Japanese Journal of Comprehensive Rehabilitation Science (2017)

Original Article

Differences in FIM improvement rate stratified by nutritional status and age in stroke patients in kaifukuki (convalescent) rehabilitation ward

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ABSTRACT
Fujitaka Y, Tanaka N, Nakadai H, Sato R, Watanabe M, Kageyama N, Okamoto T. Differences in FIM improvement rate stratified by nutritional status and age in stroke patients in kaifukuki (convalescent) rehabilitation ward. Jpn J Compr Rehabil Sci 2017; 8: 98−103.
Purpose: This study aimed to investigate the differences in improvement rate of Functional Independence Measure score (FIM) stratified by nutritional status and age in stroke patients admitted to a kaifukuki (convalescent) rehabilitation ward (KRW).
Methods: Stroke patients aged 60 years or older admitted to the KRW in our hospital between May 2013 and February 2015 were studied. Patients with Mini Nutritional Assessment-Short Form (MNA-SF) score 7 or below at admission were classified in the malnutrition group, and those with score 8 or above in the normal nutrition group. Each group was further stratified by age into 60s, 70s, and 80 and older, with a total of 6 groups. FIM effectiveness was calculated as an indicator of FIM improvement rate, and multiple comparison was conducted among groups.
Results: FIM effectiveness did not differ among age groups in the normal nutrition group, but was significantly lower in patients aged ≥80 compared to those aged 60s and 70s in the malnutrition group.
Conclusion: In stroke patients with malnutrition, the FIM improvement rate decreased as age increased. This finding suggests that in order to conduct rehabilitation efficiently, the nutritional status should be taken into consideration when planning the rehabilitation program, especially in patients of advanced age.
Key words: Kaifukuki rehabilitation ward, stroke, nutritional status, age groups, FIM improvement rate

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Accepted: September 25, 2017.
No benefits in any form have been or will be received from any commercial party related directly or indirectly to the subject of this manuscript.

doi.org/10.11336/jjcrs.8.98

Introduction

In the fiscal 2016 medical fee revision for kaifukuki (convalescent) rehabilitation ward (hereinafter abbreviated as KRW), the KRW achievement index(KRW-AI) was introduced using the Functional Independence Measure (FIM) as outcome evaluation. In the calculation of KRW-AI, the length of hospital stay (days) and the gain of FIM motor subscale score (difference between score at discharge and that at admission) are used. Therefore, efficient rehabilitation that improves FIM gain within a short hospital stay is increasing in importance. While appropriate nutritional management is considered necessary to achieve such efficiency [1], study has indicated that 43.5% of stroke patients in the KRW have malnutrition [2], implying that many malnourished stroke patients are undergoing rehabilitation. In stroke patients, malnutrition has been reported to be a negative predictor of FIM score at discharge and discharge outcome [2], and associated with high mortality, high rate of complications such as infectious diseases, and furthermore difficulty of maintaining independence in activities of daily living (ADL) [3−5]. The above findings thus indicate that in stroke patients, malnutrition is an impeding factor that cannot be neglected for efficient rehabilitation.

Furthermore, sarcopenia is attracting attention as a malnutrition-related problem. The prevalence of sarcopenia has been reported to vary depending on the age in community-dwelling elderly people in Japan [6]. Compared with approximately 10% in the 65−74 age group, the prevalence increases in correlation with age to approximately 25% in the 75−79 age group, 40% in the 80–84 age group, and 60% in the 85 and above age group. These data imply that among patients admitted to KRW, the proportion with poor nutritional status may become higher in older patients. Since older age correlates with poorer ADL outcome in stroke patients [7, 8], it may be necessary to consider age during nutrition management of stroke patients.

However, research on the relationship between nutrition management and improvement of ADL capability in KRW [9] grouped all the elderly subjects aged 65 years or older into one large age group. Therefore, the effect of the status of malnutrition and the effect of age stratified into finer age groups on the FIM improvement rate in KRW remain unknown.

The purpose of this study was to investigate the differences in FIM improvement rate stratified by nutritional status and age in stroke patients admitted to a KRW.

Methods

1. Subjects

Stroke patients aged 60 years or older admitted to the KRW in our hospital between May 2013 and February 2015 were studied. Exclusion criteria were transfer to other facilities including acute care hospitals due to complications including pneumonia and heart failure or concurrent diseases during the course of hospitalization, hospital stay not more than 30 days, and presence of missing data. The KRW of our hospital meets the facility criteria for rehabilitation ward admission fee 1. The rehabilitation volume provided during the study period averaged across the hospital was 8.5 to 8.6 units per day per patient.

2. Stratification by nutritional status and age

Nutritional status was measured at admission using the Mini Nutritional Assessment-Short Form (MNA-SF). The Mini Nutritional Assessment (MNA) is a nutritional assessment method developed by Guigoz et al. [10], and the validity of this tool has also been established in Japan [11]. The MNA-SF is a simplified version of the MNA and has been validated to be an effective screening tool [12]. MNA-SF scores of 0 to 7 points are assessed as malnourished, 8 to 11 points as at risk of malnutrition, and 12 to 14 points as normal nutritional status. In the present study, patients with MNA-SF scores of 7 or lower at admission were classified in the malnutrition group, and those with scores of 8 or higher in the normal nutrition group. In addition, each group was stratified by age into 60s, 70s, and 80 and older, with a total of 6 groups (Figure 1).

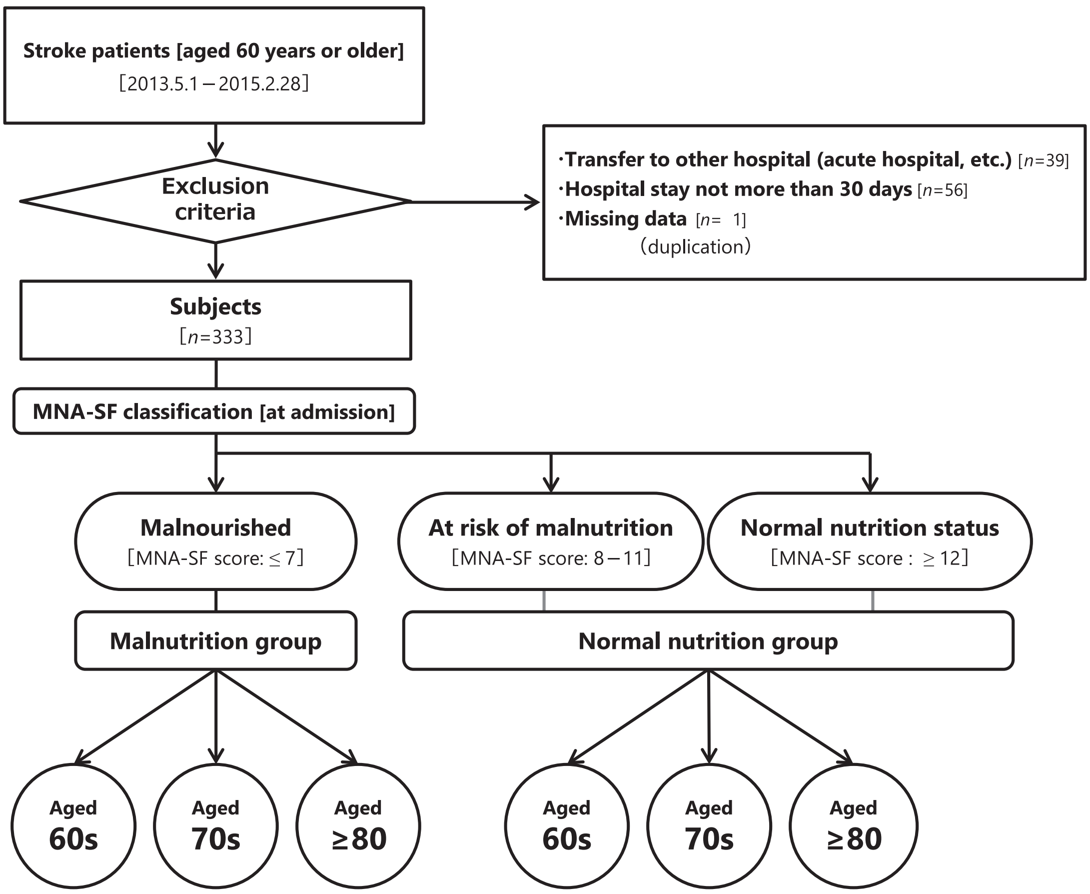

Figure 1. Flowchart of subject selection and classification.
MNA-SF, Mini Nutritional Assessment-Short Form.

3. Assessment items

As basic attribute data of the subjects, we examined age, gender, disease type, comorbidity, length of hospital stay, FIM score at admission, FIM score at discharge, and body mass index (BMI). For the evaluation of nutritional status, we measured MNA-SF at admission and at discharge, and calculated the ratio of MNA-SF score at admission to that at discharge. For the evaluation of ADL improvement rate, we measured FIM scores at admission and at discharge, and calculated FIM effectiveness [FIM score at discharge–FIM score at admission / (126–FIM score at admission)] according to the method of Shah et al. [13].

4. Ethical consideration

This study was planned in compliance with the Declaration of Helsinki, and was conducted after obtaining approval from the ethics review committee of our hospital.

5. Statistical analysis

The data of FIM effectiveness was tested for normal distribution by Shapiro-Wilk test. Then, the data were analyzed using Kruskal-Wallis test, followed by post-hoc Steel-Dwass test for multiple comparison. Statistical analyses were performed using Statcel 3. A p value less than 0.05 was considered to indicate a significant difference.

Results

A total of 333 stroke patients (190 males, 143 females) were analyzed. The basic attribute data are shown in Table 1.

From the MNA-SF scores at admission, 252 patients were assessed as malnourished, 80 patients as at risk of malnutrition, and 1 patient as normal nutritional status. Since MNA-SF scores of 7 and below were defined as malnutrition in the present study, 252 patients (75.7%) were classified in the malnutrition group and 81 patients (24.3%) in the normal nutrition group. At discharge, 91 patients were assessed as malnourished, 206 patients as at risk of malnutrition, and 36 patients as normal nutritional status according to MNA-SF scores. Ninety-one patients (27.3%) were classified in the malnutrition group and 242 patients (72.7%) in the normal nutrition group (Figure 2).

Table 1. Basic attribute data of the subjects.

	All	Aged 60s		Aged 70s		Aged ≥ 80	
		Malnutrition group	Normal nutrition group	Malnutrition group	Normal nutrition group	Malnutrition group	Normal nutrition group
Number	333	71	25	91	35	90	21
Age, years Mean (standard deviation)	75.3 (8.8)	64.8 (2.5)	65.0 (2.7)	74.6 (3.1)	74.0 (2.8)	85.5 (4.0)	84.8 (5.7)
Gender, no. (%) Male	190 (57.1)	50 (70.4)	15 (60.0)	49 (53.8)	25 (71.4)	38 (42.2)	13 (61.9)
Female	143 (43.0)	21 (29.6)	10 (40.0)	42 (46.2)	10 (28.6)	52 (57.8)	8 (38.1)
Disease, no. (%) Cerebral infarction	198 (59.5)	28 (39.4)	15 (60.0)	50 (54.9)	25 (71.4)	64 (71.1)	16 (76.2)
Cerebral hemorrhage	116 (34.8)	39 (54.9)	10 (40.0)	31 (34.1)	8 (22.9)	25 (27.8)	3 (14.3)
Subarachnoid hemorrhage	19 (5.7)	4 (5.6)	0 (0.0)	10 (11.0)	2 (5.7)	1 (0.1)	2 (9.5)
Comorbidity, no. (%) Diabetes	95 (28.5)	20 (28.2)	7 (28.0)	32 (35.2)	10 (28.6)	21 (23.3)	5 (23.8)
Dyslipidemia	80 (24.0)	14 (19.7)	10 (40.0)	19 (20.9)	9 (25.7)	21 (23.3)	7 (33.3)
Hypertension	205 (61.6)	49 (69.0)	18 (72.0)	54 (59.3)	24 (68.6)	43 (47.8)	17 (81.0)
Cardiac disease	67 (20.1)	11 (15.5)	1 (4.0)	17 (18.7)	5 (14.3)	27 (30.0)	6 (28.6)
Renal disease	13 (3.9)	5 (7.0)	0 (0.0)	3 (3.3)	5 (14.3)	0 (0.0)	0 (0.0)
Hospital stay, days Median (interquartile range)	126.0 (88.0−147.0)	140.0 (113.5−147.0)	110.0 (68.0−147.3)	138.0 (102.0−147.0)	88.0 (50.5−127.0)	128.0 (90.0−146.0)	103.0 (94.0−115.0)
FIM at admission, score Median (interquartile range)	58.0 (36.0−82.0)	48.0 (32.5−78.8)	90.0 (66.0−102.0)	53.0 (34−71.5)	86.0 (59.0−95.0)	46.5 (29−68)	79.0 (58.0−94.0)
FIM at discharge, score Median (interquartile range)	95.0 (64.0−112.0)	100.0 (65−117.8)	119.0 (103−123)	87.0 (61.5−105)	115.0 (100.5−120.0)	68.0 (44−98)	105.0 (100.0−114.0)
BMI, kg/m^2 Mean (standard deviation)	21.9 (3.4)	21.1 (3.5)	24.8 (3.4)	21.1 (3.1)	25.1 (2.6)	20.9 (2.7)	24.0 (1.9)

FIM, Functional Independence Measure; BMI, Body Mass Index.

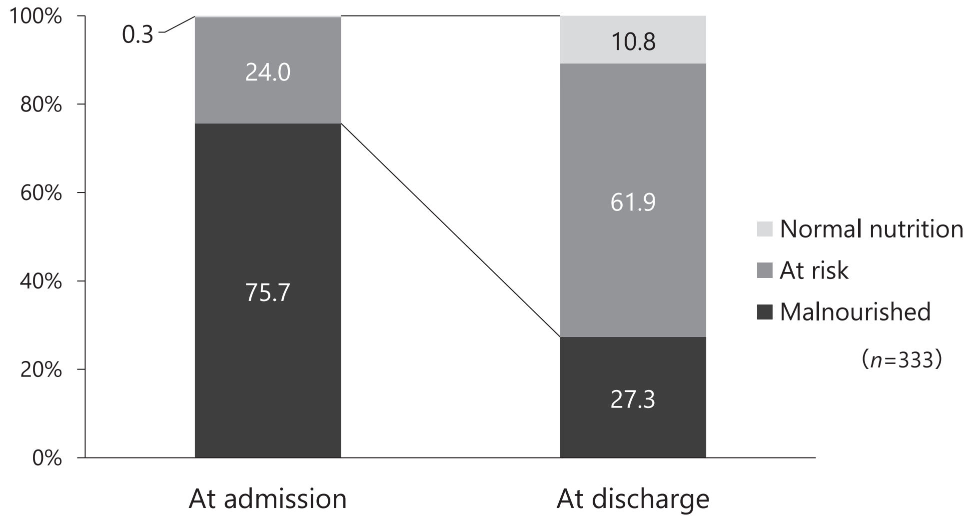

Figure 2. Nutritional status assessed by MNA-SF at admission and at discharge.

Table 2. FIM effectiveness (%).

	Aged 60s	Aged 70s	Aged ≥ 80	
Malnutrition group	60.4 (28.6−78.7)	45.5 (21.8−64.8)	28.6 (10.1−46.8)	¶,‡
	n.s.	*	**	
Normal nutrition group	73.3 (52.8−88.3)	74.2 (41.8−83.0)	58.8 (40.6−74.5)	n.s.

Median (interquartile range), FIM, Functional Independence Measure; n.s., not significant.
*, malnutrition group vs. normal nutrition group, $p < 0.05$; **, malnutrition group vs. normal nutrition group, $p < 0.01$.
¶, 60s vs. ≥ 80, $p < 0.01$; ‡, 70s vs. ≥ 80, $p < 0.05$.

First, FIM effectiveness was compared between two nutritional status groups. FIM effectiveness did not differ between two groups in patients aged 60s (malnutrition group: median 60.4%, normal nutrition group: median 73.3%), but was significantly lower in the malnutrition group in those aged 70s (malnutrition group: median 45.5%, normal nutrition group: median 74.2%) and 80 and older (malnutrition group: median 28.6%, normal nutrition group: median 58.8%). Next, FIM effectiveness was compared among three age groups within each nutritional status group. In the normal nutrition group, FIM effectiveness did not differ significantly among those aged 60s, 70s, and 80 and older (60s: median 73.3%, 70s: median 74.2%, ≥ 80: median 58.8%). In the malnutrition group, however, FIM effectiveness was significantly lower in those aged 80 and older compared to the other two age groups (60s: median 60.4%, 70s: median 45.5%, ≥ 80: median 28.6%) (Table 2).

Discussion

In the present study, we investigated the presence or absence of malnutrition in stroke patients admitted to a KRW, and the difference in FIM improvement rate by age stratification.

Among the subjects in the present study, 75.7% were assessed as malnourished at admission, and the rate was higher than that (43.5%) reported by Nishioka et al. [2]. A possible reason for this difference is the difference in method of assessment. Nishioka et al. used the Geriatric Nutritional Risk Index (GNRI) obtained from height, body weight, and serum albumin level, while we used the MNA-SF based on a questionnaire. In a previous study using the MNA-SF as the nutritional indicator, 87.6% of patients with disuse syndrome in an acute care ward were classified as malnourished [14]. In another study including patients with stroke and other diseases in the KRW, 82.0% were reported as malnourished [9], a rate that was as high as the result of our study. Among the six items in the MNA-SF, three items have a time frame of “in the past 3 months”. In the present study, the MNA-SF was administered at admission to the KRW, and “the past 3 months” before admission includes the period after onset of stroke. This may contribute to the high prevalence of malnutrition as assessed by the MNA-SF at the time of admission to the KRW.

In this study, FIM effectiveness was used as an indicator of the FIM improvement rate. Although FIM gain (FIM at admission – FIM at discharge) has been used as another index for FIM improvement, FIM gain in mild cases with high FIM at admission is low due to the ceiling effect, whereas the gain is often high in individuals who require moderate-level support [15]. FIM effectiveness is expected to correct this shortcoming of FIM gain.

Multiple comparison of FIM effectiveness revealed two features. First, in the intergroup comparison between the malnutrition and normal nutrition groups, FIM effectiveness was not different between two groups in patients aged 60s, but was significantly lower in the malnutrition group in those aged 70s and 80 and older. Second, in the intragroup comparison within each nutritional status group, FIM effectiveness was significantly lower in patients aged 80 and older compared to those aged 60s and 70s in the malnutrition group, but did not differ depending on age in the normal nutrition group.

First, regarding the intergroup comparison in which FIM effectiveness was significantly lower in the malnutrition group in patients aged 70s and 80 and older, these findings will be discussed with reference to previous studies on the relationship of ADL with nutritional status and age. In previous studies on the relationship between nutritional status and ADL, nutritional status at admission in stroke patients [2], pneumonia patients [16] and heart failure patients [17] affected the ADL outcome, and FIM gain was lower in KRW patients with malnutrition than patients with normal nutritional status [9]. Moreover, in previous studies on the association between age and ADL, ADL outcome became poorer in older stroke patients [7, 8], and FIM gain and FIM effectiveness decreased significantly as age increased in stroke patients in the KRW [18, 19]. In the present study, among patients with malnutrition, FIM effectiveness was significantly lower in those aged 70s and 80 and older, and these results support previous reports on the relationship of ADL with nutritional status and age. However, in one previous study on ADL and nutritional status in rehab ward [9], the subjects were not limited to stroke patients and the age group had a wide range (65 years and older), suggesting a possibility that wide variation in functional capability may have existed. In addition, two other previous studies on ADL and age in KRW [18, 19] reported the importance of stratification by age and by FIM at admission in the prediction of FIM gain, as well as the association of FIM at discharge with trunk function and walking ability, but nutritional status was not mentioned. Taken together, the novelty of the present study is the finding suggesting that the nutritional status may affect the rate of ADL improvement in stroke patients aged over 70 years.

Next, the intragroup comparison in which FIM effectiveness was significantly lower in patients aged 80 and older compared to those aged 60s and 70s in the malnutrition group, but did not differ depending on age in the normal nutrition group will be discussed. Elderly people show large individual differences in the rate of progression of aging, and often manifest atypical symptoms and abnormal findings [20−22]. In the malnutrition group, apart from nutritional status and comorbid diseases examined in this study, the physiological function of the body likely also declined. Age-related decline in physiological function includes impaired chewing and swallowing abilities, disturbed gastrointestinal function including diarrhea and constipation, olfactory disorder, taste disorder, and loss of appetite, which have been reported to affect the nutritional status of the elderly [23]. In addition, elderly people lack reserve capacity of physiological function compared to younger people, and once functional capability of daily living has deteriorated, complete recovery may be difficult [24, 25]. This may explain why elderly people who were malnourished at admission had low FIM improvement rate. As another factor, the prognosis of rehabilitation has been reported to worsen in patients with chronic obstructive pulmonary disease or dysphagia complicated by malnutrition [26, 27]. It is possible that concurrent respiratory diseases and dysphagia, which were not investigated in the present study, may have caused a decrease in FIM improvement rate.

The present findings suggest that in order to conduct rehabilitation efficiently for stroke patients admitted to the KRW, the nutritional status should be taken into consideration when planning the rehabilitation program, especially in patients of advanced age.

This study has several limitations. Because of the strict inclusion and exclusion criteria, we were not able to investigate the subjects' functional deficit including paralysis or the status of comorbidities such as respiratory diseases and dysphagia. In addition, there were variations in ADL capability and other data, and we were not able to exclude factors other than malnutrition and age. In addition, due to the retrospective design of the research, the causal relationship between ADL capability and nutritional status cannot be clarified. To address these limitations, a prospective study with new subject selection criteria using multivariate analysis to analyze the causal relationship between ADL capability and nutritional status is needed.

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