Original Article

Functional Outcomes, Effectiveness and Efficiency of Stroke Rehabilitation Services in Ramathibodi Hospital: A Prospective Descriptive Study

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ABSTRACT

Objectives: To study functional outcomes, effectiveness and efficiency of stroke rehabilitation services.

Study design: Prospective descriptive study.

Setting: Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand.

Subjects: Seventy-seven acute stroke patients who were consulted to the Rehabilitation Medicine Department from February to May 2016.

Methods: The patients' demographic data, Barthel Index (BI), swallowing, communication and cognitive impairments, and the type of rehabilitation services (home-based, outpatient-based and inpatient-based) were recorded and their association with functional recovery was assessed. Rehabilitation effectiveness was measured based on BI gain between the initial and the 12-week follow-up. An inpatient rehabilitation efficiency index was calculated and reported as BI gain per day while in rehabilitation.

Results: Eleven of the patients had an initial BI score of 100. Of the 56 patients having an initial BI ≤ 75, a total of 39, 11, and 6 patients had home-based, outpatient-based and inpatient-based rehabilitation programs, respectively. The levels of mean BI gain (SD) at the 12-week follow-up for those programs were 14.7 (18.6), 25.9 (13.0), 39.2 (10.7), respectively. The mean rehabilitation efficiency index was a gain in BI score of 2.1 points per day. Of the 10 patients with BI between 75 and 99, 9 received home-based rehabilitation and 1 had an inpatient-based rehabilitation program; all had a BI score at the 12-week follow-up of ≥ 95. Among those with dysphagia, recovery of the swallowing function at the 12-week follow-up was found in 30.8% of the patients, but no recovery was found in patients with cognitive impairment.

Conclusions: In moderately to severely disabled stroke patients (BI ≤ 75), inpatient-based rehabilitation is more effective based on BI score gains than either outpatient- or home-based rehabilitation. Patients with mild disability (initial BI > 75) had BI scores ≥ 95 at the 12-week follow-up regardless of the type of rehabilitation provided. The swallowing impairment recovered in one-third of the patients, although cognitive impairment remained.

Keywords: activities of daily living, effectiveness, efficiency, rehabilitation outcome, stroke

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Introduction

Stroke is a common neurological disorder and a major public health problem. The annual incidence of stroke in Thailand is up to 250,000 cases and the trend is increasing yearly. Additionally, it is the leading cause of death and disability in Thailand.[1] Stroke patients present with variety of impairments other than weakness, such as cognitive, swallowing and communication impairments. These impairments increase morbidity and mortality.[1,2]

Rehabilitation after a stroke is very important to the prevention of complications and permanent disability. Stroke patients who receive early and proper rehabilitation care have an increased level of ability and a better quality of life. According to the Thai Stroke Rehabilitation Registry, stroke patients receiving inpatient-department-based (IPD-based) rehabilitation had significant improvement in physical and mental status as well as quality of life.[3]

The Rehabilitation Medicine Department, Faculty of Medicine Ramathibodi Hospital has operated a stroke rehabilitation outpatient clinic since September 2011 with the goal of improving the quality of care and maximizing function as much as possible so post stroke patients can have more independence, less disability and a better quality of life. These stroke rehabilitation services are delivered as home-based, outpatient-based and inpatient-based.

Our rehabilitation team had previously studied functional outcomes of upper and lower extremities of subacute stroke patients receiving outpatient-based rehabilitation.[4] That study found that patients had improved functional outcomes of upper and lower extremities as assessed using the Ramathibodi modification of the Box and Block Test (R-BBT), the

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Berg balance scale and gait velocity.[4] However, the overall functionality of activities of daily living and of impairments which are consequences of stroke had not been studied.

The main objective of the present study was to demonstrate the functional outcomes, effectiveness and efficiency of stroke rehabilitation at Faculty of Medicine Ramathibodi Hospital, a university hospital with rehabilitation medicine residency training program, with each of three different types of rehabilitation service: home-based, outpatient-based and inpatient-based rehabilitation programs.

Methods

Study design

This prospective descriptive study was approved by the Institutional Review Board, Faculty of Medicine, Ramathibodi Hospital (approval number ID 04-59-04).

Participants

All acute stroke patients who consulted the Rehabilitation Medicine Department from February through May 2016 were recruited into the study if they were willing to participate in the study and to give written informed consent. Patients were excluded if they declined to participate in the study or if they had passed away. In cases where the stroke patient had cognitive impairment affecting decision making, the patient's authorized family members were invited to complete the consenting process.

Intervention

Demographic and clinical data, e.g., age, underlying diseases, type of stroke and health care coverage were collected. The type of rehabilitation service received, either home-based, outpatient-based or inpatient-based, was determined by physiatrists, the patient's individual context, criteria for admission and availability of beds in the rehabilitation ward. The determination to provide home-based rehabilitation was made by physiatrists, physical and/or occupational therapists when a patient was discharged from the acute stroke inpatient ward. The rehabilitation program was reviewed and/or revised as needed, at the follow-up in the out-patient clinic every 4-6 weeks. Outpatient- and inpatient-based rehabilitation were hospital-based programs which consisted of conventional physical and occupational therapies provided or supervised by therapists. The frequency of outpatient and inpatient hospital-based rehabilitation services were 1-2 times/week and 5 days/week, respectively.

Outcome measurements

The primary outcome in this study was the ability to perform activities of daily living using the 100-point Thai-version of the Barthel index (BI).[5] In this study, disability was categorized by BI scores into moderately to severely disabled (BI score ≤ 75), mildly disabled (BI score more than 75 but less than 100, and no disability (BI = 100).[5] Rehabilitation efficacy was evaluated using BI gain between the initial assessment and the 12-week follow-up assessment.

The secondary outcomes were impairments in three common areas: swallowing, communication and cognitive functions.[6] Swallowing and communication functions were assessed using the dysphagia screening test and the aphasia screening test which are in the clinical practice guidelines for stroke rehabilitation published by Prasat Neurological Institute, Ministry of Public Health;[5] cognitive function was assessed using the Thai version of the Mini Mental State Evaluation (MMSE-Thai 2002).[7] The results of these tests were used to determine if a patient had dysphagia (swallowing impairment) or aphasia (communication impairment). Cognitive impairment was identified based on the MMSE-Thai 2002 cut-off points for educational levels, with scores of ≤14, 17 and 22 indicating illiteracy, primary school and higher education, respectively.[7] If the above-mentioned impairments were detected at the initial but not at the final assessment, it was counted as a recovery.

Both primary and secondary outcomes were assessed by a researcher (SR) who was a rehabilitation resident in training. All patients receiving outpatient-based or home-based rehabilitation programs were assessed twice, initially within 2 weeks of the original diagnosis of stroke after medical and neurological conditions had remained stable for at least 48 hours, and then again 12 weeks later. Those receiving an inpatient-based rehabilitation program had two additional points of assessment, at admission to rehabilitation and at discharge, a total of 4 assessments.

Statistical analysis

SPSS version 21 was used for data analysis. The demographic data were analyzed using descriptive statistics, i.e., frequency, mean and standard deviation (SD). The normality of data was analyzed using the Shapiro-Wilk test.

Rehabilitation effectiveness, i.e., gain in BI score after rehabilitation,[8] was evaluated by comparing the initial and final (at the 12-week follow-up) BI scores within groups using the paired t-test. In addition, rehabilitation efficiency was also demonstrated by dividing the BI gain by the rehabilitation length of stay (LOS), i.e., a rehabilitation efficiency index.[9]

To demonstrate differences in efficacy among different types of rehabilitation services, the mean BI change/gain was analyzed using the analysis of variance (ANOVA) test with post-hoc analysis. The percentage of moderately to severely disabled patients with recovered swallowing, improved communication and reduced cognitive impairment was compared and analyzed using Fisher's exact test. Statistical significance was set at a $p < 0.05$.

Results

From February through May 2016, 79 stroke patients were consulted to the Rehabilitation Medicine Department. Of those patients, two died from other underlying diseases

and post-operative complications and were excluded from the study. Nine patients lost to follow-up at 12 weeks were assessed by telephone. All patients received an initial rehabilitation assessment by a physiatrist with a mean time (SD) of 8.4 (2.7) hours after the initial consultation request or 2.6 (3.3) days after diagnosis. The mean LOS (SD) at the acute stroke ward was 7.7 (11.1) days.

Demographic characteristics of the 77 patients are shown in Table 1. Most of the patients had a brain infarction; the three most common comorbid conditions were hypertension, dyslipidemia and diabetes mellitus. Based on initial BI scores, 11 patients (14.3%) were not disabled; 10 patients (13.0%) were mildly disabled and 56 patients (72.7%) were moderately to severely disabled. Of the 77 patients, 76.6% received home-based, 14.3% outpatient-based and 9.1% inpatient-based programs. All patients with BI = 100 received a home-based program.

Among the 56 patients classified as moderately to severely disabled (BI ≤ 75), 39 patients (69.6 %) received home-based, 11 (19.6 %) outpatient-based and 6 (10.7 %) inpatient-based rehabilitation programs (Table 2). Most of the patient characteristics were comparable among the three different programs. Two differences are that almost all patients receiving an inpatient-based program were female, had an ischemic stroke, and right hemiparesis and that patients receiving the home-based program had a higher percentage with communication and cognitive impairments.

At the 12-week follow-up, the moderately to severely disabled patients in each of the 3 types of rehabilitation programs had a statistically significant increase in BI score (Table 3), with the greatest increase in the inpatient-based group and lowest increase in the home-based group. Only the inpatient-based group showed a statistically significant difference in the mean∆BI compared to home-based rehabilitation, whereas the mean∆BI of the outpatient-based program was not statistically significant different from the other programs.

Table 1. Demographic and clinical data (n = 77)

Characteristics	
Age (years)[1]	66.3 (13.6)
Sex (male : female)[2]	32 (41.6) : 45 (58.4)
Etiology of stroke (ischemic : hemorrhagic)[2]	70 (90.9) : 7 (9.1)
Hemiparesis[2]	
Right : Left	36 (46.8) : 37 (48.0)
Bilateral	4 (5.2)
Underlying disease[2]	
Hypertension	50 (64.9)
Dyslipidemia	31 (40.3)
Diabetes mellitus	29 (37.7)
Cardiovascular	25 (32.5)
Recurrent stroke	15 (19.5)
Pulmonary	10 (13.0)
Renal	10 (13.0)
Gastrointestinal	10 (13.0)
Hematological	8 (10.4)
Other neurological	5 (6.5)
Psychiatric	2 (2.6)
Initial Barthel index score[1]	
Inpatient-based (n = 7)	52.9 (25.3)
Outpatient-based (n = 11)	47.3 (13.3)
Home-based (n = 59)	60.3 (31.3)
Health care coverage[2]	
Civil servant medical welfare	40 (51.9)
National health security scheme (NHSS)	15 (19.5)
Self-pay	12 (15.6)
State enterprise officer	5 (6.5)
Social security scheme (SSS)	3 (3.9)
Disability scheme under NHSS or SSS	2 (2.6)

[1]Mean (standard deviation, SD), [2]number (%)

The 6 moderately to severely disabled patients with (BI ≤ 75) received inpatient-based rehabilitation. The mean waiting time (SD) from the initial assessment to admission to rehabilitation was 31.3 (26.9) days. During the waiting period, the patients received a home-based program. The mean rehabili-

Table 2. Demographic data of moderately to severely disabled stroke patients categorized by type of rehabilitation program received (n = 56)

Characteristics	Home-based (n = 39)	Outpatient-based (n = 11)	Inpatient-based (n = 6)
Age (years)[1]	69.2 (14.5)	64.0 (11.4)	61.3 (10.3)
Sex (male : female)[2]	17 (43.6) : 22 (56.4)	4 (36.4) : 7 (63.6)	1 (16.7) : 5 (83.3)
Etiology of stroke[2] (ischemic : hemorrhagic)	35 (89.7) : 4 (10.3)	9 (81.8) : 2 (18.2)	6 (100.0) : 0 (0.0)
Hemiparesis[2]			
Right : left	16 (41.0) : 22 (56.4)	5 (45.5) : 5 (45.5)	4 (66.7) : 1 (16.7)
Bilateral	1 (2.6)	1 (9.1)	1 (16.7)
Stroke onset (hours)[1]	18.3 (29.7)	26.4 (35.2)	20.5 (26.2)
Initial Barthel index score[1]	42.4 (22.4)	47.3 (13.3)	47.5 (23.0)
Swallowing impairment, yes[2]	19 (48.7)	4 (36.4)	3 (50.0)
Communication impairment, yes[2]	22 (56.4)	3 (27.3)	2 (33.3)
Cognitive impairment, yes[2]	27 (69.2)	3 (27.3)	2 (33.3)

[1]Mean (standard deviation, SD), [2]number (%)

Initial BI, Barthel index before starting rehabilitation programs; stroke onset, time before admission to hospital

Table 3. Gain in Barthel index (BI) score according to disability and types of rehabilitation programs

Disability	Rehab	N	Barthel index (BI)[1]		ΔBI[1]	*p*-value
			Initial	12-week FU		
BI ≤ 75	Home	39	42.4 (22.4)	57.2 (34.4)[a]	14.7 (18.6)	< 0.01[b]
	Outpatient	11	47.3 (13.3)	73.2 (20.8)[a]	25.9 (13.0)	0.02[c]
	Inpatient	6	47.5 (23.0)	86.7 (25.6)[a]	39.2 (10.7)	0.08[d]
						< 0.01[e]
75 < BI < 100	Home	9	89.4 (5.8)	99.4 (1.7)[a]	10.0 (5.0)	
	Inpatient	1	85.0 (0.0)	95.0 (0.0)	10.0 (0.0)	
BI = 100	Home	11	100.0 (0.0)	100.0 (0.0)	0.0 (0.0)	
Total		77	57.8 (29.0)	73.3 (32.1)[a]	15.5 (17.5)	

[1]Mean (standard deviation, SD)

Rehab, types of rehabilitation programs; n, number of patients; FU, follow-up; ΔBI, BI change/gain

[a]Comparison of initial and 12-week FU BI within group using paired t-test, and $p < 0.01$

[b]Comparison of mean BI change among 3 rehabilitation programs in BI ≤ 75 group using analysis of variance test

[c]Comparison of mean BI change between home- and outpatient-based programs using post-hoc analysis

[d]Comparison of mean BI change between outpatient- and inpatient-based programs, using post-hoc analysis

[e]Comparison of mean BI change between inpatient- and home-based programs using post-hoc analysis

The statistical significance level was set at a $p < 0.05$

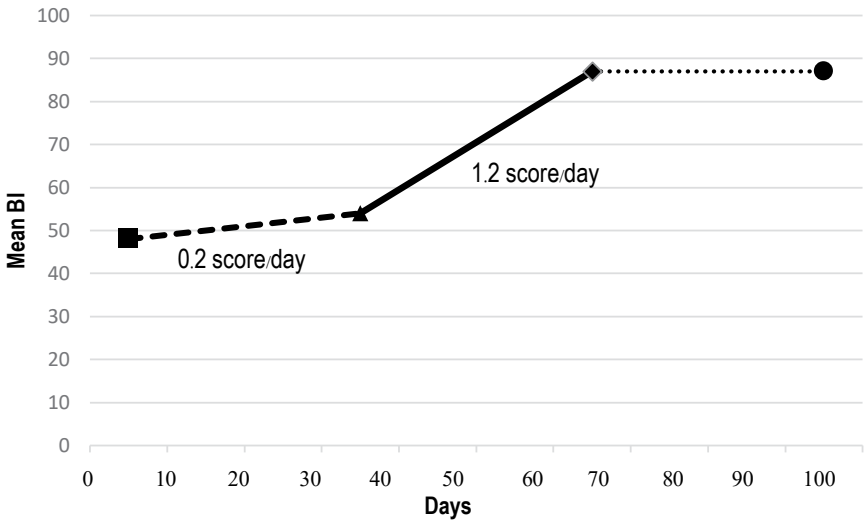

Figure 1. The rate of improvement measured as the daily change in the mean Barthel index (BI) in moderately to severely disabled patients (BI ≤ 75) who received inpatient-based rehabilitation (N = 6).

The square symbol (■) represents the initial assessment, the triangle symbol (▲) rehabilitation admission, the diamond symbol (♦) discharge from rehabilitation, and the circle symbol (●) the 12-week follow-up.

The dashed line shows the improvement rate (mean BI change/day = 0.2 score/day) during the waiting period (home-based); the solid line shows the rate during inpatient-based rehabilitation (1.2 score/day); and the dotted line, maintenance of mean BI after discharge.

tation length of stay (SD) was 28.9 (7.9) days. In this subgroup, the mean BI scores (SD) recorded at the initial assessment, at rehabilitation admission, at discharge and at the 12-week follow-up were 47.5 (23.0), 54.2 (22.7), 87.0 (26.0) and 86.7 (23.4), respectively.

To compare the improvement rate during the period of waiting before admission (home-based) and during admission (inpatient-based), the mean BI change per day (meanΔBI/day), i.e., the rehabilitation efficiency index for each period, was calculated. The mean ΔBI/day (SD) was 0.2 (0.3) during the waiting period and 1.2 (0.3) during the admission period, an approximately five-fold increase. Moreover, after discharge from inpatient rehabilitation, all 6 patients maintained their mean BI at the 12-week follow-up (Fig. 1).

Of the 10 patients in the mildly disabled group (75 < BI < 100), 9 received a home-based program and were found to have a statistically significant increase in mean BI score (SD) from 89.4 (5.8) to 99.4 (1.7). Only 1 patient in this group was admitted for inpatient-based rehabilitation; their BI score increased from 85 to 95. All patients in the mildly disabled group had a BI score of 95 or more at the 12-week follow-up.

Of the 11 patients with no disability (BI = 100), all of whom received a home-based program, none had swallowing or communication problems or cognitive impairment. They were

advised on prevention of a recurrent stroke, and all maintained their BI score at 12-week follow-up.

Regarding common impairments among the 77 patients, there were 26 patients (33.8%) with swallowing impairment, 27 patients (35.1%) with communication impairment and 34 patients (44.2%) with cognitive impairment. All were in the moderately to severely disabled group except 2 patients with cognitive impairment who were in the mildly disabled group.

In the moderately to severely disabled group, the percentage of recovery at the 12-week follow-up was highest in patients with swallowing impairment (30.8%), and 71.4% of patients who received hospital-based rehabilitation had recovery in swallowing (Table 4). These percentages were statistically significantly higher than for patients receiving a home-based program (15.8%).

Recovery in communication was found in one patient who received hospital-based rehabilitation and in two patients who received home-based rehabilitation. None of the patients in the moderately to severely disabled or in the mildly disabled groups with cognitive impairment showed recovery regardless of type of rehabilitation (Table 4).

Discussion

The main objective of our study is to demonstrate the functional outcomes, effectiveness and efficiency of stroke rehabilitation programs provided at Ramathibodi Hospital, a university hospital with a rehabilitation medicine residency training program.

In our study, the mean duration (SD) from stroke diagnosis to initial assessment by a physiatrist was 2.6 (3.3) days, shorter than the 4.5 (3.3) days reported by another university hospital.[10] This might be due to our hospital's policy of early rehabilitation consultation by a neurologist and shorter length of stay (LOS) in the acute stroke ward, an average of 8 days. Additionally, our hospital has been given a disease-specific certificate in stroke care, and one of the key performance indices (KPI) of the stroke ward is that all stroke patients should receive a rehabilitation program.

In this study, the mean initial BI (SD) before rehabilitation was 57.8 (29.0), higher than the 40.5, 39.5 and 37.4 reported in another university hospital,[10] a community hospital[11] and multicenter study[12] respectively, which includes many levels of hospitals. Higher BI scores reflecting less disability is possibly due to the effectiveness of the stroke fast track system and the availability of an acute stroke ward in our hospital, factors which have been shown to affect stroke outcomes.[1]

After rehabilitation for 12 weeks, the mean∆BI of all 77 stroke patients was 15.5 on the 100 BI scale. The minimum clinically important difference of BI is 9.3 on the 100 BI scale.[13] The mean∆BI in this study was clinically significant for all of different disability levels and types of rehabilitation.

Considering inpatient-based rehabilitation in this study, only 6 patients were admitted for rehabilitation and their LOS (SD) was 28.9 (7.9) days which is comparable to the 29.4 (17.9) days reported in the Kuptniratsaikul study[14], but longer than the standard LOS for neuromuscular inpatient rehabilitation indicated by National Health Security Office (NHSO) (2011) of 23.5 days, and shorter than the maximum acceptable LOS of 46 days.[15] This suggests revision of the standard LOS for stroke rehabilitation in Thailand may be needed, though more studies focusing on LOS are required to provide more information for the NHSO to revise the LOS standard.

For the moderately to severely disabled group (BI ≤ 75), most of the demographic data were comparable among three types of rehabilitation, but comparison among the three types of rehabilitation was not possible due to small number of patients in each group. It should be noted that the home-based rehabilitation group had a higher percentage of patients with communication and cognitive impairments than the other

Table 4. Recovery of impairments in moderately to severely disabled stroke patients (Barthel Index score ≤ 75) by to type of rehabilitation at the initial and 12-week follow-up

Impairment	Initial[1]	12-weeks follow-up[1]	Recovery[2]	*p*-value[a]
Swallowing (n = 26)[1]				
• Home-based	19	16	3 (15.8)	0.01
• Hospital-based	7	2	5 (71.4)	
• Total	26	18	8 (30.8)	
Communication (n = 27)[1]				
• Home-based	22	20	2 (9.1)	0.47
• Hospital-based	5	4	1 (20)	
• Total	27	24	3 (11.1)	
Cognitive (n = 32)[1]				
• Home-based	27	27	0 (0)	NA
• Hospital-based	5	5	0 (0)	
• Total	32	32	0 (0)	

[1]Number, [2]number (%)

[a]Comparison of percentage of recovery between home- and hospital-based rehabilitation using Fisher's exact test with statistical significance level < 0.05

NA, not assessed

groups. Comparison of mean∆BI with different types of rehabilitation services showed that patients receiving inpatient-based rehabilitation had the best outcomes. This finding is in line with results from Bangklam Hospital, a community hospital in Songkhla Province which provides intermediate care service for stroke rehabilitation. That institution reported that moderately to severely disabled stroke patients who received an inpatient-based program had a significantly greater increased in mean BI compared to non-inpatient programs.[11]

During admission for inpatient-based rehabilitation in our hospital, moderately to severely disabled stroke patients had a mean∆BI of 1.2 per day on the 100-point BI scale which is equivalent to 0.2 on the 20-point BI scale. This result is comparable to that reported by Kuptniratsaikul et al.[14,16] and by Pattanasuwanna[17] of 0.2 on the 20-point BI scale. However, it is less than that reported by Suksathien et al.[18] and by Bangklam Hospital[11] which were 0.6 and 0.4 on the 20-point BI scale, respectively. This difference might have been due to differences in waiting time for admission. The present study and studies by Kuptniratsaikul[14,16] and Pattanasuwanna[17] have reported a mean or median waiting time for rehabilitation admission of 31.3, 24 and 19 days, respectively, whereas stroke patients in Bangklam Hospital[11] received earlier inpatient-based rehabilitation, i.e., immediately after discharge from the acute stroke ward. The early inpatient-based rehabilitation in Bangklam Hospital might be a factor in the greater BI change as shown by previous studies reporting that early inpatient-based rehabilitation within a month post stroke results in better outcomes and quality of life as well as shorter LOS.[19-21]

Interestingly, both Bangklam Hospital[11] and Luangphopern Hospital[17] are among the first hospitals to develop an intermediate care rehabilitation service following the plan of the Ministry of Public Health. However, the mean∆BI per day of those two hospitals differ despite the similar context which is probably due to differences in waiting time for admission. This suggests that moderately to severely disabled stroke patients should receive inpatient-based rehabilitation as early as possible and that stroke rehabilitation services should offer inpatient-based rehabilitation to these patients as soon as they are discharged from the acute setting to increase the effectiveness of stroke rehabilitation.

The National Health Security Office in conjunction with the Thai Rehabilitation Medicine Association has proposed a subacute rehabilitation program and has recommended that all stroke patients with BI < 75 or with BI > 75 and more than one impairment should receive inpatient-based rehabilitation when they are ready for an intensive rehabilitation program.[11] Based on that recommendation, 55 of the patients in our study (71.4%) met the criteria and were rehabilitated as inpatients. However, of those 55 patients only 7, including 1 with mild disability (12.7%), actually entered inpatient-based rehabilitation. There are a number of factors related to that situation, including that there were only 10 beds in the rehabilitation ward as well as strict inpatient admission criteria during the time of this study, e.g., all rehabilitation inpatients were required to provide a 24-hour caregiver, patients' request to refer back to their hospitals according to their health care coverages, which acted as barriers to inpatient rehabilitation.

The results of this study together with previous reports[11,14,16-17,19-20] suggest that moderately to severely disabled patients should be provided inpatient-based rehabilitation as early as possible. This also suggests that less rigid and more flexible inpatient admission criteria which depend on each patient's context should be adopted. For patients who have health coverage at another hospital, establishing an inter-hospital rehabilitation network could help ensure early rehabilitation and continuity of patient care.

Factors such as age, gender, initial BI and cognitive impairment have been shown to influence stroke outcomes.[22,23] The reported effects of most factors were comparable to those included in our study with the exception of gender and cognitive impairment. Male gender and cognitive impairment have been shown to be associated with good and poor functional outcomes, respectively. In our study, more female than male patients were in an inpatient-based program, so gender was not a confounding factor for this type of rehabilitation. More patients with cognitive impairment received home-based rehabilitation which might have resulted in the poorer outcomes irrespective of the type of rehabilitation.

The three common impairments, other than weakness, were also evaluated. In this study, 33.8%, 35.1% and 44.2% of stroke patients had swallowing, communication and cognitive impairments, respectively. Previous studies have reported that 10-45% of stroke patients had swallowing problems, 23-36% had communication difficulties and 12-80% had cognitive impairments.[6,18,24] The prevalence of those impairments in this study was comparable to previous studies, suggesting that the screening techniques for impairment used in this study were also comparable to those used in other studies, in spite of the fact that different techniques were used.

At the 12-week follow-up of the moderately to severely disabled stroke patients, our study found that the recovery percentage of swallowing and communication functions was greater in patients receiving hospital-based programs (including inpatients and outpatients) than in those receiving home-based rehabilitation. The higher rates of recovery of the swallowing function in this study might have been due to the establishment of a swallowing clinic in our department and of a proper swallowing training program provided by well-trained occupational therapists. One recent study reported on the success of a home-based program using tongue palatal resistance exercise to improved swallowing function.[25] Provision of such a home-based swallowing training program for those not having access to hospital-based rehabilitation could be another option.

Our study did find a small increase in recovery of communication function in the hospital-based group, but the difference

between the hospital-based and the home-based groups was not statistically significant. To confirm this finding, more patients should be recruited for analysis. It should also be noted that our hospital is the only institute in Thailand which provides an educational program of speech therapy. The country continues to suffer from a lack of speech therapists, and most rehabilitation teams in hospitals have no access to speech therapists who can provide appropriate training for stroke patients with communication impairment.

Moreover, our results show that the cognitive impairment persists at the 12-week follow-up. That lack of improvement might be due to the nature of cognitive impairment following stroke.[26] Our stroke rehabilitation programs focus primarily on movement functions related to activities of daily living and ambulation, but lack a proper cognitive training program, either in a hospital- or home-based setting. Developing a cognitive training program in our department is challenging as it requires experienced personnel such as a neuropsychologist or a well-trained or skillful therapist to provide the training.[27]

Although this was a prospective study, there are some limitations. Statistical analyses of small samples generally cannot provide strong evidence to support the effectiveness of an inpatient-based rehabilitation program. We therefore plan to continue gathering information on additional patients to increase the power of the tests and to provide stronger evidence. The next limitation was the short duration of the follow-up period. The intermediate care plan for rehabilitation proposed by the Ministry of Public Health recommends a 6-month follow-up re-assessment of functional outcomes.[11] This 6-month follow-up seems necessary, especially for those with moderate to severe disability or for patients having additional impairments such as dysphagia, aphasia and impaired cognitive function as these impairments require a longer period for recovery.[24,28-29] In addition, our study did not evaluate psychosocial problems and quality of life of the stroke patients and their caregivers. Caregivers, in particular, are frequently affected when a moderate to severe disability persists. Value-based healthcare and health economics may provide national policy makers with supportive data for considering stroke rehabilitation services in Thailand.

Conclusions

The findings of this study demonstrate the effectiveness and efficiency of stroke rehabilitation programs, especially with moderately to severely disabled stroke patients (BI ≤ 75) treated in a university hospital with a rehabilitation medicine residency training program. The average increase in the rehabilitation efficacy index during inpatient rehabilitation is about 1.2 BI points/day based on BI gain per length of stay. Inpatient-based rehabilitation also results in greater improvement in activities of daily living than either outpatient- or home-based programs. However, all stroke patients with mild disability achieved functional recovery to near normal levels by the 12-week follow-up regardless of the type of rehabilitation provided. Among swallowing, communication and cognitive impairments, moderately to severely disabled stroke patients with swallowing problems who received hospital-based rehabilitation achieved the greatest levels of recovery at the 12-week follow-up.

Disclosure

The authors have nothing to declare.

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