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Reducing Length of Stay in Rehabilitation Hospital After Stroke by Refining the Rehabilitation Program

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Abstract: To reduce the length of stay in rehabilitation hospitals, rehabilitation programs for stroke was refined. We emphasized the importance of strengthening the uninvolved lower limb, and administered stand-up and sit-down exercises 400-600 times per day. This was easily possible when performed in group therapy. By this, length of stay in a rehabilitation hospital has become shorter, FIM scores at discharge have become higher, and ratio of patients discharged to their own home has become higher.

Keywords: Stroke, Length of Stay, Lower Extremity, Exercise

1. Introduction

As the graying of society advances, the number of patients requiring rehabilitation is increasing [1]. When all the acute-care hospital beds are occupied, new emergency care patients cannot be accepted and the concept of community medicine cannot be upheld. For this reason, rehabilitation hospitals must accept patients from acute-care hospitals without delay. To safeguard this ability, the length of stay (LOS) in a acute care hospital (ACH) and rehabilitation hospital (RH) must be reduced.

The provision of stroke care imposes a major economic burdens on the national healthcare system. The direct cost of stroke is largely determined by LOS [2]. Therefore, every country strains every nerve to reduce LOS by early starting rehabilitation and improvement of care system [3-9].

LOS is extremely different from country to country. LOS of acute ischemic stroke in an ACH in the United States is 4.66 ±3 days [3]. Another report from USA says that 4-7 days in ACH and 15days in RH [4]. In Canada, 12days in ACH and 31days in RH with patients gaining a median of 21 points on the Functional Independence Measure (FIM) [5]. Another report from Canada says that LOS in ACH is 15 days [6]. In Singapore, 8.9days in ACH and 18.1days in RH [7]. In Taiwan LOS is 11days [8], in Korea 10.9 days in ACH and 127.7days in RH [9].

In Japan, LOS in ACH is 29.1 days, and 81.3days in RH [10]. LOS in ACH is the longest in developed countries. This may be due to delayed and/or insufficient rehabilitation and resulting disuse syndrome.

Hirschberg et al [11] mentioned that a principle of rehabilitation in stroke hemiplegia is that strengthening of the uninvolved limbs and stand-up exercise should be started as early as possible. From their ideas, we attempted 400-600 repetitions of stand-up and sit-down exercises each day, assuming the strengthening of the uninvolved lower limb muscles as the most important issue. Strengthening the uninvolved lower limb can facilitate recovery of transfer motions, toileting, and walking ability to reduce LOS.

Another program was developed in which the time dedicated to speech therapy and swallowing exercises in the initial period was minimized and the majority of the time was spent on physiotherapy (stand-up and sit-down exercises) and occupational therapy (activities of daily living [ADL] exercises, with a focus on the lower limbs [12].

With this program, we were able to improve the level of ADL more quickly, and substantially reduce the LOS. The outcomes were compared with nationwide surveys for Japan [10].

Here we describe the details and treatment outcomes of our rehabilitation program.

2. Methods

Our hospital has 58 beds, employs 15 physical therapists (PTs), 14 occupational therapists (OTs), and three speech therapists (STs) and carries out rehabilitation treatment 365 days a year. From August 1, 2015, to January 31, 2017, a total of 254 stroke patients were admitted and treated at the hospital. The methods in this manuscript conform to the Declaration of Helsinki.

We compared these patients to the 9,041 patients with stroke in the nationwide survey. Comparison items were as follows: age, sex, type of disease, number of patients per PT/OT/ST, number of days from stroke onset until admission, FIM score on admission, FIM score at discharge, FIM gain, motor FIM (FIM-M) score on admission, FIM-M score at discharge, FIM-M gain, cognitive FIM (FIM-C) gain, and rate of discharge home.

The following is a description of the rehabilitation program we implemented. First, patients and their families were given sufficient explanation at the time of admission. Explanations covered such points as the fact that inpatient rehabilitation is completed in two months on average (sometimes one or three months), although there is often no end to rehabilitation for stroke; that the patient can switch to outpatient rehabilitation once they can walk; that the hospital wants patients discharged quickly once inpatient rehabilitation is completed to provide that bed to the next patient; that the hospital stay may be longer than 3 months in exceptionally severe cases; that patient will not be forced to leave the hospital; and that, in consideration of quality of life (QOL), it is preferable for a living place with a good recuperative environment, especially one's own home, to be chosen as the place for rehabilitation after discharge.

The focus in physiotherapy was not recovery from paralysis, but strengthening of the uninvolved lower limb muscles, and the main focus of the program was stand-up and sit-down exercises. In the beginning, many patients had serious impairments and could not maintain a sitting position or move from sit to stand, but these exercises were begun with assistance or encouragement. In particularly severe cases where stand-up exercise was not possible, patients began by standing on a surface with a 30° incline table and flexed and extended the knees 600-800 times until they had strengthened the lower limb muscles enough to start stand-up and sit-down exercises. Once they could sit and stand independently, they were sent to groups for group exercises. With this program, almost all patients became able to perform the exercises 400-600 times a day.

Occupational therapy consisted of: 1) practicing one-handed actions with the uninvolved hand; 2) maintaining ranges of motion in the upper limb, wrist, and finger joints on the involved side with the uninvolved hand, with only oral instruction from the therapist; 3) minimal function recovery exercises for the involved hand; and 4) a program to strengthen the lower limbs and trunk or the same stand-up and sit-down exercises as physiotherapy in order to establish ADL. Examples of specific exercises are: rolling over (involved side, uninvolved side); moving while lying on the bed in the direction of the head, direction of the feet, and to the left and right; using the uninvolved leg to lift the involved lower foot and move it off the bed; sitting up; standing and transfer to a wheelchair by placing weight on the uninvolved lower limb; transfer from the wheelchair to the bed or toilet; and riding the wheelchair and operating it with the uninvolved foot.

Speech therapy was provided if desired by the patient in cases of aphasia or dysarthria, but treatment in the beginning focused primarily on physiotherapy and occupational therapy and the amount of time spent on speech therapy was minimized. Dedicated time was not given for treatment for dysphagia; water-swallowing tests were performed during meal times. If the patient did not choke, oral feeding was reintroduced and regarded as swallowing exercises. Video-fluoroscopic examinations were not performed. This was based on our experimental finding that dysphagia symptoms improved quickly while performing stand-up and sit-down exercises [12]. At times other than meals, water-swallowing was performed as a swallowing exercise over a short duration (5-6 min). Focus was placed on tooth brushing and oral care to keep the oral cavity clean.

Patients stayed in the physiotherapy room and occupational therapy room at least 4 h/day and performed stand-up and sit-down exercises by themselves to reduce the total bed time.

This rehabilitation program was approved by the ethics committee of our hospital.

SPSS for Windows version 11.5J software was used for statistical analysis and t-tests and χ^2 tests were performed. The level of significance was 5%.

3. Results

Table 1. *Comparison Of Our Cases With Results Of A Nationwide Survey.*

Number	Our case	Nationwide survey	p
	254	9041	
Age, years	71.6±11.9	73.3±12.9	0.0380
Sex, male %	51.2%	57.0%	0.0657
Infarct	59.4%	67.2%	
Hemorrhage	30.3%	26.5%	0.0089
SAH	10.2%	6.3%	
Patients per PT	3.5	4.0	
Patients per OT	3.9	4.7	0.9971

Number	Our case	Nationwide survey	p
	254	9041	
Patients per ST	4.5	5.2	
Days from onset to admission	29.1±14.9	29.6±13.9	0.5726
Stay in rehabilitation hospital (day)	45.0±28.1	81.3±45.1	0.0000
FIM on admission	74.4±32.0	71.1±31.3	0.0977
FIM at discharge	94.6±32.0	88.3±33.6	0.0032
FIM gain	20.3±19.7	17.1±17.4	0.0040
Mobility FIM on admission	50.4±24.1	48.3±24.0	0.1691
Mobility FIM at discharge	68.2±24.0	62.9±26.0	0.0013
Mobility FIM gain	17.8±16.2	14.6±14.9	0.0008
Cognitive FIM gain	2.9±6.1	2.5±4.4	0.1582
Discharged to own home	80.3%	66.3%	0.0000

3.1. Age and Sex

Regarding age, patients in our hospital were significantly younger (71.6±11.9 years) than in the nationwide survey (73.3±12.9 years). No significant difference in sex ratios was evident.

3.2. Underlying Disease

Of the 254 patients in our hospital, the underlying pathology was cerebral infarction in 59.4%, brain hemorrhage in 30.3%, and subarachnoid hemorrhage in 10.2%. Of the 9,041 patients in the nationwide survey, the underlying pathology was cerebral infarction in 67.2%, brain hemorrhage in 26.5%, and subarachnoid hemorrhage in 6.3%. Ratios of brain hemorrhage and subarachnoid hemorrhage were higher in our hospital than in the nationwide survey.

3.3. Number of Patients Per PT/OT/ST

No significant differences were evident between our hospital and the nationwide survey in terms of the number of patients per PT/OT/ST.

3.4. Number of Days from Disease Onset Until Moving to a Rehabilitation Hospital

No significant difference in number of days from disease onset until admission to the rehabilitation hospital was seen between our hospital (29.1±14.9 days) and the nationwide survey (29.6±13.9 days). At our hospital, the duration was ≤14 days for 14% of patients, 15-30 days for 48%, and 31-60 days for 35%. In the nationwide survey, the duration was ≤14 days in 13% of patients, 15-30 days for 44%, and 31-60 days for 43%.

3.5. Hospital Stay

Mean hospital stay was 45.0±28.1 days in our hospital and 81.3±45.1 days in the nationwide survey, there showing a significant difference. The stay in our hospital was ≤30 days for 38.2% of patients, 31-60 days for 35.4%, 61-90 days for 19.3%, 91-120 days for 5.1%, and 121-150 days for 2.0%. The stay in the nationwide survey was ≤30 days for 15.9% of patients, 31-60 days for 21.6%, 61-90 days for 21.2%, 91-120 days for 16.4%, 121-150 days for 22.3%, and 151-180 days for 2.6%.

3.6. FIM and M-FIM Scores on Admission and at Discharge

No significant difference in FIM score on admission was evident between our hospital (74.4±32.0) and the nationwide survey (71.1±31.3; P=0.0977). A significant difference in FIM score at discharge was identified between our hospital (94.6±32.0) and the nationwide survey (88.3±33.6). No difference in M–FIM score on admission was found between our hospital (50.4±24.1) and the nationwide survey (48.3±24.0), but M–FIM at discharge was significantly higher at our hospital (68.2±24.0) than in the nationwide survey (62.9±26.0).

M-FIM gain was also higher in our hospital (17.8±16.2) compared to the nationwide survey (14.6±14.9). No significant difference in C-FIM gain was seen between our hospital (2.9±6.1) and the nationwide survey (2.5±4.4).

3.7. Location for Post-discharge Care

After discharge from our hospital, 80.3% of patients moved home, 9.1% moved to a nursing facility, 0.4% were transferred to another hospital, 7.1% suffered sudden deterioration or death, and the location was ‘other’ for 3.1%. In the nationwide survey, 66.3% of patients moved home, 17.5% moved to a nursing facility, 7.0% were transferred to another hospital, 6.3% suffered sudden deterioration or death, and the location was ‘other’ in 2.9%. The ratio of patients moving home after discharge was significantly higher in our hospital than in the nationwide survey.

4. Discussion

By refining the rehabilitation program, the stay in our rehabilitation hospital was reduced to 45.0 days, shorter than the duration of 81.3 days reported in the nationwide survey. In addition, FIM score at discharge was 94.6 and the rate of discharge home was 80.3%, both higher than in the nationwide survey, at 88.3 and 66.3%, respectively. Although significant differences were seen in age and type of disease, these were not considered sufficient to cause the difference in mean hospital stay [13].

The reason why we explained to patients and their families on admission that the mean time required to complete rehabilitation for stroke is 2 months was that we carried out investigations to test Hirschberg’s claim that ADL and

walking ability can be recovered within 4 weeks, even in severe cases of paralysis [11, 13]. We conjectured that 2 months would thus be sufficient for rehabilitation for stroke, even in severe cases. The idea was that 2 months would be adequate for predicting prognosis, even in patients who would require long-term care.

When told that 2 months would be sufficient, patients seemed not to believe it at first. However, they gradually came to believe this as they witnessed their own progress in rehabilitation. That said, this time line is only possible when thorough rehabilitation treatment is provided by the ACH. In the United States, the current length of stay in an ACH is 4.7±3.0 days [3-4] and rehabilitation is started early. In contrast, the length of stay in an ACH in Japan is 29.1 days [10], which may result in disuse syndrome. Moreover, the length of stay in a RH is 15 days in the United States [4] and 81.3 days in Japan [10], showing that more time is taken for recovery in Japan.

Japan has been implementing measures to reduce the LOS in ACH since about 1995, during which time the number of patients wishing to be transferred to our hospital has increased dramatically. In response, our hospital did not refuse patients who wished to be transferred in, and instead coped by reducing the LOS. The LOS for patients with stroke was reduced from 92.6 to 58.3 days over the period from 1999 to 2006, and patients transferred from ACH were accepted. A 2007 study [13] examined ADL scores at discharge for 8 years' worth of treatment outcomes, finding that reducing the LOS did not worsen the treatment outcomes.

The second point for refining the rehabilitation program was the program itself. Rather than recovery from paralysis as the treatment target, the main objective was to strengthen muscles on the uninvolved side, especially the lower limb muscles, with a focus on performing as many repetitions of stand-up and sit-down exercises as possible, striving for 400-600 repetitions a day. In other words, the focus was shifted from treatment time with a therapist to the number of repetitions of stand-up and sit-down exercise, including self-initiated exercises. This was not difficult to achieve when performed in groups. In addition, patients could carry out self-initiated exercises. This was why patients were recommended to be in the physiotherapy / occupational therapy training room at least 4 h/day and carry out repetitions on their own.

Stand-up and sit-down exercises produced abundant muscle activity, which led to more rapid recovery of transfer motions, toileting, and walking ability. When using techniques to recover from paralysis, muscle activity on the involved side is low and muscle activity on the uninvolved side also becomes insufficient, resulting in an insufficient overall amount of muscle activity throughout the body and delaying recovery of ADL.

The reasons why dedicated time was not allocated to swallowing exercises were that no evidence supports their use in the treatment of stroke and dysphagia [14-15] and that a 2012 study revealed that symptoms of dysphagia can be resolved successfully through stand-up and sit-down exercises [12]. While a great amount of time is dedicated to speech therapy for patients with aphasia who are highly motivated and have relatively mild movement disorder, such patients are rare. Even in patients having dysphasia or dysphagia, when movement disorder was severe, the amount of time allocated to speech therapy was minimized and a great amount of time was spent on physiotherapy and occupational therapy.

"Comprehensive rehabilitation" is occasionally thought to comprise three therapies: physiotherapy, occupational therapy and speech therapy. However, this type of program would give patients relatively less time for strengthening the lower limbs, which could delay recovery of ADL. At least in the initial period, more time should be given to physiotherapy and occupational therapy for the best results.

Hospital stays need to be reduced in both ACH and RH. As the number of elderly patients requiring rehabilitation continues to increase, lengthening the waiting period until admission and delaying rehabilitation should be avoided to ensure all patients have equal access to quality care.

Revising the program can help increase the efficiency of rehabilitation and reduce the LOS.

5. Study Limitations

The most serious limitation of the present study is that it is difficult to compare our treatment with the treatments described in nationwide surveys. The nationwide surveys only state that three types of treatment, specifically PT, OT, and ST, were carried out for 120 to 180 minutes/day, and do not clarify what types of activities were performed or how many minutes each PT, OT, or ST session lasted. The present study focuses more on the number of repetitions of the stand-up and sit-down exercises than the duration of treatment with a therapist. Specific details of the program will need to be addressed in future comparison studies.

The second limitation is the small sample size. This can be resolved in future studies.

6. Conclusions

By creating a rehabilitation program in which physiotherapy focuses on 400-600 stand-up and sit-down exercises a day to strengthen the uninvolved lower limb, rather than recovery from paralysis, occupational therapy focuses on strengthening the lower limbs aimed at recovery of ADL, and speech therapy focuses on treating only dysphasia while eliminating swallowing exercises, we were able to increase the effectiveness of rehabilitation and substantially reduce the mean stay in a rehabilitation hospital.

Abbreviations

ACH: acute-care hospital
RH: rehabilitation hospital
C-FIM: cognitive functional independence measure
FIM: functional independence measure
M-FIM: mobility functional independence measure
SAH: subarachnoid hemorrhage

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