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Original Article

Influence of concomitant dementia on FIM gain in convalescent rehabilitation: Strategies to provide effective rehabilitation for patients with concomitant dementia

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ABSTRACT

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Objective: The influence of the presence and severity of concomitant dementia on Functional Independence Measure (FIM) gain and strategies for rehabilitation were investigated in Kaifukuki rehabilitation wards.

Methods: The presence of dementia, and FIM gain and efficiency on admission and discharge as well as outcomes were compared among 232 patients in Kaifukuki rehabilitation wards. In addition, factors considered to be associated with a significant increase (positive) or decrease (negative) in FIM gain were investigated.

Results: Changes in FIM by the presence or absence of dementia showed a significant main effect (F=352.4, p<0.001) and interaction (F=5.382, p=0.021). FIM gain and efficiency were significantly lower in the group with dementia, but no significant difference in severity was noted between the group without dementia and the group of mildly demented elderly subjects with level II dependence in activities of daily living. Factors associated with positive FIM gain were medical and life management as well as approaches to involvement, whereas aggravation of the main disease and complications were considered negative factors.

Conclusion: FIM improved even in the presence of dementia through convalescent rehabilitation and care in consideration of dementia, suggesting that effects comparable with those for patients without dementia are possible when dementia is mild.

Key words: convalescent rehabilitation, dementia, Functional Independence Measure (FIM), Activities of Daily Living (ADL)

Introduction

The increasing number of people with dementia is a serious social issue. In the Comprehensive Strategy to Accelerate Dementia Measures published in 2015, improvement in the ability to cope with dementia is needed for medical institutions dealing with physical complications. Additional payment for dementia care was newly set in the revision of the medical payment system in 2016 aiming at prevention of aggravation of symptoms in patients with dementia to facilitate smooth treatment of physical diseases. Meanwhile, evaluation of outcomes using the performance index has been introduced into Kaifukuki rehabilitation wards. The dementia complication rate in patients in Kaifukuki rehabilitation wards is 20−50% [1], and an increase with aging is expected [2]. Accordingly, appropriate rehabilitation and care as well as

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improvement in activities of daily living (ADL) are needed for demented patients in Kaifukuki rehabilitation wards.

Although dementia has been considered an inhibitor of rehabilitation, studies using the Functional Independence Measure (FIM) [3] to evaluate the outcome of patients in Kaifukuki rehabilitation wards have been inconsistent, with some reporting inhibition [4,5] but others reporting no inhibition [6,7] of improvement in FIM for patients with cerebrovascular and orthopedic diseases. Only a small number of studies investigated the effects of rehabilitation based on the presence and severity of concomitant dementia in patients in Kaifukuki rehabilitation wards [8], and many studies were performed using inpatients at a single institution, which may have led to these inconsistencies.

In the present study, the influence of the presence and severity of concomitant dementia on improvement in FIM was examined in patients in Kaifukuki rehabilitation wards based on multicenter data. In addition, strategies for rehabilitation of patients with concomitant dementia were evaluated.

Methods

1. Subjects

The subjects were 232 patients aged 65 years or older admitted to and discharged from eleven Kaifukuki rehabilitation wards of four hospitals (two in the Kanto region, one in the Chugoku region, and one in Kyushu region) during April–August 2017.

2. Methods

The following items were retrospectively surveyed in medical records: basic information (age, gender, and degree of dependence in activities of daily living (severity) of demented elderly patients), diseases included in the calculation of rehabilitation costs (diseases of cerebrovascular, motor, and respiratory organs and disuse syndrome), duration of hospital stay, FIM on admission and discharge, FIM gain (score on discharge−score on admission), FIM efficiency (FIM gain/duration of hospital stay), and outcome (discharge to home or other places). Regarding dementia severity, the severity determined by discussion among professionals centering on the attending physician was adopted. For outcomes, discharge to home, residence with services for the elderly, or group home was designated as discharge to home, and discharge to other places was considered transfer to another hospital, including to geriatric health service facilities and other wards. Death was as is. Regarding the FIM for increased dementia severity, an increase or decrease in the total score, cognition score, or motor score by the mean +1.5 standard deviation or greater was regarded as a significant increase (positive) or decrease (negative), respectively, and these patients were extracted. Factors considered to be associated with these conditions were freely described in the survey taken by the staff in charge of rehabilitation.

3. Ethical consideration

This study was planned in accordance with the Declaration of Helsinki, and was performed after approval by the Ethics Committee of the Japan Association of Rehabilitation Hospitals and Institutions.

4. Statistical analysis

Subjects with stage I dependence and those living independently based on dementia severity were regarded as the group without dementia and those with stage II or higher dependence (II–IV, M) were regarded as the group with dementia. Differences in the following items due to the presence and severity of dementia were investigated: basic information (gender and diseases included in the calculation of rehabilitation costs), outcomes, and positive or negative FIM gain, and were analyzed using the χ^2 test for residual analysis. For changes in FIM between admission and discharge, two-way analysis of variance was performed followed by Bonferroni correction as a post hoc test. Basic information (age and duration of hospital stay) and FIM gain and efficiency were analyzed using the Mann-Whitney or Kruskal-Wallis test followed by Bonferroni correction as a post hoc test. Statistical analysis was performed using IBM SPSS Statistics 24.0.

Results

1. Basic attributes of the subjects with and without dementia (Table 1)

Regarding the subjects, the groups with and without dementia included 130 (56.0%) and 102 (44.0%) patients, respectively. In the group with dementia, the dementia severity was stage II in 43 (33.1%), III in 54 (41.5%), IV in 26 (20.0%), and M in 7 (5.4%). Regarding basic information, the mean age was 82.6±7.6 years old in the group with dementia, being significantly higher than that (77.7±8.0 years old) in the group without dementia ($p<0.001$). No significant difference was noted in any other item.

2. Changes in FIM based on the presence and severity of dementia

2.1 Changes in FIM based on the presence of dementia (Table 2)

For all subjects (n=232), the total FIM score on admission was 89.8±19.7 in the group without dementia (n=102) and it increased to 111.6±19.2 at discharge. In the group with dementia (n=130), the score increased from 56.2±23.2 on admission to 73.2±31.9 at discharge. A significant main effect of

Table 1. Basic attributes of the subjects with and without dementia.

		All (*n*=232)	Group without dementia (*n*=102)	Group with dementia (*n*=130)	*p*
Age (years)		80.4 (8.1)	77.7 (8.0)	82.6 (7.6)	<0.001
Gender (M/F)		92 (39.7) / 140 (60.3)	43 (46.7) / 59 (64.1)	49 (37.7) / 81 (62.3)	0.490
Diseases included in calculation of costs	Cerebrovascular	99 (42.7)	42 (42.4)	57 (57.6)	0.267
	Motor organ	100 (43.1)	49 (49.0)	51 (51.0)	
	Disuse syndrome	33 (14.2)	11 (33.3)	22 (66.6)	
Duration of hospital stay (days)		59.8 (30.2)	57.1 (27.8)	61.9 (32.0)	0.288

Age, duration of hospital stay: mean (SD); gender, diseases included in the calculation of costs: *n* (%).
Age, duration of hospital stay: Mann-Whitney test; gender, diseases included in calculation of costs: χ^2 test.

Table 2. Changes in FIM in the presence or absence of dementia.

FIM	Presence of dementia	On admission (score)	Between groups	On discharge (score)	Between groups	Time point		Time point × Presence of dementia		Between before and after
						F	*p*	*F*	*p*	
All subjects (*n*=232)										
Total	Absence (*n*=102)	89.8 (19.7)	**	111.6 (19.2)	**	352.4	<0.001	5.382	0.021*	<0.001
	Presence (*n*=130)	56.2 (23.2)		73.2 (31.9)						<0.001
Cognition	Absence	30.0 (5.6)	**	32.0 (5.2)	**	67.1	<0.001	0.241	0.624	<0.001
	Presence	18.3 (7.3)		20.5 (7.9)						<0.001
Motor	Absence	59.8 (16.2)	**	79.7 (15.1)	**	382.8	<0.001	8.231	0.005*	<0.001
	Presence	37.9 (18.0)		52.7 (25.2)						<0.001
Cerebrovascular (*n*=99)										
Total	Absence (*n*=42)	95.7 (18.4)	**	114.0 (18.1)	**	97.6	<0.001	0.043	0.836	<0.001
	Presence (*n*=57)	55.2 (24.4)		72.8 (4.6)						<0.001
Cognition	Absence	29.6 (5.6)	**	31.5 (5.4)	**	28.6	<0.001	1.537	0.218	0.008
	Presence	16.8 (7.0)		19.8 (8.1)						<0.001
Motor	Absence	66.1 (14.7)	**	82.5 (13.4)	**	106.0	<0.001	0.410	0.524	<0.001
	Presence	38.5 (19.3)		53.0 (27.8)						<0.001
Motor organs (*n*=100)										
Total	Absence (*n*=49)	89.7 (16.2)	**	115.0 (11.5)	**	286.0	<0.001	5.825	0.018*	<0.001
	Presence (*n*=51)	56.3 (20.0)		75.3 (27.9)						<0.001
Cognition	Absence	31.3 (4.2)	**	33.4 (2.7)	**	39.3	<0.001	0.143	0.706	<0.001
	Presence	19.7 (7.2)		21.6 (7.3)						<0.001
Motor	Absence	58.4 (14.1)	**	81.6 (9.9)	**	287.6	<0.001	6.542	0.012*	<0.001
	Presence	36.6 (14.9)		53.8 (21.8)						<0.001
Disuse syndrome (*n*=33)										
Total	Absence (*n*=11)	68.0 (24.3)	ns	87.5 (32.1)	ns	33.8	<0.001	2.638	0.114	<0.001
	Presence (*n*=22)	58.3 (27.8)		69.2 (34.3)						<0.001
Cognition	Absence	25.6 (8.4)	*	27.6 (9.0)	*	4.8	0.042	0.303	0.586	0.113
	Presence	18.7 (7.8)		20.0 (9.0)						<0.001
Motor	Absence	42.5 (17.5)	ns	59.8 (24.7)	ns	42.6	<0.001	3.390	0.075	<0.001
	Presence	39.6 (21.5)		49.3 (26.4)						<0.001

Mean (SD).
Two-way analysis of variance, Bonferroni correction. **: $p<0.01$, *: $p<0.05$, ns: not significant.

time was noted on the two-way analysis of variance and post hoc test (F=352.4, p<0.001), and the total FIM score improved significantly after admission even in the presence of dementia. On the other hand, a significant interaction was found (F=5.382, p=0.021): the FIM scores on admission and discharge were significantly lower in the group with dementia compared to the group without dementia, and the improvement was poorer. Of the sub-items, a significant interaction was noted in the motor items (F=8.231, p=0.005); as for the total score, the FIM scores on admission and discharge were significantly lower in the group with dementia, and the improvement was poorer. No significant interaction was found for cognition.

Regarding diseases included in the calculation of rehabilitation costs, no significant interaction between the presence of dementia and changes in FIM was noted in patients with cerebrovascular disease (n=99) or disuse syndrome (n=33), whereas in patients with motor organ disease (n=100), a significant interaction with the presence of dementia was noted for the total FIM score and motor items (total score: F=5.825, p=0.018; motor: F=6.542, p=0.012), and the FIM scores on admission and discharge were significantly lower in the group with dementia, with poorer improvement.

2. 2 FIM gain and efficiency based on the presence and severity of dementia (Tables 3 and 4)

Based on the presence of dementia, the total FIM gain was 21.8±13.7 and FIM gain for motor items was 19.8±12.5 in the group without dementia (n=102), whereas the values in the group with dementia (n=130) were 17.0±17.0 and 14.8±14.8, respectively, being significantly lower (total: p=0.003; motor: p=0.001). No significant difference was noted in cognition.

The total FIM efficiency was 0.44±0.39/day and the FIM efficiency for motor items was 0.39±0.38/day in the group without dementia, whereas the values in the group with dementia were 0.26±0.36/day and 0.24±0.28/day, respectively, being significantly lower (total: p<0.001; motor: p<0.001). No significant difference was noted for cognition (Table 3).

Based on the dementia severity, the total FIM gain was 21.8±13.7 in the group without dementia (n=102). In the group with dementia, the total FIM gain was 23.0±15.0 in the stage II group (n=43), 18.4±16.5 in stage III (n=54), and 7.1±15.0 in stage IV (n=26), being significantly different (p<0.001). In the post hoc test, only the gain in stage IV was significantly lower than that in the groups without dementia and with stage II or III dementia. Regarding the sub-items, the

Table 3. FIM gain and efficiency based on the presence or absence of dementia.

FIM		All (n=232)	Group without dementia (n=102)	Group with dementia (n=130)	p
Gain (score)	Total	19.1 (15.8)	21.8 (13.7)	17.0 (17.0)	0.003
	Cognition	2.2 (4.0)	2.0 (3.4)	2.3 (4.4)	0.939
	Motor	17.0 (13.7)	19.8 (12.5)	14.8 (14.1)	0.001
Efficiency (score/day)	Total	0.34 (0.39)	0.44 (0.39)	0.26 (0.36)	<0.001
	Cognition	0.03 (0.12)	0.04 (0.07)	0.02 (0.15)	0.438
	Motor	0.31 (0.33)	0.39 (0.38)	0.24 (0.28)	<0.001

Mean (SD).
Mann-Whitney test.

Table 4. FIM gain and efficiency based on dementia severity.

FIM		Group without dementia (n=102)	II (n=43)	III (n=54)	IV (n=26)	p	Group without dementia vs II	Group without dementia vs III	Group without dementia vs IV	II vs III	II vs IV	III vs IV
Gain (score)	Total	21.8 (13.7)	23.0 (15.0)	18.4 (16.5)	7.1 (15.0)	<0.001	ns	ns	**	ns	**	*
	Cognition	2.0 (3.4)	2.5 (4.4)	2.4 (3.7)	1.8 (3.9)	0.422	ns	ns	ns	ns	ns	ns
	Motor	19.8 (12.5)	20.5 (12.5)	16.1 (14.0)	5.4 (11.6)	<0.001	ns	*	**	ns	**	**
Efficiency (score/day)	Total	0.44 (0.39)	0.39 (0.40)	0.27 (0.33)	0.09 (0.25)	<0.001	ns	**	**	*	**	*
	Cognition	0.04 (0.07)	0.02 (0.22)	0.03 (0.06)	0.02 (0.07)	0.398	ns	ns	ns	ns	ns	ns
	Motor	0.39 (0.38)	0.37 (0.25)	0.24 (0.29)	0.06 (0.17)	<0.001	ns	**	**	*	**	*

Mean (SD).
Kruskal-Wallis test, Bonferroni correction. **: p<0.01, *: p<0.05, ns: not significant.
Rank M was deleted from the table due to the small number of patients.

gain in motor items was significantly lower in stage III and IV than in the group without dementia, and significantly lower in stage IV than in stage II and III, but no significant difference was noted for cognition.

The FIM efficiency was 0.44±0.39/day in the group without dementia, 0.39±0.40/day in stage II, 0.27±0.33/day in stage III, and 0.09±0.25/day in stage IV groups, being significantly different (p<0.001). In the post hoc test, the efficiency in the groups with stage III or IV dementia was significantly lower than that in the groups without dementia and with stage II dementia. Regarding the sub-items, the efficiency in stage III or IV was significantly lower than that in the groups without dementia and stage II dementia for motor items, but no significant difference was noted for cognition (Table 4).

2. 3 Outcome based on the presence and severity of dementia (Table 5)

The outcome was discharge to home for 84 (82.4%) and other places for 18 (17.6%) in the group without dementia (n=102), whereas the values were 80 (61.5%) and 50 (38.5%), respectively, in the group with dementia (n=130), demonstrating that significantly more patients in the group without dementia were discharged to home, whereas significantly more patients in the group with dementia were transferred to other places (p=0.001).

Furthermore, a significant difference was noted based on the severity of dementia (p<0.001). In the residual analysis, the rate of discharge to home was 82.4% (84 patients) in the group without dementia and 83.7% (36 patients) in the group with stage II dementia (n=43), being significantly higher, whereas the rate of discharge to other places was 73.1% (19/26) for stage IV patients.

2. 4 Rates of positive and negative FIM gain based on dementia severity and suspected cause (Table 6)

FIM gain was positive in 12 (11.8%) in the group without dementia (n=102) and in 18 (13.8%) in the group with dementia (n=130). Based on the dementia severity, the gain was positive in 6 (14.0%) in the stage II dementia group (n=43), 7 (13.0%) in stage III (n=54), and 5 (15.2%) in stage IV or M (n=33). Thus, a positive gain occurred in all severity groups. FIM gain was negative in 3 (2.9%) in the group without dementia and in 12 (9.2%) in the group with dementia. Based on the dementia severity, the gain was negative in 3 (7.0%) in the stage II dementia group, 5 (9.3%) in stage III, and 4 (12.1%) in stage IV or M, revealing that a negative gain increased as the dementia severity increased, but no significant difference was detected.

The influence of the main disease (resolution of pain and improvement of symptoms) was frequently considered by the rehabilitation staff to be associated with a positive gain (6 cases (50.0%)) in the group without dementia (n=12). In the group with dementia (n=18), the following measures were frequently described: medical and life management (utilization of inpatient day care and group rehabilitation to improve daily activities, regulation of life rhythm to deal with delirium, and management of complications) (12 patients (66.7%)), approaches to involvement (incorporation of things the patient is interested in and activities that the patient is familiar with, providing a role and daily routine, not restricting the patient's activity, and utilization of memos and time tables) (11 patients (61.1%)), and communication (listening attentively to patient complaints, consistency of responses, frequently talking to patients, utilization of memory books, talking to patients according to their social history, and expression of gratitude) (10 patients (55.6%)).

The same factors were considered to be associated with a negative gain in the groups with and without dementia (15 patients in total), and the factors were aggravation/recurrence of the main disease in 8 (53.3%), aggravation of complications (fever, pneumonia, etc.) in 8 (53.3%), and aggravation of behavioral and psychological symptoms of dementia (BPSD) in 5 (33.3%).

Discussion

The influence of the presence of concomitant dementia on improvement in the FIM was investigated in patients in Kaifukuki rehabilitation wards. The FIM improved significantly after admission even in the

Table 5. Outcome based on dementia severity.

	Discharge to home (n=164)	Others (n=68)	p
Group without dementia (n=102)	84 (82.4)	18 (17.6)	<0.001
II (n=43)	36 (83.7)	7 (16.3)	
III (n=54)	34 (63.0)	20 (37.0)	
IV (n=26)	7 (26.9)	19 (73.1)	
M (n=7)	3 (42.9)	4 (57.1)	

n (%).
χ^2 test, highlighted cells: residual difference of approximately 2.0 or greater/lower.

Table 6. Rates of positive and negative FIM gain and factors considered to be associated.

	Group without dementia (*n*=102)	Group with dementia (*n*=130)
Positive	*n*=12 (11.8%) - 6 cases of influence of the main disease: Resolution of pain, improvement of symptoms - 4 cases of medical and life management: Improvement of activity in life, independent training - 4 cases of motivation: originally motivated, increase in motivation - 3 cases of approaches to involvement: Providing a role, incorporation of things that the patient is interested in - 2 cases of communication: Listening attentively, frequently talking to the patient - 1 case of environment adjustment: Utilization of a sensor	*n*=18 (13.8%) - 12 cases of medical and life management: Improvement of activity in life, life rhythm, interaction, inpatient day care, management of complications - 11 cases of approaches to involvement: Providing a role, familiar activity, self-determination, no restriction, support to prevent errors , memo, time table, memory book, pleasant stimulation, early acquisition of independence in relieving oneself - 10 cases of communication: Listening attentively to complaints, frequently talking to patient, explanation that is easy to understand, consistency of responses, familiar relationship, no denial, expression of gratitude, talking to patients in a way corresponding to their social history - 6 cases of environment adjustment: Prevention of confusion, comfort, safety, utilization of a sensor - 3 cases of motivation: Increase in motivation - 3 cases of influence of the main disease: Improvement of aphasia, mild condition on admission
Negative	*n*=3 (2.9%) - 2 cases of influence/aggravation of the main disease: Pneumonia, severe on admission - 2 cases of aggravation of complications: Pneumonia, hydrocephalus, Parkinson's - 1 case of aggravation of BPSD: Violent language	*n*=12 (9.2%) - 6 cases of influence/aggravation of the main disease: Pneumonia, cerebrovascular disorder, chronic subdural hematoma, severe on admission, total assistance - 6 cases of aggravation of complications: Recurrence of cerebrovascular disorder, hydrocephalus, fever, urinary tract infection - 4 cases of aggravation of BPSD: Risky behavior, entering rooms of other patients, mental depression, anxiety

Multiple answers were included for the considered factors.

presence of dementia, but the FIM scores on admission and discharge were significantly lower in the group with dementia than in the group without dementia, and improvement was also poorer. FIM gain was also significantly lower in the group with dementia. Based on the dementia severity, no significant difference was noted between the group without dementia and the group with stage II or III dementia, and the score was significantly lower only in the stage IV dementia group. Regarding FIM efficiency, no significant difference was noted between the group without dementia and the group with stage II dementia, and the efficiency was significantly lower in the stage III and IV groups. The outcome was "discharge to home" for many patients in the group without dementia and the group with stage II dementia, whereas the outcome was "other" in significantly more patients in the stage IV dementia group. Thus, the FIM was significantly improved by being in a Kaifukuki rehabilitation ward even in the presence of dementia. Furthermore, the FIM gain and efficiency as well as the rate of discharge to home in the stage II dementia group were similar to those in the group without dementia. However, the FIM value was low on admission and discharge due to concomitant dementia, and the improvement was poor.

In previous studies on the influence of concomitant dementia on FIM improvement in patients in Kaifukuki rehabilitation wards, the FIM values on admission and discharge were significantly lower in the group with dementia, but FIM gain was positive in both groups [7, 8]. In our study, the FIM was improved by being in a Kaifukuki rehabilitation ward even in the presence of dementia, consistent with the results of previous studies. In studies in which the dementia severity was classified based on the cognitive function test on admission and its relationship with changes in FIM and outcome was investigated, no significant difference was noted in FIM gain or the rate of discharge to home between the group without dementia and the groups with mild–moderate dementia, and these scores were significantly lower only in the group with severe dementia [2, 6]. Although the method for determining dementia severity was different, our study results were similar to those of previous studies: FIM improvement was comparable to that in non-dementia patients and

discharge to home was possible when the dementia severity was mild.

Factors considered to be associated with positive gain were as follows: 1) medical and life management, such as increased daily activity, regulation of life rhythm, dealing with delirium, and management of complications, 2) approaches to involvement, such as incorporation of things that the patient is interested in and activities that the patient is familiar with, and providing a role and daily routine, 3) communication, such as listening attentively to patient complaints, consistency of responses, and frequently talking to patients. Yamaguchi et al. [1] reported a survey of points for rehabilitation of patients with dementia in Kaifukuki rehabilitation wards in which strategies related to time (setting a familiar environment), devising rehabilitation tasks (attracting interest, comfortable environment, difficulty and pace), communication (not denying, listening attentively, and using explanations that are easy to understand) were noted, in addition to strategies related to life rhythm and rehabilitation, suggesting that the current strategies employed in Kaifukuki rehabilitation wards are important for increasing the effects of rehabilitation. On the other hand, factors considered to be associated with a negative gain were aggravation/recurrence of the main disease and complications as well as aggravation of BPSD. Kashiwa et al. [9] reported that difficulties in Kaifukuki rehabilitation wards were due to aggravation of the main disease, development of complications, repeated pneumonia, severe dementia, and socially abnormal behavior, which is consistent with our study.

The FIM improved even in the presence of dementia by providing convalescent rehabilitation and care in consideration of dementia while performing medical and life management of the main disease and complications such as delirium, and effects comparable with those in non-dementia patients are possible when dementia is mild. One limitation of this study is that we adopted the degree of dependence in activities of daily living (severity) of demented elderly patients to represent the severity of dementia. As the judgement of dementia severity using this scale varies among different professions [10], we adopted the results of discussion by many professionals, but some patients were difficult to judge. Thus, the severity of dementia of the subjects in this study may not be reliable. Moreover, this was a retrospective study. By investigating the effects of rehabilitation for patients with concomitant dementia in a prospective study, such as that with intervention by a dementia support team, the objective effects and effective strategies may be clarified.

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