ORIGINAL ARTICLE

Outcome of a Comprehensive Neurorehabilitation Program for Patients With Traumatic Brain Injury

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Objective: To evaluate the outcome of a comprehensive neurorehabilitation program compared with that of conventional clinical care and rehabilitation for patients with traumatic brain injury (TBI).

Design: Nonrandomized, controlled trial with a 2-year follow-up.

Setting: Nationwide rehabilitation center and level I trauma center, both in Finland.

Participants: We studied 19 consecutive adults with a significant TBI who underwent a comprehensive neurorehabilitation program and 20 control patients who received conventional rehabilitation referred by physicians in the general health care system. The outcome of the control patients was not known before the selection. The groups were similar in age, sex, education, injury severity (assessed on the Glasgow Coma Scale, radiologic and neuropsychologic findings, neurosurgical interventions), time from the injury, and preinjury employment status.

Interventions: A postacute, intensive, interdisciplinary, 6-week rehabilitation program for TBI patients who are considered to have adequate potential to achieve productivity by this means; focus on neuropsychologic rehabilitation and psychotherapy with vocational interventions and follow-up support.

Main Outcome Measure: Status of productivity, judged as productive (defined as working, studying, or participating in volunteer activities) or nonproductive, evaluated on questionnaires filled in by patients and their significant others at the time of follow-up evaluation.

Results: At follow-up, 89% of the treated patients were productive compared with 55% of the controls. The rehabilitation program was significantly predictive of the productive status at follow-up (odds ratio=6.96; 95% confidence interval, 1.26–38.44; $P=.017$). Other factors did not explain the better productivity of the treatment group. Two neuropsychologist-evaluators, who were blind to the rehabilitation history of patients and to each other's evaluations, were perfectly consistent in their classification of patients' productivity statuses.

Conclusions: The findings support the proposition that comprehensive neuropsychologically oriented rehabilitation programs can improve psychosocial functioning in terms of productivity in postacute patients with moderate to severe TBI. Additional larger controlled studies are needed to establish the efficacy of TBI rehabilitation interventions.

Key Words: Brain injuries; Neuropsychology; Outcome assessment (health care); Rehabilitation.

TRAUMATIC BRAIN INJURY (TBI) is a disorder of major public health concern because of its high incidence, prevalence, and economic consequences. It affects people of all ages and is the leading cause of long-term disability in young adults.[1-5] Most brain injuries occur during the years when people are aiming for vocational goals and acquiring the skills and values needed to achieve vocational success. Patients with TBI frequently have cognitive, emotional, and behavioral deficits, with difficulties in establishing interpersonal relationships and returning to productive life.[6,7] TBI is a heterogeneous disorder, and different forms of rehabilitation are needed for different subgroups of patients and at different phases over the course of recovery to optimize outcomes.[8-10] During the past 20 years, there have been considerable improvements in TBI rehabilitation services. Although results suggest that the use of certain rehabilitation interventions may enhance patients' psychosocial outcomes, the effectiveness of TBI rehabilitation has received little rigorous evaluation.[11-13]

Employment rates for patients with TBI have ranged from 19% to 99%.[10,14-18] Poor rates have been reported for patients with severe TBI.[16-20] This large range is also due to differences between study groups in the time from injury, patients' ages and preinjury characteristics, and methods of operationalizing the return to work.[11,21] Additionally, vocational status has been shown to decrease over time.[22] The effectiveness of systematic, holistic, and comprehensive neuropsychologically oriented postacute rehabilitation programs in enhancing the productivity status of patients with TBI has been supported by uncontrolled studies[23-25] and a few studies with historical control groups.[26] The main elements of these programs include the promotion of a therapeutic milieu, psychotherapy and cognitive retraining carried out in individual and group settings, supported work trials, family education and therapeutic assistance, and follow-up procedures.

The consensus statement of the U.S. National Institutes of Health on the rehabilitation of people with TBI suggests that controlled studies on the effectiveness of rehabilitation interventions are needed but points out that it is difficult to conduct research in this area.[5] Adequate sample sizes, appropriate comparison groups, and the random assignment of patients to rehabilitation and control conditions are seldom achieved in a

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clinical rehabilitation environment.[5,27] Moreover, the spontaneous recovery course of TBI is poorly understood.[28,29]

This study was designed to evaluate the outcome of a postacute comprehensive neuropsychologically oriented rehabilitation program for patients with TBI. We compared the productivity (defined as working, studying, or participating in meaningful organized voluntary work) of patients who underwent the rehabilitation program with that of matched control patients who received conventional clinical care and rehabilitation. After the completion of the rehabilitation program, patients were followed up for 2 years and then evaluated for the long-term and stabilized outcome after the postacute rehabilitation program and their initial trauma. The 2-year follow-up period was considered long enough to show the effect of rehabilitation but not so long that other factors would confound the findings.

METHODS

Participants

Nineteen patients with the primary diagnosis of TBI consecutively admitted to the Individualized Neuropsychological Subgroup Rehabilitation Program (INSURE) at the nationwide rehabilitation center for neurologic patients, Käpylä Rehabilitation Centre, in Helsinki, Finland, served as the rehabilitation patients (treatment group). They took part in 1 of 4 separate INSURE programs; the first started in May 1993 and the last in December 1994. The inclusion criteria were (1) independence in daily life and only slight physical disabilities, (2) 16 to 55 years of age, (3) completed compulsory education, and (4) adequate potential to achieve productivity if given special rehabilitation. The last criterion was evaluated by 3 senior neuropsychologists in the context of admission decisions. These clinical judgments were based on patients' preinjury employment history, reports from their physicians, neuropsychologists, or rehabilitation counselors, and a neuropsychologic recruitment interview. Patients were excluded if they presented (1) a significant psychiatric history, (2) alcohol or drug abuse, (3) a previous brain injury, or (4) another malignant disease during the follow-up.

We selected control patients from 213 patients with TBI who were seen for neuropsychologic examination at the department of neurosurgery at Helsinki University Central Hospital in a level I trauma center, who had their head injury during the same time period as the treatment patients, but who were not referred to the INSURE program. Ten (53%) of the patients in the treatment group had also been at the department of neurosurgery in Helsinki during their acute treatment and had afterward been referred to the program. Twenty-three control patients were selected from the group of 213 patients using the same inclusion and exclusion criteria as in the treatment group. The control patients were selected to make the group as similar as possible to the treatment group with respect to age, sex, education level, injury severity (based on the Glasgow Coma Scale [GCS] and radiologic, neuropsychologic, and neurosurgical findings), time from the injury to the evaluation, and preinjury employment status. These variables have all been shown to influence outcome after brain injury.[15,18,30,31]

Consequently, all control patients were considered potential candidates for the INSURE program based on the clinical judgment of a senior neuropsychologist in the program and the neuropsychologist who had assessed them at the department of neurosurgery. Three of them were later lost because they did not return the study questionnaires. The outcomes of patients were not known during the selection, because the information was not available until the same time interval from injury to outcome evaluation as in the treatment group had passed, and it was asked according to the study protocol.

Control patients received conventional clinical care and rehabilitation, because in a clinical rehabilitation environment we compare the outcomes of similar patients, some of whom receive special neurorehabilitation and some of whom receive conventional clinical care and rehabilitation. There is no general management system for getting a referral to our program. It depends on the units and health professionals in the health care system taking care of each patient's rehabilitation process. According to usual practice patients are referred to their local health care units after acute treatment in the level I trauma center in Helsinki (where all the controls were seen). These local units differ with respect to their rehabilitation policies, which depend on referral practices of specific physicians, geographic locations of patients, and financial resources.

Demographic and injury-related information obtained from hospital files is given in table 1. The primary computed tomography and magnetic resonance imaging scans of each patient were analyzed by a neuroradiologist (ARS). Information concerning subjects' GCS scores and neurosurgical interventions was evaluated by a neurosurgeon (MRN). The neuropsychologic sequelae of patients in both groups consisted of various combinations of problems, including (1) tendency to fatigue, (2) slowness of information processing, (3) disorders of attention and concentration, (4) disorders of learning and memory, (5) disturbances in executive skills (eg, difficulties in initiation, planning, and self-monitoring or in judgment), (6) difficulties in modulating affective states (eg, irritability, emotional lability), and (7) disorders of language communication (eg, tangentiality, hyperverbality, ineffective word retrieval). Table 2 presents the rehabilitation before the program and the follow-up support therapy after the basic program for patients in the treatment group. Many of these patients had received a lot of rehabilitative care conventionally available in the health care system. These findings might also reflect the gravity of their TBIs. Six (32%) of them had also attempted to return to work or education 1 or more times but had failed before their entry into the program. Six (30%) of the control patients reported that they had attempted to return to work after their TBI but had failed. General information about the conventional clinical care and rehabilitation that the control patients received is given in the Interventions section.

Interventions

The INSURE program has been described in detail elsewhere.[32] It is a postacute, interdisciplinary, 6-week, inpatient rehabilitation program for selected groups of patients with TBI. The core of the program is neuropsychologic rehabilitation and psychotherapy. It is based on the work of Christensen, Ben-Yishay, and Prigatano and colleagues.[21,23,24,33]

Each group consists of 5 to 8 members. The daily schedule runs from 8:30 AM to 4:00 PM on weekdays. Patients are treated in group and individual rehabilitation formats. Although the program is standardized, it is also individualized—especially concerning the allocation of different individual therapies—to meet the special needs of each patient. The staff includes 3 neuropsychologists, a neurologist, a rehabilitation nurse, a social worker, 2 speech and language pathologists, an occupational therapist, and a physical therapist. Medical consultations are arranged, usually with specialists in neuropsychiatry, neuroradiology, and physiatry. The staff works closely together to foster consistency among the various rehabilitation activities. The importance of therapeutic alliance, which refers to patients and therapists working together to achieve certain goals, is also emphasized.[26]

Table 1: Comparison of the Treatment and Control Groups on Demographic and Injury-Related Variables

Variable	Treatment Group (n=19)	Control Group (n=20)	*U**	*P*
Age at injury (y)	30.5±10.6 (16.0–52.0)	29.5±11.0 (17.0–54.0)	.52	.60
Education (y)	11.3±2.0 (9.0–17.0)	12.2±2.9 (8.5–18.0)	.76	.45
Admission GCS score	7.9±2.7 (4.0–14.0)	8.0±2.5 (3.0–13.0)	−.32	.75
Chronicity (mo)†	42.4±17.7 (28.0–106.0)	46.6±20.2 (25.0–119.0)	−.98	.34
Sex (men/women)	16/3	17/3		
Employment status (n)‡	16	17		
Mechanism of injury (n)				
Motor vehicle collision	8	7		
Bicycle collision	3	1		
Pedestrian–auto collision	1	3		
Assault	1	1		
Other (fall, hit by an object)	5	8		
Unknown	1	0		
Brain CT/MRI findings (n)				
CH	15	16		
DAI	8	5		
ICP	7	5		
Craniotomy	4	5		

NOTE. Values are mean ± standard deviation (range) unless otherwise indicated.
Abbreviations: CH, contusion and/or intracranial hematoma; CT, computed tomography; DAI, diffuse axonal injury; ICP, signs of severe intracranial pressure; MRI, magnetic resonance imaging.
*Mann-Whitney statistic.
†Time from injury to 2-year follow-up evaluation.
‡Number of patients who were employed or studying preinjury.

The days begin with a group meeting in which the members and the neuropsychologists determine individual goals for the day and the program. As the program continues, long-term goals are set. Another aim of the meeting is to promote both psychologic and physiologic arousal and to foster personal orientation.

The neuropsychologic psychotherapy group meets 4 days a week. The groups involve discussions on injury-related pathophysiologic, neuropsychologic, and neurobehavioral aspects of TBI, as well as on personal reactions, coping, and psychosocial adjustment. The participants also have similar individual sessions daily. They are taught to assess their goals for work and education realistically, bearing in mind the postinjury changes in their resources.

Various kinds of group activities are used to reinforce the program, which as a whole simulates the conditions and stress of normal working. The cognitive group aims to help subjects compensate for their cognitive symptoms. The practical implications of injury-related neuropsychologic changes are considered in terms of recovery, compensation, and functional obstacles. Rehabilitation software and lectures are used to show the changes. The cognitive group takes place twice a week. The following 4 weekly group sessions are also held. In the pragmatic group, speech and language pathologists coach the mastering of pragmatic communication disorders. In the pictures-of-self group, patients express their emotions, experiences, and visions of themselves and their lives through photography. The quality-of-life group deals with social and material issues related to everyday life and good health practices. The sport, relaxation, and jogging group aims to encourage members to start or restart sport activities.

Table 2: Pretreatment and Postdischarge Follow-Up Therapy for Patients in the Treatment Group (n=19)

Type of Rehabilitation	Before n (%)	Follow-Up n (%)
Acute hospital		
Occupational therapy	6 (32)	0 (0)
Physical therapy	9 (47)	0 (0)
Speech therapy	5 (26)	0 (0)
Neuropsychologic rehabilitation	7 (37)	0 (0)
Rehabilitation center	11 (58)	7 (37)
Outpatient		
Occupational therapy	2 (11)	0 (0)
Physical therapy	4 (21)	3 (16)
Speech therapy	2 (11)	2 (11)
Neuropsychologic rehabilitation	14 (74)	16 (84)
Revision of the program	NA	3 (15)

Abbreviation: NA, not applicable.

After 4 weeks, a 2-day INSURE seminar is held. Present and former INSURE participants, significant others, employers, and professionals from the public health care system are called together to share information and to learn about experiences that follow TBI. During the seminar, each participant also attends a meeting in which his/her plan for continuing rehabilitation is adjusted. After the seminar the rehabilitation protocol continues as described above for the rest of the 6-week rehabilitation program.

An essential element in the INSURE program is supported and individually tailored vocational interventions to help patients find productive activities that fit their interests and abilities after TBI. When considering an adapted and practical goal, patients are encouraged to have supported work trials in the general market where they could possibly continue afterward. These interventions are worked out during the program and organized with local social and health care units and the compensation system liable for care in each case. Adequate neuropsychologic follow-up support and coaching have been shown to be important for success in trials of work and education and for the achievement of good psychosocial balance.[21,34-36] During the program recommendations are made concerning future maintenance support. Follow-up support is

Table 3: Number of Productive and Nonproductive Patients in the Treatment and Control Groups at Outcome Evaluation

Status	Treatment Group (n=19), n (%)	Control Group (n=20), n (%)
Productive	17 (89)	11 (55)
Nonproductive	2 (11)	9 (45)

NOTE. OR=6.96; 95% CI, 1.26–38.44. χ_1^2 test=5.718, P=.017.

arranged through public or private health care services. Most patients continue with individual neuropsychologic rehabilitation and coaching for different periods after completing the basic program. On completion of an INSURE program, patients should have substantial knowledge about TBI, giving them a sound basis for understanding and coping with TBI-related changes and for participating in productive living according to their own best self-interests.

Patients in the control group received conventional clinical care and rehabilitation referred by physicians in the local health care system and depending on the compensation system liable for care in each case. The treatment included therapies such as physical, occupational, speech, neuropsychologic, and psychotherapy during hospital care or later in the outpatient format; evaluations concerning rehabilitation needs; multidisciplinary inpatient rehabilitation in rehabilitation centers; and outpatient follow-ups. TBI rehabilitation services are individually tailored and delivered in an unstructured and nonsystematic way in the health care system. We did not collect detailed information on the treatments of control patients.

Outcome Assessment

We mailed a detailed and structured self-completion questionnaire covering different areas of productive activities (including full- or part-time employment, studying, household management, supported or sheltered work, work trials, voluntary work) to patients and their significant others 2 years after they had completed each of the 4 neurorehabilitation programs. They were asked to evaluate the primary productive activity in which the patient was engaged just before the injury and at the time of the follow-up evaluation. The controls and their spouses or partners were also asked to use the same questionnaire to evaluate the productive activities in which the patient was engaged just before the injury and after the same time interval from injury to outcome evaluation as that of the treatment group. If they did not respond, they were reminded by letter, telephone, or a further mailing of the questionnaires. If the information given was inadequate or unclear, patients and their spouses or partners were interviewed by telephone. Three controls were seen personally to fill in the questionnaire. All 19 patients in the treatment group and 18 of their spouses or partners returned the questionnaires or were interviewed. In the group of 23 control patients, the respective numbers were 20 and 15.

In this study, we evaluated outcome as productive or nonproductive. Productivity was defined as working (from full-time gainful work to supported work or work trial), studying, or participating in meaningful organized voluntary work. Two neuropsychologists, who were not in any other way involved in this study or in patients' care and rehabilitation and who did not know what rehabilitation each patient had received, independently assessed patients' productivity statuses by analyzing the questionnaires.

Statistical Analysis

To compare the 2 groups we used the Mann-Whitney U test and the chi-square test for independent samples. Because the injury-related and demographic variables might have confounded the effect of rehabilitation on the outcome, we studied their effects by means of a logistic regression analysis.[37] The primary measure of the effect obtained from the logistic model consisted of the odds ratio (OR) and the consequent 95% confidence intervals (CIs). Two-tailed tests were used. The SPSS software package, version 12.0.1,[a] was used for the statistical analysis.

RESULTS

The 2 groups did not differ on any of the demographic or injury-related matching variables (see table 1). The consistency of the classification of patients in the productive and nonproductive categories by the 2 independent raters was perfect. At the end of follow-up, 17 (89%) patients in the treatment group and 11 (55%) control patients were productive. The outcome of the treatment group was better and significantly different from that of the control group (OR=6.96; 95% CI, 1.26–38.44; P=.017) (table 3).

Table 4: Type of Productive Activity Before Treatment for the Treated Patients and at Outcome Evaluation for the Treated and Control Patients

Type of Productive Activity	Pretreatment	2-Year Follow-Up	
	Treated Patients (n=19)	Treated Patients (n=19)	Control Patients (n=20)
Gainful work			
Full time	0	1	7
Part time	0	3	1
Education/student	0	4*	3
Work trial	0	3*	0
Productive but nongainful work			
Full time	0	0	0
Part time	1	3	0
Volunteer work (organized and routine)	0	3†	0
No productive activity‡	18	2	9

*Six of the patients who were at school or on a work trial were aiming at gainful part-time work and 1 patient at productive but nongainful part-time work.
†One patient was an independent homemaker and taking care of a 1-parent family.
‡No working, studying, or participation in organized and routine volunteer work.

Table 5: Productivity Status* Explained by Treatment and Other Variables Using Logistic Regression Analysis (N=39)

Variables	Regression Coefficent	SE	OR (95% CI)	P§
Treatment†	1.97	0.90	7.19 (1.23–42.20)	.029
Sex‡	0.11	1.09	1.11 (0.13–9.35)	.921
Age at injury (y)	−0.027	0.039	0.97 (0.90–1.05)	.481
Chronicity (mo)	−0.021	0.020	0.98 (0.94–1.02)	.296
GCS score	0.14	0.17	1.15 (0.82–1.60)	.416
Constant	0.81	2.27	2.25	.721

NOTE. Categoric variables were coded as 0 and 1 as follows:
Abbreviation: SE, standard error.
*Productive=1, nonproductive=0
†INSURE=1, control=0
‡Man=1, woman=0.
§Wald test.

Table 4 shows the numbers of patients classified according to the type of productive activity before the rehabilitation program for the treated patients and at the 2-year follow-up for the treated and control patients. The productivity status of the treated patients clearly improved during that time interval. The 2 treated patients who were unproductive at the moment of evaluation were looking for supported work-trial places. At the time of follow-up, 7 control patients were in gainful full-time work, 1 was in gainful part-time work, and 3 were studying. Three of them reported significant difficulties related to working or studying after their injury, and 2 reported that their jobs were less demanding than before the injury. The proportion of patients engaged in gainful work at the follow-up was bigger in the control group (8/20) than in the treatment group (4/19), but the difference was not statistically significant (χ^2 test=1.642, P=.200).

The potential confounding variables used in the logistic regression analysis were age at injury, sex, education level, chronicity (the time from injury to the outcome evaluation), injury severity (GCS score), and preinjury employment status. From these variables only the preinjury employment status was associated statistically significantly with productivity (OR=7.43; 95% CI, 1.12–49.24; P=.038). Patients who were unemployed at the time of injury were more likely than the other patients to be unproductive at follow-up (67% vs 21%).

Both the treatment variable and all these potential confounding variables were entered simultaneously into the logistic regression model with productivity status as the dependent variable. However, some of the regression coefficients in this model were poorly estimated because of both high intercorrelations of some independent variables (age at injury and education, r=.55) and a small number of subjects in the "unemployed" category of preinjury employment status (n=6). Including either the combination of "age at injury" and "education" or the combination of "treatment" and "employment status" as independent variables in the model produced a huge increase in standard errors of regression coefficients of these variables. Therefore, for better fit of the model, the variables of education and preinjury employment status were excluded from the analysis.

A logistic regression analysis (table 5) showed that the rehabilitation program was significantly predictive of the productive status at follow-up when adjusted for the remaining independent variables (OR=7.19; 95% CI, 1.23–42.20; P=.029). The dropout of 2 independent variables from the model was of no importance from the point of interpretation of the results, which we can conclude based on some additional analysis. In the model in which age at injury was replaced with education, association between rehabilitation program and productivity status was very similar (OR=8.39; 95% CI, 1.54–52.54; P=.023). The association between treatment and productivity status was not confounded by preinjury employment status, because the association was obvious both among patients who were employed or studying at the time of injury (OR=11.19; 95% CI, .89–140.99, P=.062) and among those who were unemployed. Because there were only 6 patients in the latter group, statistical testing was not applicable. Nevertheless, the 2 patients who were productive were in the treatment group.

DISCUSSION

The percentage of productive patients was higher in our special neuropsychologic rehabilitation group (89%) than in the matched control group (55%) receiving conventional clinical care and rehabilitation. The likelihood of being productive was greater among patients who were employed or studying at the time of injury, which is in line with previous findings in studies attempting to predict employment outcome after TBI.[15,18,30,31]

The rate of productivity was quite consistent with that reported in previous studies on the efficacy of similar comprehensive rehabilitation programs for postacute patients.[6,21,24-26] Ben-Yishay et al[21] reported that 84% of the 94 previously nonproductive patients with severe chronic TBI gained the ability to engage in productive endeavors after rehabilitation. Christensen's group[24] found that over 70% of the 46 patients with brain injury returned to work or education or engaged in voluntary work activities after their rehabilitation program. Klonoff et al[25] reported that 83.5% of 164 patients with brain injury were productive (defined as gainful employment, school, or volunteer work) in some capacity at up to 11 years postdischarge from their rehabilitation program. None of these studies included a nontreatment control group. Prigatano et al[6] reported 50% productivity for 18 patients with TBI in the rehabilitation group at follow-up (8–33mo) compared with 36% of 17 matched controls who were given traditional rehabilitation. In this study, productivity was defined in terms of being gainfully employed part time or full time or being actively engaged in a realistic school program. In a more recent study, Prigatano et al[26] replicated the findings of their earlier study in a larger group of 38 patients with TBI with 38 controls in a different rehabilitation setting and under different therapists. The treated patients were admitted to the rehabilitation program at various intervals after injury (range, 2–55mo). When part-time and meaningful volunteer work were taken into account, 77% of the treated patients were productive compared with 47% of the controls. The appropriate timing of the holistic neuropsychologically oriented approach seems to be crucial to gaining positive outcome. Results in patients with acute TBI have been associated with less favorable outcomes.[34,38]

Productivity was strongly polarized in our control group. Nine patients were completely unproductive and 11 were involved in gainful work or studying. An explanation for this finding could be that our control patients were more productive than patients in the treatment group more than 2 years before the outcome evaluation, at the beginning of the treatment program. The 2 groups were similar with respect to background characteristics, injury severity, and time from injury to outcome evaluation, but we did not select the control patients to match patients in the treatment group with respect to their pretreatment productivity, although they were matched with respect to their employment status before injury.

An additional question concerns strategies for returning to work or productive activity. An essential element in the INSURE and similar rehabilitation programs is supported vocational interventions. Individually tailored placements and supported work trials help patients find productive activities that fit their interests and abilities after TBI.[5,20,39,40] Such interventions are used in a less systematic way—if at all—in conventional clinical care and rehabilitation.

Consistent with similar studies, we believe that productivity is an appropriate outcome variable for the assessment of TBI rehabilitation. The major difference between the treatment and control groups was due to the fact that more treated than control patients were engaged in structured, productive (but nongainful) activity. This is likely to be a direct result of the special rehabilitation program, in which patients who would otherwise engage in no productive activity are provided with some means of establishing productive activity. This difference (and the corresponding reduction in the number of patients engaged in no productive activity) suggests that a major impact of the program is on patients at the lower end of functional recovery (more than on the numbers engaged in gainful work). However, productivity is a rather broad criterion compared with, for example, gainful work. When we consider return to gainful work as an outcome criterion, more control patients than treated patients were engaged in gainful work, although the difference between the 2 groups was not statistically significant. It is noteworthy, however, that return to work as such does not guarantee good psychosocial adjustment.[35] Three of our 11 control patients who were productive reported significant difficulties related to their working, and 2 had less demanding work than before the injury. O'Neill et al[41] suggested that part-time employment might be superior to full-time employment after TBI. In their study, part-time workers had fewer unmet needs, were more socially integrated, and were more engaged in home activities than full-time workers. Full-time workers may have been so fully engaged in their work that they had less time and energy to pursue other life domains. These findings suggest that successful outcomes need to be expanded to include the ability to engage in a sufficiently wide range of activities. Of particular interest in future studies would be the relation between different types of productive activities and quality of life.

The importance of individual and peer-group psychotherapeutic interventions that help patients attain optimal psychosocial adjustment and be productive has been emphasized in comprehensive TBI rehabilitation programs.[5,21,23,24,33] Above all, the psychotherapeutic process is vital for helping patients achieve a sense of identity, learn to behave in their own best self-interests, and reconstruct life after brain injury. According to Prigatano,[42] one of the primary symbols of normality that guides the psychotherapeutic process is work (ie, productivity).

Rapid step-down to no adequate maintenance support has also been found to have a negative impact on the durability of the rehabilitation outcome after discharge from rehabilitation programs.[21,34-36] After completion of the basic program, 16 of our patients continued neuropsychologic rehabilitation and support therapy according to their plans for the continuation of rehabilitation made during the INSURE program. Eight patients were engaging in therapy at the end of the follow-up. One patient continued therapy for 18 months and 4 patients for a year after finishing the basic program. We did not try to separate the effect of the INSURE program from that of the subsequent support, because the latter was considered part of the program.

When assessing applicants for the program, we bear in mind that it is beneficial only to members of particular selected subgroups and not to all people who have suffered TBI. However, the basic principle of learning to cope with TBI can be applied generally in the rehabilitation of injuries with a wide range of complications and severity. Also, from a clinical perspective, trying to identify the subgroups that are most likely to benefit from different kinds of therapies would allow more judicious allocation of resources and would optimize outcomes over the course of recovery.[5,10]

This study was not a randomized trial, which weakens the conclusions. In this study an attempt was made to evaluate the outcome of 1 form of rehabilitation in a clinical rehabilitation environment. In a matched-control study design, groups should be carefully compared on important variables to rule out alternative explanations. On average, our groups were very similar on each important variable measured in the preinjury and acute phases. The possible confounders were taken into account in statistical analysis, but the demographic or injury-related variables did not confound the role of the rehabilitation program in the outcome evaluation. However, we did not select the control patients to match patients in the treatment group with respect to their pretreatment productivity, although they were similar with respect to their preinjury productivity. This study was also limited by its small sample size, which affects the generalizability of the findings.

We did not address the detailed information about the rehabilitation of the control patients. The aim of our study was to evaluate the outcomes of patients who underwent a special rehabilitation program and compare it with those of patients who received conventional clinical care and rehabilitation available in the health care units. The type of rehabilitation that the treatment group received before the INSURE program reflects the conventional rehabilitative care of the control patients. However, additional research is needed to evaluate the contents and benefits of different rehabilitation interventions.

CONCLUSIONS

Our findings support the proposition that neuropsychologically oriented rehabilitation programs with adequate postdischarge maintenance therapy can improve psychosocial functioning in terms of productivity in postacute patients with significant TBI. It seems that comprehensive rehabilitation does overcome handicaps and improve outcome. Additional larger, controlled studies are needed to evaluate the benefits of different rehabilitation interventions.

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