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CAUSES OF FUNCTIONAL DECLINE IN ELDERLY HOSPITALIZED PATIENTS RECEIVING EITHER INDIVIDUAL OR EXCLUSIVE REHABILITATION THERAPY: A COHORT STUDY

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ABSTRACT

Background: Recently, exclusive rehabilitation therapy was introduced to prevent functional decline due to hospital-associated deconditioning by managing older inpatients' activities of daily living in Japan. However, this type of therapy does not provide one-on-one exercises similar to individual rehabilitation therapy. This study aimed to report the present ward conditions and the causes of the functional decline in elderly patients receiving individual or exclusive rehabilitation therapy.

Methods: A total of 1,636 inpatients, aged 65 years or older, were included in the study. Barthel Index at admission and discharge was assessed prospectively to analyze functional decline. We further analyzed the causes of functional decline by investigating the inpatient's medical records.

Results: Forty-three inpatients (2.6%) had functional decline during hospitalization. There were no significant differences in age, Barthel Index at the time of admission, and the type of clinical department between inpatients with and without functional decline. The functional decline rate in individual rehabilitation therapy was 8.2%, which was significantly higher compared to exclusive rehabilitation therapy (0.8%). The most common causes of functional decline were a pain, low postoperative physical fitness, malignant neoplasm, and new-onset cerebral stroke.

Conclusions: We report the present ward conditions in elderly patients receiving either individual or exclusive rehabilitation therapies. Functional decline was correlated to the inpatients' disease and conditions. The causes of the functional decline can be classified based on whether rehabilitation was effective or ineffective. If the functional decline was caused by hospital-associated deconditioning, we should address the functional decline by providing appropriate rehabilitation methods.

Keywords: activities of daily living, functional decline, hospitalization, older adult, rehabilitation.

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INTRODUCTION

In 2015, 26.7% of people in Japan were 65 years or older, and the number of people who are aging is progressing rapidly [1]. For many older adults, hospital admission itself has a detrimental effect. One of these effects is deconditioning, a complex process of physiological change that often results in functional decline [2]. Hospitalization can result in complications that are unrelated to the problem that caused admission, even if the condition for which the inpatients were admitted is cured or repaired [3].

Furthermore, acute hospitalization can result in a significant functional decline that is unrelated to a specific neurological or orthopedic insult [4]. Many inpatients' function at discharge is worse than their function at admission, and the risk of functional decline increases markedly with age [5]. Among older Japanese adults in the general community, 11% were frail [6]. An individual is considered frail if he or she has three of the following diagnostic markers: muscle weakness, slow movement speed, self-reported exhaustion, low physical activity, and unintentional weight loss [7]. The risk of deconditioning and the functional decline has increased along with the increase in the number of older adults in Japan. The functional decline that is associated with acute hospitalization has been described as part of a clinical sequela that was historically termed not only "deconditioning" but also "hospital-associated deconditioning" [4]. We will use hospital-associated deconditioning to describe functional decline that is associated with hospitalization in this article, as this term better describes deficits that are seen in physical therapy settings [4,8].

Functional decline due to hospital-associated deconditioning increases the length of hospital stay [9] and is an important independent risk factor after discharge [10]. The functional decline at discharge was associated with poor 1-year functional mobility afterward [11]. Functional recovery and prevention of functional decline during hospitalization are important targets for clinical intervention to minimize the risk of loss of function [12]. Regarding clinical intervention, we suggest that an inpatient rehabilitation service is started as soon as possible to maximize the inpatient's independent function. The function is an important predictor of hospital outcomes in older inpatients [13], and recent evidence indicated that the functional recovery of inpatients with hospital-associated deconditioning who participate in acute inpatient rehabilitation is favorable [4]. In one study, when an exercise program was started during hospitalization and continued for one month, the instrumental activities of daily living (ADL) were improved at one month, but the intervention did not change other physical functions [14]. Research has not yet examined the effectiveness of specific inpatient rehabilitation interventions to reduce the functional decline in older adults with hospital-associated deconditioning [15].

In conventional rehabilitation therapy, one-on-one exercises are often provided to individual inpatients, known as individual rehabilitation therapy, to prevent hospital-associated deconditioning. However, individual rehabilitation

therapy requires many physical and occupational therapists in an institution to assist as many inpatients as well. Therefore, to prevent hospital-associated deconditioning of many older inpatients effectively, an exclusive rehabilitation therapy introduced per acute hospital ward is provided and covered by insurance in Japan since 2014. An exclusive rehabilitation therapy does not provide one-on-one exercises but is implemented to manage inpatients' functioning through consultation, education, and group exercises. An exclusive working therapist evaluates and instructs inpatients and their families on how to perform ADL, prepares an environment to prevent falls, offers information to inpatients and their families to achieve a safe and comfortable living environment not only during hospitalization but also after discharge; and participates in conferences held inwards to collaborate with other specialists in the management of inpatients' conditions.

To our knowledge, there have been no reports on exclusive rehabilitation therapy. We provided inpatients with individual and exclusive rehabilitation therapies to prevent functional decline, but some experienced functional decline to some extent. It is important to assess present ward conditions and causes of functional decline to prevent it from happening in older inpatients. This study aimed to report the present ward conditions and causes of the functional decline in elderly inpatients who had exclusive rehabilitation therapy, which was newly introduced in Japan.

METHODS

Ethical Considerations

All procedures were approved by the ethics committee of Hidaka Hospital (reference number 188), and the study was performed by the ethical principles of the Declaration of Helsinki.

Subjects

We included subjects who were admitted to the ward at Hidaka Hospital, Gunma after September 2014 and left the hospital by March 2016. The ward was a mixed unit, consisting of several clinical departments including surgery, cardiovascular disease, and cerebrovascular surgery. The individual or exclusive rehabilitation was provided to inpatients in this ward.

We included inpatients aged 65 years or older and subjects for whom we could collect enough data from their medical records. To analyze the causes of functional decline concerning rehabilitation, deceased inpatients were excluded. A total of 2,819 inpatients were hospitalized and discharged, and 1,905 of these inpatients were aged 65 years or older. Of these 1,905 inpatients, 269 were not eligible for inclusion in these analyses because they died before hospital discharge (n=127) or not enough data could be extracted from the medical records (n=171), resulting in 1,636 in patients who were analyzed. Figure 1 shows the study flowchart.

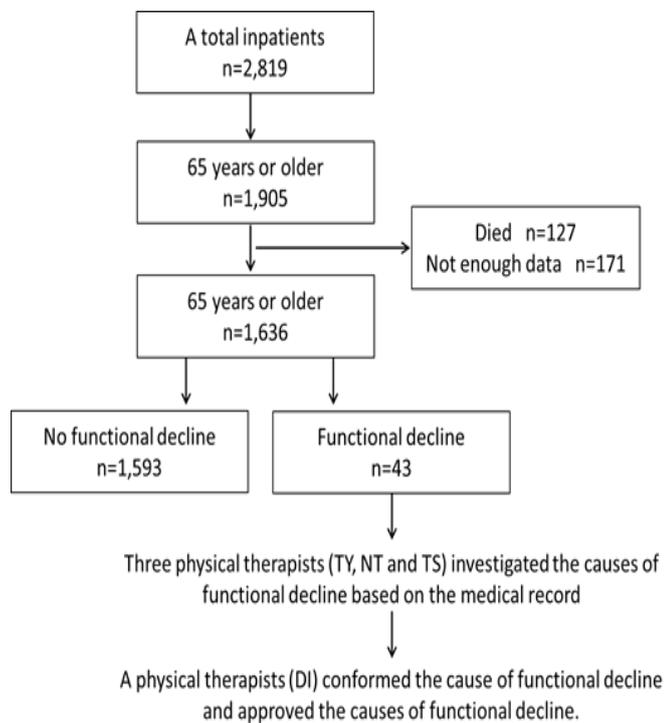


Figure 1: The flowchart of the subject in this study.

Data Collection

We obtained information about the inpatients' ages, lengths of hospital stay, clinical department, and rehabilitation type (the individual or exclusive rehabilitation therapy). To determine the inpatients' functions, we assessed the Barthel Index [16] both upon admission and at discharge. Given that inpatients' abilities could be evaluated using the Barthel Index, we were able to investigate the functional decline in these individuals. A small Barthel Index at discharge that was more than 5 points greater than it was at admission indicated a functional decline. If the subject's function decreased, we confirmed the reason for the decline. To analyze the causes of functional decline, three physical therapists (with 17, 15, and eight years of experience) retrospectively investigated the subject's medical record. They decided the main cause of functional decline for each subject independently; therefore, they did not inspect the causes that other researchers investigated. If the cause of functional decline was the same for two or more of the researchers, the cause of functional decline was decided. If the three researchers' causes differed completely, a consensus was reached among them after discussion. Also, another researcher (a physical therapist with 15 years of experience) confirmed the cause of functional decline and approved it. To indicate the functional decline according to the diseases that caused hospitalization, we classified the subjects according to the clinical departments: surgery, cardiovascular disease, cerebrovascular surgery, and others (internal medicine, nephrology, kidney surgery, orthopedics, ophthalmology, emergency, and urology).

Statistical Analyses

To analyze the differences between individuals with and without functional decline, a t-test was used for age, the Mann-Whitney U test was used for the Barthel Index and

length of hospital stay, and the Chi-square test was used to determine the clinical department, and the provided individual rehabilitation rate. Moreover, the inpatients were assigned to either the individual rehabilitation therapy or the exclusive rehabilitation therapy, and we analyzed the differences between inpatients with and without functional decline. To assess the causes of functional decline, we calculated the number of causes according to the inpatients' clinical department and rehabilitation type. The data analyses were conducted using Dr. SPSS II for Windows (SPSS Japan Inc., Tokyo, Japan), and a p-value of .05 indicated a statistical significance.

RESULTS

Characteristics of the subjects

The mean age of the inpatients was 76.5 years. The mean Barthel Index at admission and discharge was 62.3 and 79.5, respectively. Although most inpatients' ADLs improved by the time of discharge, 43 (2.6%) inpatients experienced a functional decline. Twenty-two inpatients (51.2%) with Barthel Index less than 10 points had a decline (Figure 2). The mean hospital length of stay was 11.6 days.

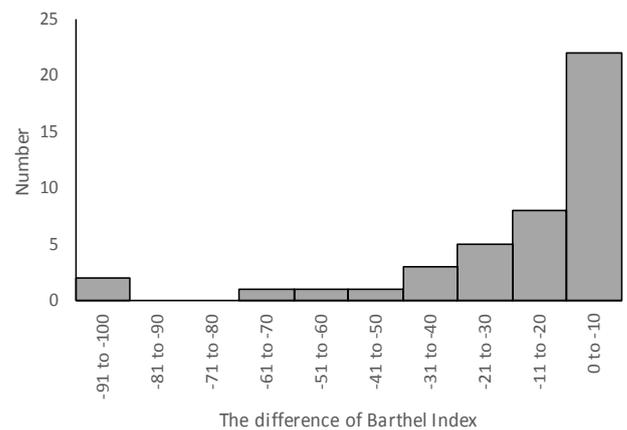


Figure 2: The difference of Barthel Index between admission and discharge with functional decline (n=43).

A small Barthel index at discharge that was more than 5 points greater than it was at admission indicated a functional decline. The inpatients with the difference of Barthel Index less than 10 points was twenty-two (51.2%).

The difference between inpatients with and without a functional decline

Table 1 shows the difference between inpatients with and without functional decline. The mean Barthel Index at admission was similar between patients with and without functional decline, but there were significant differences in the mean Barthel Index at discharge and hospital length of stay. Inpatients with functional decline had a higher provided individual rehabilitation rate (76.7%) than those without functional decline (23.2%). There were no significant differences in the type of clinical department.

Table 1: The Differences between individuals with and without functional decline n=1,636

	With functional decline n=43	Without functional decline n=1,593	P-value
Mean age (years)	77.8 ± 7.7	76.5 ± 7.7	.264
Mean Barthel Index			
at admission	64.0 ± 31.6	62.3 ± 40.1	.784
at discharge	42.4 ± 34.5	80.5 ± 29.7	<.001
Mean length of hospital stay (days)	40.5 ± 30.6	10.8 ± 11.8	<.001
The clinical department (n)			
Surgery	19	559	
Cardiovascular disease	21	751	.214
Cerebrovascular surgery	3	180	
Others	0	103	
Provided individual rehabilitation (n)	33	371	<.001

The functional decline rate in individual rehabilitation therapy was 8.2% (n=404), which was significantly higher compared to the exclusive rehabilitation therapy (n=1,232, 0.8%). Table 2 shows the comparison in each rehabilitation type. In the individual rehabilitation therapy, there were significant differences in the mean Barthel Index at admission and discharge, hospital length of stay, and the type of clinical department. The functional decline rate in surgery was 15.7%, in cardiovascular disease was 8.0%, in cerebrovascular surgery was 4.2% and in others was 0.0%. The functional decline rate in surgery was the highest in clinical departments. In the exclusive rehabilitation therapy, there were significant differences in the mean Barthel at discharge and hospital length of stay. There were no significant differences regarding age, the mean Barthel index at admission, and the type of clinical department.

Table 2: Comparison in the each rehabilitation type (n=1,636)

	The individual rehabilitation (n=404)			The exclusive rehabilitation (n=1,232)		
	With functional decline n=33	Without functional decline n=371	P-Value	With functional decline n=10	Without functional decline n=1,222	P-Value
Mean age (years)	77.9 ± 7.8	80.1 ± 8.6	.163	77.5 ± 7.7	75.4 ± 7.1	.356
Mean Barthel Index						
at admission	66.7 ± 32.0	24.0 ± 33.6	<.001	55.0 ± 29.9	73.9 ± 34.2	.082
at discharge	43.5 ± 34.9	62.0 ± 34.2	<.001	39.0 ± 34.9	86.2 ± 25.7	<.001
Mean length of hospital stay (days)	46.0 ± 32.4	23.3 ± 15.1	<.001	22.3 ± 12.4	7.0 ± 7.1	<.01
The clinical department (n)						
Surgery	11	59		8	500	
Cardiovascular disease	19	219	<.05	2	532	.090
Cerebrovascular surgery	3	68		0	112	
Others	0	25		0	78	

The Causes of Functional Decline

The most common causes of functional decline were a pain, low postoperative physical fitness, malignant neo-

plasm, and new-onset cerebral stroke (Table 3). The causes included malignant neoplasm and carcinomatous pain, but only for inpatients who were treated in the surgery department. In the cardiovascular disease department, many inpatients had low postoperative physical fitness. The cause of functional decline tended to vary according to the clinical department. In the exclusive rehabilitation therapy, many inpatients had carcinomatous pain, malignant neoplasm, or pain.

Table 3: The causes of functional decline (n=43)

The cause of functional decline	Overall (n=43)	The clinical department			
		Surgery (n=19)	Cardiovascular disease (n=21)	Cerebrovascular surgery (n=3)	Others (n=0)
Pain (without carcinomatous pain)	4 / 1	1 / 1	3 / -	-	-
Low postoperative physical fitness	5 / -	1 / -	4 / -	-	-
Malignant neoplasm	3 / 2	3 / 2	-	-	-
New-onset cerebral stroke	5 / -	-	3 / -	2 / -	-
Carcinomatous pain	1 / 3	1 / 3	-	-	-
Aggravation of mind function	2 / 1	- / 1	2 / -	-	-
Aggravation of respiration	3 / -	1 / -	2 / -	-	-
Progression of paralysis	2 / -	1 / -	-	1 / -	-
Learn the measuring of a stoma	1 / 1	1 / 1	-	-	-
Aggravation of locomotion	2 / -	-	2 / -	-	-
Others	5 / 2	2 / -	3 / 2	-	-
Total	33 / 10	11 / 8	19 / 2	3 / -	0 / 0

the individual rehabilitation / the exclusive rehabilitation

DISCUSSION

This study suggested that 2.6% of older adult inpatients had functional decline during hospitalization. They needed rest with treatment or an operation to treat the functional mobility disorder. In other studies, 65% of inpatients experienced a functional decline in mobility within three days of admission, suggesting that many older adult inpatients may experience functional impairment during hospitalization [17]. Additionally, 31% of inpatients experienced a decline in ADL compared with the baseline levels preadmission, showing that there was a high incidence of functional decline after hospitalization for acute medical illness [18]. Our functional decline rate of 2.6% is low, although there were differences in the disease, length of hospital stay, and rehabilitation that was provided from those in other studies. The ward in this study had mixed clinical departments and in patients with a variety of diseases, but all inpatients had either individual rehabilitation therapy or exclusive rehabilitation therapy. When they did not have individual rehabilitation therapy, they underwent the exclusive rehabilitation therapy to conserve or improve their function and ADL. While rehabilitation services are often

seen as a costly intervention, they may prevent functional decline in seniors who are hospitalized [13]. We suggest that the slight functional decline in this study was due to the individual or exclusive rehabilitation programs.

On the other hand, in more than half of the inpatients with functional decline, there was a less than a 10-point decline in the Barthel Index. Although these inpatients had functional decline during hospitalization, in almost all cases, there was a small decline in one or two items of ADL. Therefore, this decline may be prevented by providing appropriate rehabilitation.

In one study, three inpatient characteristics were suggested as independent predictors of functional decline: increased age, lower Mini-Mental Status Exam scores upon admission, and lower instrumental ADL function preadmission [19]. To identify older adult inpatients who are at risk for the functional decline on admission, a predictive model was suggested, based on four risk factors: decubitus ulcer, cognitive impairment, functional impairment, and low social activity level [20]. However, in this study, there were no significant differences regarding age and functional impairment at admission between inpatients with and without functional decline. We included only in patients aged 65 years or older in this cohort study, and there was no significant difference in age. We considered that the clinical department influenced functional decline, particularly in inpatients who had individual rehabilitation therapy. The inpatients' conditions that were associated with the disease and the treatment for the diseases including various limitations related to a functional disorder were important factors to predict the risk of functional decline. We should assess the diseases and conditions of older inpatients to prevent them from having a functional decline.

Although individual rehabilitation therapy was provided, the functional decline rate in the individual rehabilitation therapy was higher than that in the exclusive rehabilitation therapy. The Barthel Index at admission in the individual rehabilitation therapy was higher than that in the exclusive rehabilitation therapy in inpatients with functional decline. We consider that in patients who had individual rehabilitation therapy might have a functional disorder, and it was more difficult to conserve function in this group than in the exclusive rehabilitation therapy group. Mostly, we tend to provide individual rehabilitation therapy to inpatients who we expect to have functional decline.

The causes of the functional decline can be classified based on whether rehabilitation was effective or ineffective. In this study, pain (without carcinomatous pain), low post-operative physical fitness, aggravation of mental function, respiration, and locomotorium were possibly reduced due to appropriate rehabilitation with exercise. These are correlated to hospital-associated deconditioning, and rehabilitation may be effective. However, malignant neoplasm, new-onset cerebral stroke, carcinomatous pain, and progression of paralysis strongly influenced decreases in function and were not correlated to hospital-associated deconditioning. Illness can occur due to ineffective rehabilitation,

and functional decline is often seen during hospitalization [3]. In the exclusive rehabilitation therapy, some conditions were correlated to hospital-associated deconditioning, including pain and aggravation of mental function. Therapists should switch from the exclusive to the individual rehabilitation therapy to improve function in inpatients so that therapists providing the individual rehabilitation therapy have more time to spend on inpatients than therapists providing the exclusive rehabilitation therapy.

This study has some limitations. First, a small Barthel Index at discharge that was more than 5 points greater than it was at admission indicated a functional decline. Functional decline due to hospital-associated deconditioning is assessed in various ways, including functional balance, physical fitness, cognitive, and mental function, using the Barthel Index. Second, the functional decline that was reported in this study was described from admission to discharge. Even if older adults experienced a functional decline during hospitalization, their function might be improved after discharge. We were only able to describe the causes of functional decline and the effectiveness of rehabilitation during hospitalization.

In conclusion, we report the present ward conditions with inpatients who had either individual or exclusive rehabilitation therapy. We found that 2.6% of older adult inpatients had a functional decline in our ward during the acute individual or exclusive rehabilitation therapies. Functional decline was correlated with the disease and conditions of older adult inpatients. The functional decline may be due to effective and ineffective rehabilitation. Older adults may be frail at preadmission and experience hospital-associated deconditioning after admission. There are various causes of the functional decline in older adults, which should be prevented by providing appropriate rehabilitation.

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