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Original Article

Effects of age on functional independence measure score gain in stroke patients in kaifukuki rehabilitation ward

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ABSTRACT
Tokunaga M, Yonemura M, Inoue R, Sannomiya K, Nakashima Y, Watanabe S, Nakanishi R, Yamanaga H, Yonemitsu H, Sonoda S. Effects of age on functional independence measure score gain in stroke patients in kaifukuki rehabilitation ward. Jpn J Compr Rehabil Sci 2012; 3: 32–36.
Purpose: The purpose of this study was to clarify the effects of age on the gain of Functional Independence Measure (FIM) total scores in stroke patients.
Methods: A total of 1,572 stroke patients who were discharged from the kaifukuki rehabilitation ward of Hospital A were studied. The patients were classified into six groups according to their FIM scores at the time of admission (AFIM scores), and further divided into four groups according to their ages (59 years or younger, 60 to 69 years, 70 to 79 years, and 80 years or older). The mean FIM score gains of these 24 groups were compared.
Results: FIM score gain decreased significantly as the age of the patients increased in the groups with AFIM scores from 18 to 107 points. In the group with AFIM scores of 36 to 53 points, the mean FIM score gain in patients aged 80 years or older (19.7 points) was 38% of that in patients aged 59 years or younger (51.8 points). In the group with AFIM scores of 108 to 126 points, the relationship between age and FIM score gain was unclear.
Conclusion: The FIM score gain in older patients was significantly lower than that in younger patients, except in the group with AFIM scores of 108 to 126 points in which a ceiling effect was observed.
Key words: age, FIM score gain, classification, stroke, kaifukuki rehabilitation ward

Introduction

Elderly people tend to have multiple comorbidities caused by aging of multiple organs, which lead to the development of various geriatric syndromes that require nursing care as well as treatment [1]. Stroke, which often occurs in elderly people, is a major condition treated in kaifukuki rehabilitation wards [2, 3].

Although some studies have shown lower gain in activities of daily living (ADL) score in older patients with stroke than in younger patients, other studies have shown no significant difference or limited effects of age on outcome measures [4]. ADL score gain should not be compared among age groups alone, because the gain also differs depending on the ADL score at the time of admission (AADL score). The effects of age on ADL score gain should be evaluated on the basis of stratifying the patients according to the AADL score; however, such studies are scarce [4].

In this study, the patients with stroke in a kaifukuki rehabilitation ward were classified according to the Functional Independence Measure (FIM) [5] total score at the time of admission (AFIM score) to elucidate the effects of age on FIM score gain.

Methods

A total of 1,572 patients with stroke who were discharged from the kaifukuki rehabilitation ward of Hospital A between 1 April 2006 and 31 December 2011 were studied (Table 1). In Hospital A, the database of the patients who underwent rehabilitation was constructed using FileMaker pro, which contained all the items required for this study. To perform a retrospective study using this database, the necessary

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Table 1. Clinical characteristics of subjects in this study compared with other studies

	This study	National survey [2]	Black-Schaffer, et al [4]
Type of ward	KRW	KRW	LTAC
Number of patients	1,572	12,001	979
Stroke	Infarction 1,054, Hemorrhage 518	Infarction 66.0%, Hemorrhage 28.7%, SAH 5.3%	Infarction and Hemorrhage
Sex	Male 932, Female 640	Male 51.6%, Female 43.9%	—
Age	69.3±12.9 years	71.5 years	68 years
From onset of stroke to admission	19.4±11.2 days	36.9 days	—
Length of hospital stay	93.5±54.0 days	91.5 days	34.6 days
FIM score at admission	74.3±33.7	68.1	60.7
FIM score at discharge	94.7±32.1	85.2	89.1
FIM score gain	20.3±19.3	17.1	28.4

KRW, kaifukuki rehabilitation ward; LTAC, long-term acute care rehabilitation hospital; FIM, Functional Independence Measure. Data of this study are expressed as mean±standard deviation, or number of patients

data were downloaded in an Excel format on 20 January 2012. The background characteristics of the subjects were not markedly different from those in the national survey on kaifukuki rehabilitation wards [2], except that the duration from stroke onset to hospital admission was shorter in our study.

Assessment 1: Relationship of age with AFIM score and FIM score gain

The patients were divided according to age into four groups: 59 years or younger, 60 to 69 years, 70 to 79 years, and 80 years or older. Then, Kruskal-Wallis test was conducted to determine whether there were differences in AFIM score and FIM score gain (FIM score at discharge – AFIM score) among these four groups. Moreover, chi-square test for independence was carried out to determine whether there were significant differences in the proportion of patients with AFIM scores of 18 to 35 points, 36 to 107 points, and 108 to 126 points between patients aged 59 years or younger and those aged 80 years or older. The level of significance was set at less than 1% in both tests.

Assessment 2: FIM score gains in six groups classified according to AFIM score and four groups classified according to age

The patients were divided into six groups according to their AFIM score: 18 to 35 points, 36 to 53 points, 54 to 71 points, 72 to 89 points, 90 to 107 points, and 108 to 126 points. Then, the patients in each AFIM group were further divided into four age groups as in Assessment 1. The mean FIM score gains in these 24 groups were analyzed. Kruskal-Wallis test (level of significance: less than 1%) was conducted to determine whether there were significant differences in FIM score gain among the four age groups.

Assessment 3: Comparison of FIM score gain between age groups of 74 years or younger and 75 years or older

FIM score gains in patients aged 74 years or younger and those aged 75 years or older were analyzed by dividing the patients in each age group into six groups according to their AFIM scores as in Assessment 2. Mann-Whitney test (level of significance: less than 1%) was carried out to compare the FIM score gains between the two age groups.

The personal data examined in this study were processed such that no particular individuals were identifiable. This study was conducted in accordance with the regulations of the institutional review board of the hospital to which the lead author is affiliated.

Results

Among the four age groups of 59 years or younger, 60 to 69 years, 70 to 79 years, and 80 years or older, both the AFIM score and FIM score gain decreased significantly with increasing age (Table 2). The mean FIM score gain in patients aged 80 years or older was 15.7 points whereas the gain in patients aged 59 years or younger was 23.8 points, with a difference of 8.1 points (Table 2).

The percentage of patients with AFIM scores of 18 to 35 points was 27.6% (100 of 362 patients) in patients aged 80 years or older, which was significantly higher than that in patients aged 59 years or younger (10.7%, 39 of 366 patients; Fig. 1). The percentage of patients with AFIM scores of 108 to 126 points was significantly lower in patients aged 80 years or older (11.6%, 42 of 362 patients) than in those aged 59 years or younger (36.3%, 133 of 366 patients; Fig. 1). On the other hand, the percentage of patients with AFIM scores of

Table 2. FIM score gains in patients classified into four age groups

	Age group				Significance
	~59 years	60~69 years	70~79 years	80~ years	
Number of patients (%)	366 (23.3%)	335 (21.3%)	509 (32.4%)	362 (23.0%)	—
FIM score at admission	84.8±32.7	76.6±33.0	72.5±33.6	64.1±32.4	p<0.01
FIM score gain	23.8±21.3	23.8±20.5	18.9±17.6	15.7±17.0	p<0.01

FIM, Functional Independence Measure; Data are expressed as mean±standard deviation, or number of patients with percentage in parenthesis

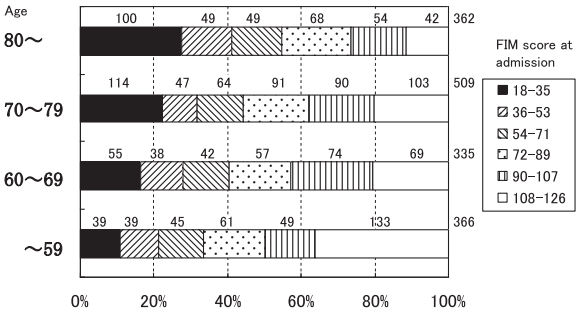

Figure 1. Distribution of Functional Independence. Measure (FIM) scores at admission.

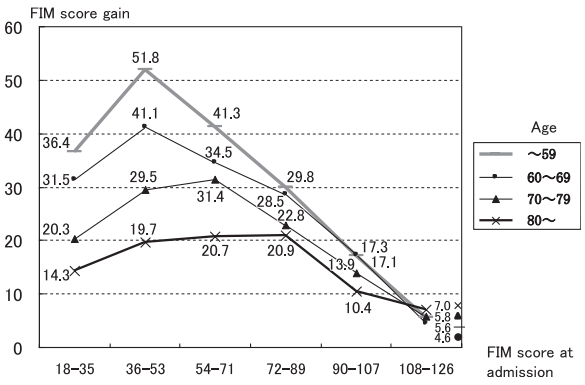

Figure 2. Functional Independence Measure (FIM) score gains in patients classified into 24 groups (four age groups for each of six admission-FIM groups). The numbers denote average FIM score gain.

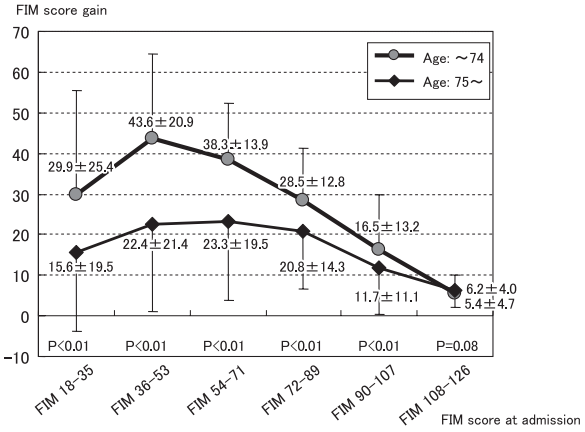

Figure 3. Functional Independence Measure (FIM) score gains in patients classified into 12 groups (two age groups for each of six admission-FIM groups). Data are expressed as mean ± standard deviation.

36 to 107 points was 60.8% (220 of 362 patients) in patients aged 80 years or older and 53.0% (194 of 366 patients) in those aged 59 years or younger, with no significant difference between two groups (Fig. 1).

When comparing the FIM score gain among the four age groups in patients with AFIM scores of 18 to 35 points, the FIM score gain decreased significantly with increasing age. The same findings were obtained in patients with AFIM scores of 36 to 53 points, 54 to 71 points, 72 to 89 points, and 90 to 107 points. However, there was no significant difference in FIM score gain among the four age groups in patients with AFIM scores of 108 to 126 points (Fig. 2).

In the group with AFIM scores of 36 to 53 points, in which the largest difference in FIM score gain among age groups was observed, the mean FIM score gain in patients aged 80 years or older (19.7 points) was 38% of that in patients aged 59 years or younger (51.8 points) (Fig. 2).

When comparing the mean FIM score gain in the 24 groups; namely, six AFIM score groups in each of the four age groups, the maximum mean FIM score gain was 51.8 points (in the group with AFIM scores of 36 to 53 points) and the minimum mean FIM score gain was 5.6 points (in the group with AFIM scores of 108 to 126 points) in patients aged 59 years or younger, with a difference of 46.2 points. The difference diminished as the age of the patients increased. In patients aged 80 years or older, the maximum mean FIM score gain was 20.9 points (in the group with AFIM scores of 72 to 89 points) and the minimum mean FIM score gain was 7.0 points (in the group with AFIM scores of 108 to 126 points), with a difference of 13.9 points (Fig. 2).

Although the FIM score gain reached a peak in the AFIM group of 36 to 53 points in patients aged 59 years or younger and in those aged 60 to 69 years, the gain peaked in the AFIM group of 54 to 71 points in patients aged 70 to 79 years, and in the AFIM group of 72 to 89 points in patients aged 80 years or older (Fig. 2).

Next, an analysis was conducted by dividing the patients into two age groups: 74 years of younger and

75 years or older (Fig. 3). There was a significant difference between the mean FIM score gain in patients aged 74 years or younger (930 patients; 23.0±20.2 points) and those aged 75 years or older (642 patients; 16.5±17.2 points). In the group with AFIM scores of 36 to 53 points, in which the difference in FIM score gain among the two age groups was the largest, the mean FIM score gain in patients aged 75 years or older (22.4 points) was 51% of that in patients aged 74 years or younger (43.6 points).

Discussion

In this study, the effects of age on FIM score gain in stroke patients were elucidated numerically by studying a large number of patients stratified into 24 groups according to age and AFIM score. The major findings of this study were as follows: 1) the FIM score gain was significantly lower in older patients than in younger patients in the groups with AFIM scores of 18 to 107 points; 2) the relationship between age and FIM score gain was unclear in the group with AFIM scores of 108 to 126 points because of the ceiling effect; 3) the FIM score gain in patients aged 80 years or older was 38% of that in patients aged 59 years or younger (in the group with AFIM scores of 36 to 53 points); 4) FIM score gain reached a peak in the AFIM group of 36 to 53 points in patients aged 69 years or younger, in the AFIM group of 54 to 71 points in patients aged 70 to 79 years, and in the AFIM group of 72 to 89 points in patients aged 80 years or older; and 5) the FIM score gain in patients aged 75 years or older was 51% of that in patients aged 74 years or younger (in the group with AFIM scores of 36 to 53 points).

FIM score gain tends to be low in patients requiring complete assistance, because improvement cannot be expected in many of them, and also in patients requiring minimal assistance because of the ceiling effect [6]. On the other hand, FIM score gain in patients requiring moderate assistance tends to be high. In particular, FIM score gain is the highest in stroke patients with a AFIM motor score of approximately 40 points (ranging from 13 to 91 points) [7]. Therefore, it is necessary to classify stroke patients according to AFIM score to evaluate the effects of age on FIM score gain. Indeed, when patients were classified according to age only, the difference in mean FIM score gain was 6.5 points (23.0−16.5 points) between two age groups (74 years or younger and 75 years or older) and 8.1 points (23.8−15.7 points) among four age groups. In contrast, the difference reached 32.1 points (51.8−19.7 points, in the group with AFIM scores of 36 to 53 points) when patients were classified according to age and AFIM score.

It may seem natural that the FIM score gain is lower in older patients than in younger patients. However, even when limiting literature review to only reliable reports, some studies showed that the age of the patients affected the outcome of rehabilitation, while others indicated that the effects of age were very limited or not detected [4]. Black-Schaffer et al. [4] classified 979 stroke patients into three groups according to AFIM score (lower than 40 points, 40 to 80 points, and 81 points or higher). They reported that FIM score gain decreased significantly as the age of the patients increased in the groups with AFIM scores lower than 40 points and 40 to 80 points, but there was no relationship between age and FIM score gain in the group with AFIM scores of 81 points or higher. In our study also, we obtained results similar to their report. However, while Black-Schaffer et al. [4] reported no relationship between age and FIM score gain in the group with AFIM scores of 81 points or higher, we found that FIM score gain decreased significantly as the age of the patients increased also in the group with AFIM scores of 81 to 107 points. In addition, Black-Schaffer et al. [4] did not deny the possibility that older patients could achieve FIM score gain equivalent to that in younger patients if a sufficient length of time was allowed, because the mean length of stay (LOS) in a rehabilitation hospital was 34.6 days in their study. On the other hand, such a possibility is unlikely in our study because the mean duration from stroke onset to hospital admission was 19.4 days and the mean LOS was 93.5 days in our study. However, we cannot simply compare the study of Black-Schaffer et al. [4] with our study because of the differences in study setting (a long-term acute care rehabilitation hospital versus a kaifukuki rehabilitation ward [3]), differences in content and hours of training, and racial differences.

In order to address the increase in financial burden caused by aging of the population, the Medical Care System for People Aged 75 and Over was initiated in Japan in fiscal year 2008 [8]. Although most of the previous reports on elderly people compared those aged 80 or 85 years and older with younger people, it is necessary to compare persons aged 74 years or younger with those aged 75 years or older when discussing the Medical Care System for People Aged 75 and older.

Several interpretations or limitations of the present study have to be noted. First, we do not conclude that rehabilitation for elderly patients is meaningless just because of the low ADL score gain. The mean FIM score gain in patients aged 80 years or older ranged from 7.0 points (in the group with AFIM scores of 108 to 126 points) to 20.9 points (in the group with AFIM scores of 72 to 89 points). Moreover, some elderly patients achieved improvements far greater than the mean scores. Wylie [9] emphasized that there should not be a uniform age limit for rehabilitation because some elderly patients achieve the same outcome as younger patients, although the outcome of rehabilitation is generally poor in elderly patients 65 years or older. However, it may become necessary to provide evidence on the limitations of rehabilitation in the elderly to

patients and their families who have excessive expectations on kaifukuki rehabilitation. Second, it is noteworthy that the standard deviation of FIM score gain was very large. This is because there are many factors besides age and AFIM which affect FIM score gain [10]. Although the mean FIM score gain of a study population can be calculated, it is difficult to accurately estimate the FIM score gain of an individual patient. Third, it remains unclear whether age per se is an impeding factor of rehabilitation, or whether dementia, bilateral impairment, and heart diseases, which are common in elderly patients, also affect the outcome of rehabilitation. Fourth, whether the FIM score gain in patients 90 or 100 years and older would decrease to 10 points or lower is not known. Fifth, this research was a single-center study. A multicenter collaborative study is necessary to arrive at a general conclusion. Sixth, FIM total scores were used in this study. More detailed evaluation of the effects of age on FIM score gain in elderly patients may be possible if FIM motor score gain and FIM cognitive score gain are evaluated separately. Moreover, it is desirable to examine the effects of age on recovery from functional impairments and on the scores of individual FIM subscales. Seventh, it is more important to develop effective rehabilitation strategies for elderly patients who are unlikely to achieve significant improvement under the present conditions, rather than to emphasize the limitations of rehabilitation for elderly patients.

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