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INFLUENCE OF INITIAL STATUS ON FUNCTIONAL GAIN FOR JAPANESE PATIENTS WITH FIRST CEREBRAL HEMORRHAGE

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It is important to identify in advance patients who will achieve the greatest functional gains from rehabilitation therapy, as specialist rehabilitation resources are still scarce in Japan. The purpose of this study was to determine whether functional score at admission influences the functional change (functional score at discharge minus functional score at admission) after inpatient rehabilitation for first cerebral hemorrhage. One hundred and ninety-three patients with cerebral hemorrhage were enrolled in this study. They were assessed using the Functional Independence Measure (FIM) at admission and discharge and underwent inpatient rehabilitation treatment. Patients were stratified into 3 groups according to their FIM total scores on admission as follows: (1) $\leq$36 (severely affected patient group); (2) 37–72 (moderately affected patient group); and (3) $\geq$73 (mildly affected patient group). Scheffe's multiple comparison test showed that patients in group 1 were significantly older (mean $\pm$ SD = 63 $\pm$ 10 years) than those in groups 2 (56 $\pm$ 10 years) or 3 (53 $\pm$ 12 years). Patients in group 2 showed significantly greater FIM gain (37 $\pm$ 17) compared with patients in groups 3 (23 $\pm$ 12) or 1 (27 $\pm$ 23). The results suggest that moderately affected patients at admission will show significantly higher functional gain compared with severely or mildly affected patients. Mildly affected patients at admission had a significantly shorter length of hospital stay for rehabilitation than the other groups. There was no significant difference in onset to admission interval between the 3 groups. The functional levels of affected patients on admission, as stratified by the FIM scale, roughly predict the degree of functional gain following rehabilitation in patients with first cerebral hemorrhage. Moderately affected patients will benefit from intensive rehabilitation. This study may be useful in determining how best to prioritize rehabilitation therapy.

Key words: functional gain, Functional Independence Measure, cerebral hemorrhage.

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INTRODUCTION

In stroke rehabilitation, it is always important to inform patients and their families of the obtainable levels of functional recovery as soon as they are admitted to a rehabilitation hospital. Levels of functional recovery are related to the burden of care and discharge places. Age, gender, marital status, lesion size and location, complete or bilateral limb paralysis, urinary and bowel incontinence, visual deficits, sitting balance, communication impairments, decreased level of consciousness, depression, cognitive dysfunction, motivation and admission functional score (1–18) have been proven to be valid predictors for assessing stroke rehabilitation outcome. Of these factors, functional admission score has been found to be positively correlated with functional outcome in most studies (19–22), although its relationship with functional gain is less clear. Little has been done to investigate rehabilitation outcome in terms of functional gain. Functional gain in this study is defined as the value calculated by subtracting the functional discharge score from the functional admission score, which indicates functional improvement following rehabilitation therapy.

The Functional Independence Measure (FIM™) is widely used in rehabilitation as a means of categorizing a patient's condition and to provide data for program evaluation via the Uniform Data System (23, 24). The FIM score is a composite of 6 subsections dealing with self care (42 points), mobility (21 points), sphincter (14 points), locomotion (14 points), communication (14 points) and social cognition (21 points). The score for each item is added to make the section scores and these are then added together to give the total FIM score. The FIM score was developed as a measure of a person's disability and of the progress made in the rehabilitation program. FIM total scores at admission have been found to be the best predictor of rehabilitation outcome (25, 26). However, little has been done to study the relationship with functional gain.

As specialist rehabilitation resources are still scarce in Japan, there is a 1–2 month waiting list to enter our rehabilitation hospital. Therefore it is important for the physician to determine admission priorities for rehabilitation therapy and the proper intensity of rehabilitation treatment. Accordingly, it is desirable to identify in advance those patients who will achieve the greatest functional gains and to offer them intensive and effective rehabilitation therapy. The purpose of this study was to determine whether or not the FIM total score at admission

Table I. *Characteristics of patients with cerebral hemorrhage stratified using FIM total score at admission*

Characteristic	FIMad 18–36 ($n = 54$)	FIMad 37–72 ($n = 53$)	FIMad 73–126 ($n = 76$)	All cases ($n = 193$)	All men ($n = 135$)	All women ($n = 58$)
Male (n)	41	45	49	135		
Female (n)	13	18	27	58		
Age (years)	63 ± 10*,#	56 ± 10*	53 ± 12#	57 ± 11	56 ± 12	60 ± 10
FIMad	26 ± 6x,y	54 ± 11x,z	91 ± 13y,z	61 ± 29	59 ± 29	64 ± 38
FIMdis	53 ± 27a,c	90 ± 19a,b	113 ± 8b,c	89 ± 31	88 ± 31	92 ± 30
OAI (days)	77 ± 37	76 ± 38	70 ± 36	74 ± 37	76 ± 40	70 ± 30
LOHS (days)	118 ± 40%	118 ± 35!	101 ± 38%,!	111 ± 38	112 ± 37	109 ± 43
FIMgain	27 ± 23+	37 ± 17+,@	23 ± 12@	29 ± 18	29 ± 17	29 ± 21

Data are expressed as mean ± SD. Means sharing common letters or symbols in the same row are significantly different from each other at $p < 0.05$ by Scheffe's multiple comparison procedure. FIMad = FIM at admission; FIMdis = FIM at discharge; OAI = interval from onset to admission; LOHS = Length of hospital stay; FIM gain is calculated by substracting FIMdis from FIMad for each patient.

influences functional gain for Japanese patients with first cerebral hemorrhage.

METHODS

Patients

Sample selection criteria were as follows: admission to rehabilitation hospital within 26 weeks of first cerebral hemorrhage; single lesion (verified by computerized tomography or magnetic resonance imaging); and no history of prior stroke or prior neuromuscular conditions such as seizure disorder, multiple sclerosis, traumatic brain injury, spinal cord injury, myopathy or severe peripheral neuropathy. No specific criteria with reference to age, side or severity of paralysis, aphasia, neglect, incontinence or cognitive function were applied. During a period of 19 months from May 1, 1997 to November 30, 1998, 790 patients with stroke consecutively admitted to our hospital for comprehensive rehabilitation were screened for inclusion; 193 patients satisfied the selection criteria. Patients had undergone various levels or intensities of rehabilitation in acute care hospitals prior to admission to our hospital. Comprehensive rehabilitation therapy included physical, occupational and speech therapy. Each type of therapy was offered for ≈1 hour a day, 5 days a week.

Measures

FIM total score was measured at admission and discharge by trained nurses. Raw FIM scores were used. Patients were stratified into 3 groups according to their FIM total scores at admission as follows: (1) ≤36; (2) 37–72; and (3) ≥73. Table I summarizes the characteristics of the patients.

Statistical analysis

The StatView II v. 1.03 statistical program (Abacus Concept, Inc., Berkeley, CA) was used for all statistical analyses. Scheffe's multiple comparison procedure was used to test the relationships between the 3 groups. p-values < 0.05 were considered statistically significant. Data are expressed as the mean ± SD.

RESULTS

Table I summarizes the characteristics of the patients with cerebral hemorrhage stratified by gender (characteristics did not differ significantly between men and women) and by FIM total score on admission. Scheffe's multiple comparison test showed that patients in group 1 were significantly older (mean ± SD = 63 ± 10 years) than those in groups 2 (56 ± 10 years) or 3 (53 ± 12 years). Patients in group 2 showed significantly greater FIM gain (37 ± 17) compared with patients in groups 3 (23 ± 12) or 1 (27 ± 23). The results indicate that patients who are moderately affected at admission will show significantly higher functional gain compared with severely or mildly affected patients. Mildly affected patients at admission had a significantly shorter length of hospital stay for rehabilitation than the other groups. There was no significant difference between the 3 groups in terms of the interval between onset and admission.

Fig. 1 is a scatter plot of discharge vs admission FIM scores. The admission FIM scores were partly influenced by rehabilitation received in acute care hospitals. The plot appears to show a curvilinear relationship. Fig. 2 shows histograms of mean FIM total score at admission, mean FIM total score at discharge and mean FIM gain classified by FIM total score at admission. A linear trend was observed between the FIM total score at admission and the mean FIM total score at admission or at discharge. However, a peaked pattern was observed between FIM total score at admission and the mean FIM gain, i.e. moderately affected patients at admission showed higher values of FIM gain compared with severely or mildly affected patients.

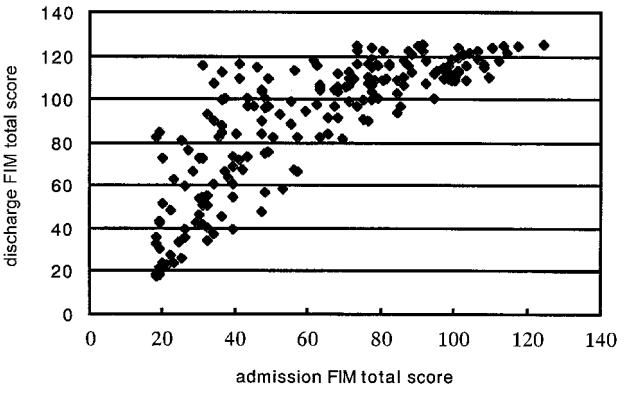

Fig. 1. Relationship between admission FIM total score and discharge FIM total score in patients with cerebral hemorrhage.

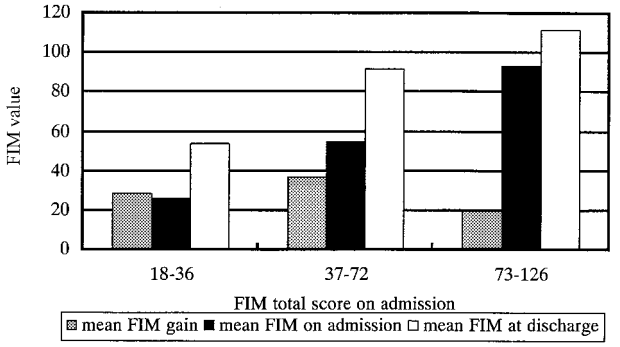

Fig. 2. Mean FIM on admission and at discharge and mean FIM gain classified by FIM total score on admission.

DISCUSSION

In most studies (19–22) functional admission score has been found to be positively correlated with functional outcome, although the relationship with functional gain is less clear. Whether functional admission score influences functional gain or not is a serious matter prior to rehabilitation therapy: due to financial restraints and limited human resources it is highly desirable to be able to identify in advance those patients who will achieve the greatest functional gain and to offer them intensive and effective rehabilitation therapy. What level of FIM total score at admission will show the greatest change in FIM score after rehabilitation therapy? Little has been done to answer this question. Ween et al. (27) reported that an admission FIM of ≥ 60 was associated with a higher probability of functional improvement during rehabilitation. Oczkowski & Barreca (25) reported that stroke survivors with admission FIM scores of < 36 or > 96, i.e. people with either high or low levels of impairment and disability, showed little change in FIM scores after rehabilitation therapy and demonstrated that stroke survivors with admission FIM scores of 36–96, i.e. people who had moderate impairment and disability, showed the greatest change in FIM scores after rehabilitation therapy.

Our study was carried out retrospectively in order to test whether or not the FIM total scores at admission roughly predicted the functional gain following rehabilitation in patients with cerebral hemorrhage. The admission FIM scores of our patients with cerebral hemorrhage were classified into 3 groups: severely, moderately and mildly affected patients. Our study clarified that the advanced age of patients had a strong influence on the functional score at admission. The mildly affected patients at admission had a significantly shorter length of hospital stay compared with the others. A peaked pattern, and not a linear trend, was observed between the FIM total score at admission and FIM gain, i.e. moderately affected patients at admission showed significantly higher values of FIM gain compared with severely or mildly affected patients. We agree with Oczkowski & Barreca (25) that moderately affected patients show more improvement than mildly or severely affected patients. Patients with intermediate FIM total scores at admission made greater gains because they had a reserve of functional improvement. Patients with high FIM total scores at admission might have been expected to have the greatest functional gain but in fact had the lowest gain. This may be explained by a ceiling effect, i.e. these patients appeared to have little room for improvement. Although patients with low FIM total scores on admission had large scope for improvement they unfortunately showed relatively low gain. This may reflect the fact that they have little intrinsic ability to improve.

Our results indicate that conclusions can be drawn in order to determine how to prioritize rehabilitation treatment. As patients with high FIM total score (our group 3) admitted to our rehabilitation hospital can be expected to achieve better functional improvement without any intervention, they should be discharged to their own homes directly from the acute care hospital without entering the rehabilitation hospital, assuming that appropriate outpatient services are available. As patients with low FIM total score at admission (our group 1) cannot be expected to show early hospital improvement, they should receive rehabilitation therapy at a lower level of intensity but still be closely monitored for any delayed recovery. Levels of rehabilitation therapy should be adjusted according to their future recovery. All other patients (our group 2) should undergo intensive inpatient rehabilitation therapy as they will probably benefit from it. Ween et al. (27) have also proposed this. Stroke survivors may achieve a better degree of recovery after cerebral hemorrhage than after cerebral infarction (28). To avoid the influence of the difference in functional recovery between cerebral hemorrhage and cerebral infarction patients, we selected only patients with cerebral hemorrhage as a homogeneous group in our study. Further studies on the differences in functional recovery between these groups are necessary.

Limitations

The average age of stroke survivors is considerably lower in Japan than in the USA (57 years vs 71 years) (24). Our patients were admitted on average 74 days after onset, compared with 20 days in the USA (24). This may be related to the fact there is a 1–2 month waiting list to enter our rehabilitation hospital as specialist rehabilitation resources are still scarce in Japan. We would like to stress the importance of reducing the length of time from onset to admission. Accordingly it is absolutely necessary to identify those patients who will have the best outcome following rehabilitation. It should also be noted that the mean length of hospital stay is markedly longer in Japan than in the USA (111 vs 28 days) (24). However, the mean FIM total score on admission of Japanese patients is similar to that of USA patients (61 vs 62) (24) and the mean discharge FIM total score in this study is close to that in the USA (89 vs 86); hence, there is no significant difference in FIM gain between Japanese patients and USA patients (27 vs 24). This indicates that rehabilitation efficiency in Japan is low. We would like to stress the importance of reducing the length of hospital stay as it is found to have little influence on the prediction of functional status at discharge (29). The major differences in onset to admission and

length of hospital stay can be attributed to the difference between the healthcare systems in the 2 nations. The longer hospital stay in Japan may be due to the short time actually spent undergoing rehabilitation treatment. In Japan, the average time for which patients receive each therapy is about 1 hour a day. Therefore, the average total time of rehabilitation treatment does not exceed 3 hours a day. Our patients have received a 5 days per week treatment regimen since 1993. No treatment takes place on Saturdays and Sundays, although USA stroke patients receive the traditional 6 days per week treatment regimen. Our patients appear not to have sufficient treatment time. We would like to stress the importance of increasing the number of hours and days of therapy. Weekend treatment is also needed in order to improve the efficiency of rehabilitation.

The longer the hospital stay, the greater the cost. Reductions in the length of hospital stay are cost-effective. The average total cost per patient per month in our hospital is ≈700,000 yen (≈7000 US$), including doctor and hospital fees. Is low functional gain worth the expense or not? Better function as achieved by rehabilitation therapy is the key to less disability for a patient and to lower costs to society through less long-term supportive care.

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