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Results of stroke rehabilitation in Thailand

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Abstract

Objective: The purpose of this study is to identify predictors of functional outcome after acute to sub-acute stroke rehabilitation using raw FIM™ score and results of stroke rehabilitation in Thailand.
Design: Descriptive and multivariate analysis was performed on data collected prospectively from 50 patients who were on stroke rehabilitation at Thai Red Cross Rehabilitation Center from October 1, 2000 to September 30, 2001. Six independent variables were obtained from patients' medical records.
Results: The total FIM scores at the time of discharge and total FIM scores gain are strongly correlated with the total FIM scores at the time of admission to the hospital and correlated negatively with age using multiple linear regression analysis, significant at $p < 0.05$. The equation for all cases were: (discharge total FIM scores) = 82.856 + 0.708 × (admission total FIM scores) − 0.408 × (age) and (total FIM scores gain) = 82.85 − 0.292 × (admission total FIM scores) − 0.408 × (age). The models explained 76.48% of variation for total FIM scores at the time of discharge and 45.66% of variation for total FIM scores gain. The total FIM scores at the time of admission and age were the best predictors of the total FIM score at the time of discharge and the total FIM scores gain. However, the nature of stroke, gender, onset to admission interval (OAI), and length of rehabilitation stay (LOS) were not statistically significantly correlated with the total FIM scores at the time of discharge and the total FIM scores gain.
Conclusions: Because the total FIM score at the time of discharge and the total FIM scores gain are highly correlated with the total FIM scores at the time of admission and age, we can inform the patient and their family about the possibility of recovery, and assess the amount and quality of care needed at home or placement after discharge.

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Introduction

Stroke is the third leading cause of death in the USA.[1] In Thailand, Public Health Statistics show that stroke has been on the increase.[2] For example, the death rate from cerebrovascular disease (CVD) was 3.7/100 000 in 1950, rising to 6.7/100 000 in 1970, and yet to 11.8/100 000 in 1983. In 1984, there were 9414 cases of CVD admitted to hospitals in Thailand. The incidence (in patients) increased from 12.7/100 000 in 1981 to 18.7/100 000 in 1984. Since 1957, the mortality rate has been steadily increasing, from approximately 1/100 000 to approximately 6/10 000. In a survey taken in 1983 of a medium-size community in Bangkok, it was found that the prevalence of CVD was 6.9/1 000.[2] Although the study of the epidemiology of stroke in Thailand is extensive, it has been comparatively limited. Many of the studies are believed to be published in local journals not usually cited and difficult to retrieve from. Survivors of stroke are left with a disabling degree of physical handicap and cognitive impairments. Many patients with more severe strokes receive inpatient rehabilitation interventions. The great majority of stroke patients in rehabilitation improve in function,[1] but improvement is quite variable among patients.[3] To optimize the use of limited sources and in order to assist in the development of rehabilitation plan and goals, predictors of functional outcome needed to be identified. Substantial research has been done on predictors of outcomes after stroke.[3] Although some researchers alleged that higher order cognitive factors have a 'dominant' role in producing disability after stroke,[4] the traditional view is that motor impairment is a major cause of disability after stroke.

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Previous studies have identified: age, health condition prior to stroke, bowel and bladder incontinence, visuospatial deficits, early poststroke function and motor status, balance comobidity, stroke severity, cognition, electrophysiologic data, and size and site of lesions as predictors of post stroke function.[3-5] Among these, early poststroke functional limitation has been repeatedly documented as a strong, and perhaps the strongest predictor of long-term functional outcomes.[3, 6-12] Many functional scales (Katz Index of activities of daily living, Barthel Index, Kenny self care, Patient Evaluation Conference System (PECS)) have been developed. Most recently, the FIM™ instrument has become a predominant tool for measuring the patient's multiple disabilities in the USA[13].

The FIM™ instrument, historically derived from the Barthel Index, is primarily an ordinal scale with some interval characteristics. The FIM™ instrument evaluates 18 items on a 7-level scale of independent performance in self-care, sphincter control, transfer, lomotion, communication, and social cognition. It also measures physical and neuropsycological aspects of functional independence in stroke, and it has been documented as a valid and reliable measure of disability and useful screening tool.[13]

The purpose of this study is to identify predictors of functional outcome after stroke rehabilitation and its results in Thailand (according to patients admitted to the Thai Red Cross Rehabilitation Center from all parts of the country).

Methods

PATIENT SAMPLE

Sample selection criteria for inclusion in our study were as follows: admission to Thai Red Cross Rehabilitation Center within 6 months of the first stroke episode; single lesion (confirmed by computed tomography or magnetic resonance imaging); no history of prior stroke and prior neuromuscular conditions such as seizure disorder, multiple sclerosis, traumatic brain injury, spinal cord injury, myopathy and severe peripheral neuropathy. We screened for possible inclusions into our study a total of 94 patients, who were consecutively admitted to the Thai Red Cross Rehabilitation Center, during the 12 months from October 1, 2000 to September 30, 2001. Of 94 patients, 50 (53.19%) stroke survivors fulfilled the selection criteria.

As usual, the admission criteria to Thai Red Cross Rehabilitation Center of stroke patients are as follows: (1) willing to rehabilitate at Thai Red Cross Rehabilitation Center until allowed to discharge by physiatrists, (2) good cognitive function assessed by ability to follow two to three step commands and good recent memory within 24 h, (3) medical and neurological conditions are stable, (4) good family support, (5) good motivation.

The discharge criteria are as follows: (1) no willingness or motivation to rehabilitate, (2) poor cognitive function, (3) has medical or neurological emergency condition, (4) no improvement of physical condition within 1 month. They were tranferred from acute care hospitals from all parts of the country, especially the King Chulalongkorn Memorial Hospital.

MEASURES

For the purpose of our study, patients were characterized according to their age, gender, the nature of their stroke (haemorrhage or infarction), the site of lesion (cortical or subcortical), onset to admission interval (OAI; number of days from onset of stroke to rehabilitation center admission) and length of rehabilitation center stay (LOS; number of days from rehabilitation admission to discharge), Functional Independence Measure (FIM) scores, FIM score gain, FIM efficiency.

The complete FIM scores were measured three times; (1) within 72 h after admission; (2) at the time of discharge ; (3) 3–4 months after discharge.

FIM scores gain from admission to discharge was measured by FIM scores at the time of discharge minus FIM scores within 72 h after admission.

STATISTICAL ANALYSIS

Statistical analysis was performed using SPSS for Windows version 10.1. The computer program managed the following data:

(1) General information, i.e.; age, gender, city, ethnicity, marital status, used percentage (%).
(2) Health information, i.e.; nature and site of lesions, program-interrupted, admission from, prehospital living setting, living with used percentage (%).
(3) OAI, LOS, FIM scores within 72 h after admission, FIM scores at the time of discharge, FIM scores at 3–4 months after discharge, total FIM scores gain, total rehabilitation charge used mean $\pm$ standard diviation values and range between minimum and maximum value.
(4) Compare the mean FIM scores within 72 h after admission and at the time of discharge and 3–4 months after discharge by student paired t-test, significance at $p < 0.05$.

(5) Relate FIM scores at the time of discharge, and the total FIM scores gain and age, gender, FIM scores at admission OAI, LOS by Multiple Linear Regression, significance at $p < 0.05$.

ETHICS

The study was approved by the Ethics Committee of the Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand.

Results

The average age of 50 stroke patients was 62.32 ± 11.51 years old, mostly between 45–75 years: three were younger than 44 years (6%); 24 were 45–64 years (48%); 15 were 65–74 years (30%); and 8 were 75 year or older (16%). Thirty patients (60%) were males, 20 (40%) were females. Twenty-two patients (44%) lived in Bangkok, 28(56%) lived outside Bangkok. Forty (80%) were white, 10 (20%) were black. All (100%) were married. Before hospitalization, 100% lived with at least one other person. Twelve patients (24%) had cerebal haemorrhage; 24 (48%) had cerebral infarction and 14 (28%) had subarachnoid haermorrhage. Patients were admitted to the Thai Red Cross Rehabilitation Center referred from acute care hospitals (90%), whereas 10% were directly from the community. None had their rehabilitation programme interrupted.

Mean admission total FIM scores were 67.38 ± 24.93 (ranged 23–121), discharge total FIM scores were 105.18 ± 24.46 (ranged 26–126), and 3 months after discharge total FIM scores were 110.69 ± 20.91 (ranged 37–126). There was statistically significant difference between discharge total FIM scores and admission total FIM score at $p < 0.001$. Also, there was statistically significant difference between 3 months after discharge total FIM scores and discharge total FIM score at $p < 0.001$. Mean total FIM score gain from admission to discharge was 37.8 ± 17.71 (ranged 0–78). Mean FIM efficiency was 0.6356 ± 0.499 (ranged 0–2.62). Mean onset to admission interval (OAI) was 52.92 ± 40.72 days (ranged 5–150 days). Mean length of stay (LOS) was 78.22 ± 44.84 days (ranged 13–199 days). Mean total rehabilitation charge was 1026.8 ± 787.42 USD (ranged 70–4000 USD) (tables 1 and 2).

A stepwise multiple regression analysis was performed to determine which variables would predict the total FIM scores in stroke survivors at the time of discharge from the rehabilitation center. When an analysis was performed in 50 patients (table 3), the independent variables selected were age, and total FIM scores at the time of rehabilitation center admission. This model was very good and explained 76.48% of variation for total FIM scores at the time of discharge from the rehabilitation center. The equation for all cases was: (discharge total FIM scores) = 82.856 + 0.708 × (admission total FIM scores) − 0.408 × (age).

A stepwise multiple regression analysis was performed to determine which variables would predict the total FIM scores gain in stroke survivors at the time of discharge from the rehabilitation center. When an analy-

Table 1 Characteristics of 50 stroke patients in the study

Stroke type (%)	
Cerebral haemorrhage	24% (12 patients)
Cerebral infarction	48% (24 patients)
Subarachnoid haemorrhage	28% (14 patients)
Age (year)	62.32 ± 11.51[a] (36–96)[b]
Admission total FIM scores	67.38 ± 24.93[a] (23–121)[b]
Discharge total FIM scores	105.18 ± 24.46[a] (26–126)[b]
3 month after discharge total FIM scores	110.64 ± 20.91[a] (37–126)[b]
Total FIM scores gain	37.80 ± 17.71[a] (0–78)[b]
Onset to admission interval (OAI) (days)	52.92 ± 40.72[a] (5–150)[b]
Length of stay (LOS) (day)	78.22 ± 44.84[a] (13–199)[b]
Total rehabilitation charge (US$)	1026.8 ± 787.42[a] (70–4000)[b]

[a]Mean ± standard deviation value
[b]minimum–Maximum values
FIM, Functional Independence Measure

Table 2 Differences between admission total FIM score (admission score), discharge total FIM scores (DC scores), and 3 months total FIM score after discharge (F/U scores)

FIM™ instrument	*SE*	t-*value*	*df*	*95% CI* *L*	*U*	p-*value*
Admission score						
D/C scores	2.50	15.09	49	32.76	42.83	$p < 0.001$*
F/U scores	1.20	4.547	49	7.87	3.04	$p < 0.001$*

*$p < 0.05$ by paired *t*-test

Table 3 Correlation between total FIM score at discharge and total FIM scores on admission, age, nature of stroke, gender, OAI, LOS and total rehabilitation charge by Multiple Linear Regression

Variables	N	Coefficient (β)	P-value
Admission score	50	0.708	0.000*
Age	50	− 0.408	0.048*
Nature of stroke	50	− 0.041	0.676^{NS}
Gender	50	0.145	0.145^{NS}
OAI	50	− 0.052	0.600^{NS}
LOS	50	0.170	0.103^{NS}
Total rehabilitation charge	50	0.148	0.118^{NS}

*$p < 0.05$ by Multiple Linear Regression analysis

sis was performed in 50 patients (table 4), the independent variables selected were age, and total FIM scores at the time of rehabilitation center admission. This model explained 45.66% of variation for total FIM scores gain. The equation for all cases was: (total FIM scores gain) $= 82.85 - 0.292 \times$ (admission total FIM scores) $- 0.408 \times$ (age).

Discussion

Prediction of rehabilitation outcome is relevant for rehabilitation specialist to maximize their client's preparation for the return home. Hence, we developed a simple method to predict the outcome after a stroke for inpatients who were on rehabilitation at our center using FIM measure. The prediction of the outcome of rehabilitation is useful to set up rehabilitation programmes, to inform patients and their family about the possibility of recovery, and to assess the burden of care needed to be given at home or placement at the time of discharge from the rehabilitation center.

The FIM instrument was developed by the Uniform Data System for Medical Rehabilitation to assess activities of daily living,[14, 15] It is an 18 item-scale for rating independence in the domains of self-care, sphincter control, mobility, locomotion, communication and social cognition. The total FIM score may range from 18 to 126 (higher score = greater independence).

Tsuji *et al.*[16] maintained that the FIM measurement has only a few general cognitive-behavioural, communication, and community-related items, and that its content validity is limited. However, the raw total FIM score is a simple, practical, and efficient measure of function in stroke patients at the time of admission to a rehabilitation programme.[17] It can help in early patient selection, in the determination of the necessary rehabilitation period, and as a monitor of inpatient progress.[18] The validity of the FIM instrument has been processed in a study which identified the rehabilitation needs for stroke patients.[19]

Our major findings are that total FIM scores at the time of discharge and total FIM scores gain are strongly correlated with total FIM scores at the time of rehabilitation center admission and negatively correlated with age. Total FIM scores at the time of admission are the best predictors of total FIM scores at the time of discharge and total FIM scores gain. Functional score at the time of admission has been found to be positively correlated with functional outcome in most studies.[6,9,19–22]

We found that age correlated weakly and negatively with the total FIM scores at the time of discharge from the rehabilitation center.[9, 20, 22–26] The increased incidence of chronic disease (such as coronary heart disease, congestive heart failure, diabetes, and hypertension) or dementia in older people is a possible explanation for the negative correlation between age and the total FIM scores at the time of discharge.

Previous studies [9, 27–30] reported that the longer the OAI, the less favourable the functional outcome. However, Novack and colleagues[31] found that certain functional activities (ambulation and transfers) were affected adversely by delayed admission to the rehabilitation center, although other activities of daily living (ADL) were not affected. As stroke recovery occurs most rapidly during the early months, it is to be expected that those patients who are studied earlier will show more change in their functional status. Our findings showed a negative correlation ($r = -0.052$) between delay in hospital admission and the total FIM scores at the time of discharge from the rehabilitation center. Mean OAI in Japan was approximately 50 days[32], our study was nearly 53 days, in contrast to 20 days in the US.[14] The mean OAI in our study is quite prolonged because of bedding availability.

Stroke survivors may have a better degree of recovery after cerebral haemorrhage than after a cerebral infarction, because blood may track between the nerve fibres without destroying them.[33] The incidence of cerebral haemorrhage (24%) in this study is quite a high value in world-wide reports, but we do not have the report in Thailand. However, our study shows no differences in the functional recovery related to the nature of the stroke. We can speculate or explain that by the small sample size in this study. As previously reported[21, 34, 35] and confirmed in the present study, no evidence suggests that there is any difference in the rate of recovery after stroke between men and women. No differences are found in their functional recovery related to LOS. Kalra *et al.*[36] have reported that in relationship to LOS, stroke

Table 4 Correlation between total FIM score gain and total FIM scores on admission, age, nature of stroke, gender, OAI, LOS and total rehabilitation charge by Multiple Linear Regression

Variables	N	Coefficient (β)	P-value
Admission score	50	0.292	0.003*
Age	50	− 0.408	0.048*
Nature of stroke	50	− 0.051	0.705^{NS}
Gender	50	0.138	0.334^{NS}
OAI	50	− 0.073	0.586^{NS}
LOS	50	0.179	0.240^{NS}
Total rehabilitation charge	50	0.149	0.280^{NS}

*$p < 0.05$ by Multiple Linear Regression analysis

patients with poor prognosis have shown a much longer hospital stay, whereas those with intermediate prognosis had significantly better outcome, i.e., more patients being discharged, a shorter average LOS, and better functional abilities at the time of discharge from hospital. Although the mean value of LOS was approximately 90 days in Japan,[37] it was 78 days in this study. In contrast, it was 26 days in the USA in 1992.[14] The total rehabilitation charge had no correlation with the outcome in this study; this determined that the quality of care for everyone is equal at Thai Red Cross Rehabilitation Center.

Reasons why the major differences between our study and those of the US[14] exist in OAI and LOS include the following. First, the differences may be attributed to the difference of the health care systems. In Thailand health insurance covers the longer period of hospital stay in both acute care hospitals and rehabilitation hospitals, but in the US health insurance usually does not cover longer stays. Also it is the policy of the Thai Red Cross to partially support the rehabilitation charge for all patients who have indication for rehabilitation if they cannot support themselves. Patients can stay as long as physiatrists determine. Secondly, in Thailand there is little pressure to discharge patients who are on rehabilitation. Thai patients wish to be kept in hospital as long as they are improving in their functional score or, often, even when they have reached a plateau. Thirdly, in Thailand, the intensity and frequency of rehabilitation treatment does not exceed 10 h a week; 5 days per week and 2 h per day. No treatment takes place on Saturday and Sunday, although in the US, patients with stroke receive the traditional 6-day-a-week treatment regimen.[13–15] The quality or contents of rehabilitation therapy should also be compared; further study is therefore required. In Thailand, a 3-month programme has been popular, but now it has become shorter because of the pressure for earlier discharge from the new health policy and increased availability of community rehabilitation services, including daycare rehabilitation. A limitation of this study is that it was conducted in a single facility, even though it is accepted as the biggest and the best rehabilitation center in Thailand. Data cannot be generalized to all Thai rehabilitation facilities and lead to any statistical inference.

In summary, this study showed that the total FIM scores at the time of admission and age had a large effect on predicting the total FIM scores at the time of discharge and the FIM scores gain for stroke survivors. The equation was: (expected discharge total FIM scores) = $82.856 + 0.708 \times$ (admission total FIM scores) $- 0.408 \times$ (age) and (expected total FIM scores gain) = $82.85 - 0.292 \times$ (admission total FIM scores) $- 0.408 \times$ (age). The models explained 76.48% of variation for the total FIM scores at the time of discharge and 45.66% of variation for the total FIM scores gain. Using the equation, this may allow us to predict measurable functional improvement of patients before starting medical rehabilitation at the Thai Red Cross Rehabilitation Center.

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