ 115 FIQ 109
21	28	Male	Office worker	Traffic accident Pedestrian	Moderate GCS = 10	DBI	761	Motor 91 Cognition 29 Total 120	Estimated FIQ = 50-70
22	52	Male	Office worker	Glioma	Not clear	DBI	1725	Motor 87 Cognition 23 Total 110	VIQ 63 PIQ 79 FIQ 67
23	21	Male	Stock farm worker	Work accident	Severe JCS = 200	DBI	403	Motor 91 Cognition 30 Total 121	VIQ 97 PIQ 47 FIQ 68
24	29	Female	Office worker	Cerebral aneurysm	Moderate JCS = 30	SAH	97	Motor 91 Cognition 29 Total 120	VIQ 72 PIQ 54 FIQ 61
25	23	Male	Student	Traffic accident Fellow passenger	Severe JCS = 300	DBI	1526	Motor 71 Cognition 27 Total 98	VIQ 79 PIQ 64 FIQ 74

JCS = Japan Coma Scale; DBI = diffuse brain injury; GCS = Glasgow Coma Scale; rt.AEDH = right acute epidural hematoma; rt.ASDH = right acute subdural hematoma; lt.ASDH = left acute subdural hematoma; PIQ = performal intelligence quotient; FIQ = full IQ; VIQ = Verbal IQ; MMSE = Mini-mental state examination; WAIS-R = Wechsler Adult Intelligence Scale-Revised; SAH = Sub arachnoid hemorrhage.

Table II. Characteristics of program participant group vs control group. No significant differences between the two groups were seen

Characteristics	Participant group (25 cases)	Control group (12 cases)
	Mean (SD)	Mean (SD)
Mean age at beginning of program (years)	26.6 (9.7)	28.7 (10.9)
Mean time lag of beginning of program after injury (days)	527.3 (512.6)	487.6 (125.9)
Rate of severe TBI patients	19 of 25	10 of 12
Mean total score of FIM movement at beginning	87.7 (7.6)	89.3 (3.9)
Mean total score of FIM cognition at beginning	29.6 (3.1)	29.7 (3.9)

Table III. Content of outpatient rehabilitation program and profession of rehabilitation team members

Major occupation	Content of each session	Frequency
Doctor/nurse	Health consultation, medical examination, explanation of disorders	Every time the patients participated in the program
Social worker	Consultation about provision of medical care Co-ordination with community and businesses	Every time the patients participated in the program Whenever necessary
Clinical psychologist/speech therapist	Social skills training	Once a week
Vocational rehabilitation counsellor	Evaluation of vocational ability Gardening therapy Role play	At first session Once every 2 weeks Once every 2 weeks
Physical therapist	Assessment and application of physical capability	Once every 2 weeks
Rehabilitation gymnastic trainer	Various sports	Once every 2 weeks
Occupational therapist	Occupational therapy (ceramic art; "Tougei")	Once every 2 weeks
Welfare facility life advisor	Provision of social resources Cooking practice Planning and execution of hiking	Once every 2 weeks Once every 2 weeks 3 times
All staff members	Regular conference with patient/family Visiting welfare facilities	Once every 3 months Once

Table IV. Comparison of improvement of FIM/FAM between 2 groups

FIM/FAM	Improvement	
	Participants (25 cases) Mean (SD)	Controls (12 cases) Mean (SD)
Comprehension (FIM)	0.24 (0.44)	0.08 (0.29)
Expression (FIM)	0.24 (0.44)	0.08 (0.29)
Reading (FAM)	0.12 (0.33)	0.08 (0.29)
Writing (FAM)	0.20 (0.41)	0.08 (0.29)
Speech intelligibility (FAM)	0.24 (0.44)*	0.00 (0.00)
Total of communication	1.08 (0.81)	0.50 (0.91)
Emotional status (FAM)	0.36 (0.64)	0.17 (0.39)
Problem solving (FIM)	0.72 (0.68)*	0.17 (0.39)
Memory (FIM)	0.83 (0.29)*	0.44 (0.51)
Adjustment to limitations (FAM)	0.68 (0.63)	0.50 (0.52)
Orientation (FAM)	0.36 (0.49)	0.17 (0.39)
Attention (FAM)	0.83 (0.29)*	0.40 (0.50)
Safety judgement (FAM)	0.20 (0.41)	0.17 (0.39)
Employability (FAM)	0.44 (0.65)	0.17 (0.39)
Social integration (FIM)	0.68 (0.63)*	0.25 (0.45)
Total of social cognition	5.64 (2.48)	1.75 (1.22)
Total of FIM motor	0.12 (0.44)	0.27 (0.91)

*Significant difference between the two groups $p < 0.05$.

FIM/FAM = Functional Independence Measure/Functional Assessment Measure.

treatment program were related to the scarcity of extended treatment for patients with TBI. In Japan, hospitalization of a duration such as 3 months is often insufficient for young patients with TBI accompanied by cognitive disturbances to solve their difficulties and to re-enter society. Resources such as welfare facilities for social rehabilitation are few. When a social rehabilitation facility is available, young patients with TBI tend to dislike it and would rather have training or treatment from a hospital, hoping that their impairment can be cured. Inevitably, outpatient treatment by conventional physical therapy or occupational therapy is often continued individually. In such cases, however, there is no system available to co-ordinate problems inherent in returning to work or school long-term or to support patients when return to work or school becomes difficult. Thus, these patients spend their days in idleness. Our comprehensive day treatment program was set up in 2001 to solve such problems.

All 25 participants in the present program are nearly independent in ADL. However, in the acute stage, the majority

Table V. Comparison of Community Integration Questionnaire (CIQ) scores between 2 groups

CIQ	Improvement	
	Participants (25 cases) Mean (SD)	Controls (12 cases) Mean (SD)
Home integration	0.56 (0.92)	0.17 (0.58)
Social integration	1.04 (1.06)*	0.17 (0.39)
Productive activity	1.92 (1.66)*	0.25 (0.45)
Total*	3.52 (2.57)	0.58 (1.08)

*Significant difference between the two groups $p < 0.05$.

experienced severe brain trauma due to diffuse brain injury. Consequently, scores for cognition items on the FIM/FAM tended to be low although physical disorders were slight. Those patients could not participate in society after leaving hospital, the major reasons being neuropsychosocial disorders that included problems with communication and cognition.

Among the 25 program participants, 23 had improvement in the total CIQ score. In comparison with the control group, the CIQ productive activity score was significantly improved in the participant group. These results suggest that the present program satisfied the aim of strengthening connection with welfare, labour and educational services through the work of various disciplines within the program.

All outpatient program participants showed an improvement either in communication or in social cognition items. Compared with the control group, the participant group had a significantly greater improvement in speech intelligibility, attention/concentration and social exchange among the items on the FIM/FAM. These data suggest that the continuation of regular activities during the 3- or 4-month period of the sessions contributed to improvements in attention/durability and memory. Also, the social skills training provided may have contributed to improvements in speech intelligibility and sociability. However, we could not conclude that these changes were all due to the outpatient program. It is possible that patients highly responsive to group programs agreed to participate, thus skewing the participant population. Furthermore, although the FIM/FAM aims to evaluate independence in actual daily life, judgement may be subjective. Program participants may have spent more time with evaluators than control patients, making small changes in participants more noticeable.

The outpatient program of our hospital modelled itself after the Brain Injury Day Treatment Program at New York University (20). This model program also focuses on multifaceted disorders of neurocognition, neurobehaviour and personal relations occurring in patients with acquired brain injury. The program at New York University is run for 5 hours a day, 4 times a week, with a 20-week cycle. It is a highly intensive program run by several clinical neuro-psychologists.

If we adopt such a program, sufficient investigation from the viewpoint of medical economics or hospital management is necessary with regard to when, where, by whom and how it should be practised. Essential staff members needed to present the outpatient program at our hospital were a clinical psychologist, occupational therapist, physical therapist and medical social worker. In order to reduce the administrative burden, adoption of a transdisciplinary team model approach may be considered. In our hospital, we offered rehabilitation to patients with TBI, and we are planning to continue this outpatient program. We expect further improvement in the program content and more appropriate evaluation of outcome as the number of participants increases. In this connection, some graduates of our program still need some support. Therefore, it is necessary to construct a system for continuation of long-term support. In the meantime, however, the results shown here

demonstrate the effectiveness of the current program in helping patients with acquired brain injury to return to society.

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