few trials having tested the effectiveness of nutritional supplementation in sarcopenia (21-23). The aim of the present study is to investigate the effects of the combination of resistance training with a multinutrient supplementation (including vitamin D and proteins) on muscle mass and physical performance in frail older adults with low muscle mass. We hypothesized that muscle mass and physical performance might better benefy from the combined intervention compared to when only resistance training is adopted.

Methods

Participants

Participants were recruited by an advertisement in the local press and public ads. We recruited 96 community-dwelling older adults from two communities with similar environment in Kyoto city. Participants of one community were allocated to a resistance training intervention (Ex); subjects from the other community received the same resistance training intervention and the additional nutritional supplementation (S/Ex).

The following inclusion criteria were verified during the initial interview:
- Frailty status as certified by the long-term care insurance service;
- Presence of low muscle mass (defined as appendicular muscle mass divided by squared height lower than 6.87 kg/m2 in men, and lower than 5.46 kg/m2 in women [24])
- Age of 65 years and older;
- Living in the community;
- No severe cognitive impairment (defined as a Rapid Dementia Screening Test score higher than 4) [25];
- Ability to independently walk (even with a cane);
- No regular supplementation of vitamin D and protein during the previous 12 months.

The exclusion criteria adopted in the present study were:
- Severe cardiac, pulmonary, or musculoskeletal disorders;
- Presence of comorbidities associated with an increased risk of falls, such as Parkinson's disease or stroke;
- Use of psychotropic drugs.

Written informed consent was obtained from each subject in accordance with the guidelines approved by the Kyoto University Graduate School of Medicine and the Declaration of Human Rights, Helsinki, 1975.

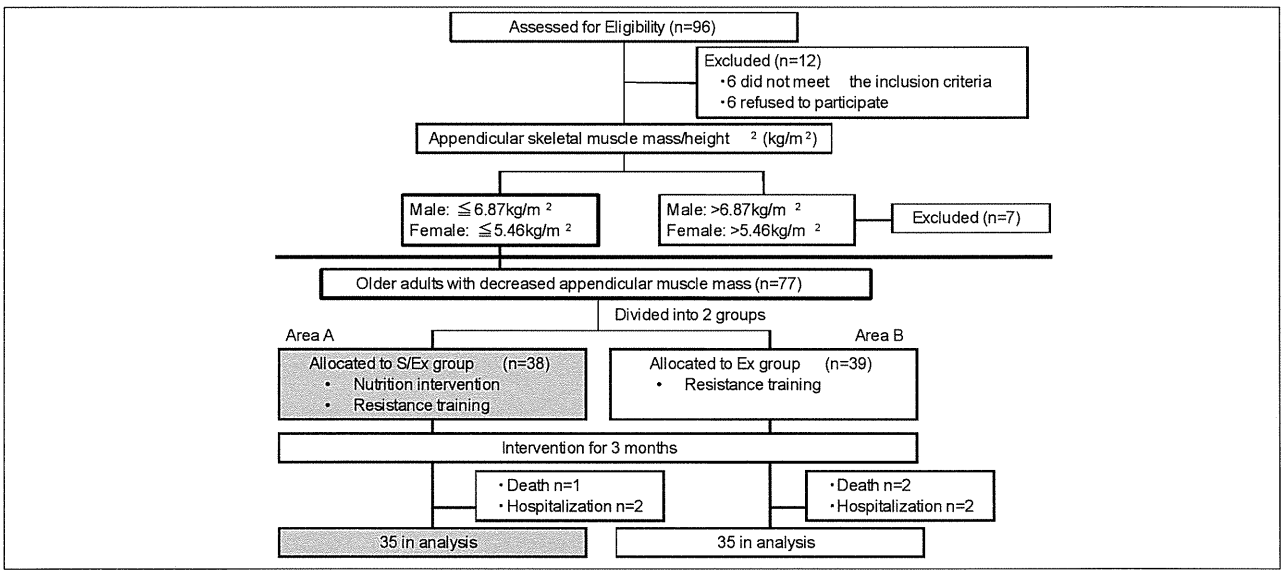
Of the total 96 screened community-dwelling older adults, 19 were excluded. The remaining 77 older adults with low muscle mass were divided into the 2 groups: nutritional supplementation during resistance training (S/Ex: n = 38) group and resistance training alone (Ex: n = 39) group (Figure 1).

Interventions

Multinutrient supplementation

A multinutrient supplementation, particularly aimed at increasing vitamin D and protein intakes, was provided 3 times a week for 3 months to participants in the S/Ex group. A detailed description of the adopted product (Resource PemPal Active®; 12.5 μg of vitamin D, 10.0 g of protein with branched chain amino acids; 200kcal, 41% carbohydrate, 37% fat, 20%

Figure 1
Flow chart describing the study design



protein, 2% oligosaccharide, Nestle Japan Ltd. Tokyo, Japan) is provided in the Appendix.

Resistance training

Participants performed 90 minutes of group training sessions 3 times a week for the 3 months of the study. Each exercise class used a standardized format that included 10 minutes of warm-up exercises, 60 minutes of progressive strength training, 10 minutes of flexibility and balance exercises, and 10 minutes of cool-down activities. The warm-up exercise consisted of movement of legs, trunk, and arms to include all joints and major muscle groups in activities such as mild dancing. Strength training consisted of progressive resistive exercises using an elastic band and exercise machines.

Participants performed biceps curls, double-arm pull downs, seated row, leg press, leg curl, and leg extension exercises on the resistance training machines. Training loads were chosen using the 10-repetition maximum (10-RM, the maximal weight that can be lifted 10 times). Participants used the 10-RM for 3 sets of 10 repetitions for each machine exercise. Participants were required to adjust the training weight to ensure failure at the 10-RM.

A sequence of progressively more difficult exercises was also performed to improve static and dynamic balance. Although exercises could be performed in a sitting position, the importance of performing in a standing position to improve balance was encouraged. Physiotherapists evaluated each participant twice during the study period to ensure adherence to the exercise protocols during classes.

Outcome measurements

A physiotherapist blinded about the group allocation of each subject administered the test of interest at the baseline visit, and later at the completion of the 3-month intervention. All baseline measures were completed before group allocation. Before the study started, all staff members received training by one of the authors (MY) about the correct protocols to administer the measures included in this study.

Skeletal muscle mass index (SMI)

Bioelectrical impedance analysis (BIA; Physion MD; Physion Co. Ltd, Kyoto, Japan) was performed to determine body composition (26). This system applies a constant current of 800 mA at 50 kHz through the body. Participants were assessed in supine position with their arms and legs extended and relaxed. Using segmental body composition and muscle mass, a value for the appendicular skeletal muscle mass was determined and used for the present analysis. Muscle mass was converted to the skeletal muscle mass index (SMI) by dividing appendicular skeletal muscle mass by squared height (kg/m^2). This index has been used in several epidemiological studies (5, 27).

Measurement of physical performances

For all participants, the following 6 measurements were obtained: 10-m maximum walking time (28), the timed up and go (TUG) test (29), the functional reach (FR) test (30), the five chair stand (5CS) test (31), the hand grip strength (HGS) (32), and the knee-extension strength (KES) (33). If a walking aid was normally used at home, this aid was used during the TUG test and 10-m walking.

In the maximum walking, participants were asked to walk 15 m at a maximum pace. A stopwatch was used to record the time required to reach the 10 m point (marked in the course). The time recorded in 2 trials was averaged to obtain the parameter used in the present analyses.

In the TUG test, participants were asked to stand up from a chair with a seat height of 40 cm, walk a distance of 3 m at a maximum pace, turn, walk back to the chair, and sit down. The time recorded from 2 trials was averaged to obtain the parameter used in the present analyses.

In the FR test, each participant was positioned next to a wall with one arm raised at 90° and fingers extended. A meter stick was placed on the wall at shoulder height. The distance that a participant could reach while extending forward from an initial upright position to the maximal anterior leaning position without moving or lifting the feet was visually measured in centimetres according to the position of the tip of the third finger against the placed meter stick. The distances measured in 2 trials were averaged to obtain the variable used in the present analyses.

In the 5CS, participants were asked to stand up and sit down five times as quickly as possible, and they were timed from the initial sitting position to the final standing position at the end of the fifth stand. The5CS score was defined as the better performance of two trials.

In the HGS, participants used a hand-held dynamometer with the arm by the side of the body. The participants squeeze the dynamometer with maximum isometric effort. No other body movement was allowed. The HGS score was defined as the better performance of their two trials.

The KES was measured with hand-held dynamometer (HHD; mTas F-1; ANIMA, Tokyo, Japan) during isometric contraction of the knee extensor. In a sitting position, the subject kept the hip and knee at 90° angle. The maximal isometric strength was measured after adequate pre-

measurement trials. The HHD was placed 25 cm distal to the knee joint. Torque was calculated by multiplying strength by the arm (25 cm) and expressed at the percentage of bodyweight (Nm/kg). The KES score was defined as the better performance of two trials.

Assessment of sarcopenia

For the present study we adopted the SSCWD criteria (2). The SSCWD recommended to define sarcopenia as the concurrent presence of slow walking speed (equal to or less than 1 m/sec) and low appendicular muscle mass. Japanese criteria for sarcopenia assessed by appendicular muscle mass/squared height were less than 6.87 kg/m^2 in men and less than 5.46 kg/m^2 in women (24).

Statistical analysis

Baseline characteristics of S/Ex and Ex groups were compared to examine the comparability of the 2 groups. Differences in the physical function variables between the 2 groups were analysed using the Student's t-test or chi-square test.

Analysis of covariance (ANCOVA) was used to determine the effect of the intervention program on each outcome measure, with baseline values as covariates. Post hoc Tukey tests were used to assess which group or time periods showed significant differences.

Data were entered and analysed using the SPSS (Windows version 18.0, SPSS, Inc., Chicago, IL). A P value <0.05 was

Table 1
Baseline characteristics of study participants according to the S/Ex and Ex groups

Characteristics		S/Ex group (n=35) Mean	SD	Ex group (n=35) Mean	SD	P-value
Age	Mean±SD	74.4±7.3		75.6±6		.411
Height	cm, Mean±SD	156.2±9.1		157.2±8.7		.603
Weight	kg, Mean±SD	55.2±8.8		55.9±10.4		.733
BMI	kg/m^2, Mean±SD	22.6±3.1		22.5±3.3		.890
Gender (female)	n (%)	17 (48.5%)		19 (54.3%)		.408[a]
Medication	number, Mean±SD	5.2±2.9		5.7±3.7		.499
Walking aid user	n (%)	24 (68.6%)		25 (71.4%)		.500[a]
Fear of falling	n (%)	26 (74.3%)		24 (68.6%)		.398[a]
Falls in past year	n (%)	12 (34.3%)		14 (40.0%)		.402[a]

a. chi-square test

Table 2
Functional fitness items in each group at pre- and post-intervention

Items		Baseline Mean	SD	Post Mean	SD	main effect (time) F-value	P-value	Group _ Time Interaction F-value	P-value
Maximum walking time, sec	S/Ex	13.3	7.3	12.5	6.3	7.83	.01	5.98	.02
	Ex	12.5	5.2	12.5	5.3				
Timed up & go test, sec	S/Ex	15.8	8.3	14.8	7.9	.78	.38	1.87	.18
	Ex	14.2	5.0	14.5	6.7				
Functional reach, cm	S/Ex	17.7	8.3	20.3	5.8	7.84	.01	.06	.82
	Ex	20.4	6.8	23.5	6.9				
Five chair stand, sec	S/Ex	13.0	6.1	12.3	6.0	3.35	.07	.21	.65
	Ex	13.2	3.9	12.7	3.7				
Hand grip strength, kg	S/Ex	24.4	8.4	26.1	8.3	2.26	.14	.36	.55
	Ex	23.1	6.7	24.1	8.2				
Knee extension torque, Nm/kg	S/Ex	.55	.25	.63	.30	4.38	.04	.15	.70
	Ex	.61	.28	.65	.30				
Appendicular muscle mass, kg/m^2	S/Ex	4.62	.87	4.87	.99	$ 17.78	<.01	8.61	<.01
	Ex	4.41	.77	4.45	.74				

Notes: Columns indicating pre- and post-intervention values are expressed as mean (SD); $ Post hoc test: S/Ex vs Ex (P<0.05)

considered statistically significant for all analyses.

Results

A total of 96 people were screened, and 77 (80.2%) meeting the inclusion criteria of the trial and agreeing to participate were enrolled (Figure 1). Twelve participants were excluded because they did not match the inclusion criteria or refused to participate, and 7 participants were also excluded because they did not match the criteria for low muscle mass.

Among the 77 individuals selected for the study, 70 (90.9%) completed the 3-month intervention: 35 in the S/Ex group (92.1%) and 35 in the Ex group (89.7%).

All the 24 scheduled intervention sessions were completed. The median relative adherence was 83% (25th–75th percentile, 73–88%) in the S/Ex group and 77% (73–88%) in the Ex group. No fall incidents occurred during training sessions or testing. No health problems, including cardiovascular or musculoskeletal complications, occurred during training sessions or testing. Minor problems observed in both groups were muscle-ache after the first training sessions and fatigue. All problems were managed easily by adjustment of the intervention. Participants in the S/Ex and Ex groups were comparable and well matched with regard to their baseline characteristics (Table 1).

The significant time effects were found for maximum walking time, FR, KES and SMI ($P<0.05$) (Table 2). Participants in the S/Ex group had significantly greater improvements in maximum walking time and SMI ($P<0.05$) (Table 2). However, the other outcome measures were not significantly different between the 2 groups ($P > 0.05$).

At pre-intervention, the prevalence of sarcopenia was 65.7% and 68.6% in the S/Ex and the Ex groups, respectively, while at post-intervention, that was 42.9% and 68.6% in the S/Ex and the Ex groups, respectively. The relative risk was calculated as 1.60 (95% CI: 1.03-2.49).

Discussion

In this 3-month pilot trial to address the role of combination of resistance training and nutritional supplementation intervention for frail older adults with low muscle mass, we have shown that SMI and walking speed were significantly improved only in the S/Ex group. These results suggested that combination of resistance training and nutritional supplementation program may be beneficial for frail older adults to prevent and treat sarcopenia. On the other hand, the reported time effects for improved walking speed, balance function, leg strength and SMI confirm that a resistance training intervention may be able to increase physical function in older persons.

Interestingly, no significant time effects were not found for TUG, 5CS or HGS, despite previous studies showed that the resistance training is effective for improving strength (8) and eliciting gains in muscle mass in older adults (9). However, a recent meta-analysis showed that the resistance training is effective for improving maximal strength, but does not consistently improve physical performance such as walking speed (34). Longer interventions might be effective for the improvement of physical performance. Our study showed that in the Ex group, a 3-month resistance training program was not effective to improve walking speed.

In the present trial, we tested a multinutrient intervention particularly rich in vitamin D and proteins. It has been shown that vitamin D supplementation may enhance muscle strength in frail older adults with vitamin D deficiency (35). Although the primary source of vitamin D is sunlight, it still can be obtained from diet. In serum, vitamin D3 is transported to the liver by binding to a vitamin D-binding protein. In the kidney, 25(OH) D3 is further metabolised into a biologically active form of vitamin D (36, 37). However, the vitamin D production capacity of the skin at the age of 70 is reduced to only 30% of that of 20-year-old persons (38, 39), and an increased dietary intake should be recommended in older adults.

Protein supplementation has been shown to augment the muscle strengthening effect of resistance exercise (14, 40). Older adults have a high risk of inadequate protein intake (41), and their synthetic response to protein intake may be blunted (42). Several studies found a positive association between protein intake and muscle mass (43, 44). In fact, aminoacids intake has a stimulatory effect on muscle protein synthesis (45).

Despite of a short period of supplementation (3 times a week for 3 months), the intervention was effective at increasing muscle mass in frail sarcopenic older adults. Moreover, the present results showed that the nutritional supplementation provided added benefits to those from the resistance training for increasing muscle mass and physical performance. Longer interventions might turn out to be more effective, even for the other outcomes (e.g. knee extension torque and falls) for which we did not reported significant findings. Further studies are required to address the effect of nutritional supplementation and exercise on sarcopenia and physical performance.

Several limitations of the present study need to be mentioned. First, single participants were not randomized. Therefore, the evidence level is not so strong as it would be obtained from a randomized controlled trial (RCT). Second, these findings should be considered as preliminary due to the relatively small sample size. This issue may introduce some error of inference, reduce the power of the analysis, and limit

generalization. Third, no follow-up after completion of the trial was conducted. Since there is a lack of evidence regarding the long-term effect of nutritional supplement on the treatment of sarcopenia, this issue also needs to be addressed in future specific studies. Forth, the intake of dietary food was not recorded. The nutritional supplement may have changed dietary intakes. Fifth, the measurement of SMI was estimated using the BIA which is far from the gold standard to accurately assess sarcopenia. Sixth, serum levels of 25 (OH) D were not measured. Therefore, the relationship between the nutritional supplement and 25 (OH) D cannot be determined. Finally, a control group not engaged in interventions was lacking. Participants in S/Ex group may have had higher motivation and interest in health issues than the general elderly population.

In conclusion, results of our study suggest that the combination of resistance training and nutritional supplementation program may be more effective at improving SMI and walking speed than resistance training only. These results imply the importance of these prevention programs to reduce sacropenia in older adults. A larger RCT is needed to confirm and extend the present results.

Appendix

Micro- and macro-nutrients of the adopted nutritional supplementation

		125 ml
Protein	g	10.0
Vitamin D	μg	12.5
Fat	g	8.2
Carbohydrate	g	20.6
Oligosaccharide	g	2.0
Natrium	mg	100
Fluid	g	93.5
Mineral	mg	91.7
Vitamin A	μgRE	244
Vitamin E	mg	4.5
Vitamin K	μg	11
Vitamin B1	mg	0.6
Vitamin B2	mg	0.8
Niacin	mg	9.8
Vitamin B6	mg	0.9
Vitamin B12	μg	1.3
Folate	μg	125
Pantothenic acid	mg	4.4
Vitamin C	mg	56.0
Biotin	μg	9
Unsaturated fatty acid	g	0.35

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Conflicts of interest: All authors declare that they have no conflict of interest or financial disclosures.

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ORIGINAL ARTICLE: EPIDEMIOLOGY, CLINICAL PRACTICE AND HEALTH

Both conventional indices of cognitive function and frailty predict levels of care required in a long-term care insurance program for memory clinic patients in Japan

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Aim: To delineate relationships among cognitive function, frailty and level of care required in the Japanese long-term care insurance program (LTCIP) in outpatient memory clinic patients.

Methods: This was a cross-sectional study carried out at an outpatient memory clinic. Participants were 201 cognitively impaired patients. Cognitive function was measured by the Mini-Mental State Examination (MMSE). Frailty was measured by Timed Up & Go (TUG) and grip strength. Waist circumference, body mass index, living arrangement and level of care required in the LTCIP (rank 1 minor disability to rank 7 severe disability) were also assessed.

Results: Mean age, MMSE score, TUG score and grip strength were 78.8 ± 6.9 years, 19.6 ± 6.1, 14.6 ± 6.7 s and 16.9 ± 7.5 kg, respectively. A total of 70 patients (34.8%) had not applied for the certification, at least in part because of their younger age and existence of family caregivers. LTCIP rank was correlated both with MMSE score (β: −0.49, $P = 0.001$), grip strength (β: −0.27, $P = 0.005$) and living alone (β: −0.18, $P = 0.03$), but not with TUG score (β: 0.14, $P = 0.105$).

Conclusion: In outpatients of a memory clinic, care ranks, which define the upper limit of monthly benefit in the Japanese LTCIP, were influenced by age, cognitive function, frailty and living arrangements. Understanding the relationship among these parameters would be useful in predicting the needs of cognitively impaired patients and important when comparing the possible services provided by long-term care systems for them worldwide. **Geriatr Gerontol Int 2012; 12: 630–636.**

Keywords: cognition, dementia, frailty, living arrangements, long-term care insurance program.

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Introduction

With the accelerated aging of the population, the number of patients suffering from dementia is increasing. There were estimated to be more than 1.8 million dementia patients in Japan in 2005, and 24.3 million

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worldwide in 2001.[1] To improve quality of life for cognitively impaired patients, it is important to use social services in addition to the care provided by family caregivers.[2] In developed countries facing the social burden of aging, care systems have been constructed taking into account national characteristics, such as history, nationality, percentage of elderly people and economic conditions.[3,4] The main framework of these systems consists of comprehensive evaluation of the elderly and provision of care in-kind or payments to help families secure care, according to the anticipated care requirement. In Japan, a long-term care insurance program (LTCIP) has been implemented since 2000.[5–7]

Despite the importance of social services for dementia patients, few studies have investigated correlations between anticipated care requirement, which determines the care services allocated, with common indices of dementia severity, such as the Mini-Mental State Examination (MMSE).[8,9] When predicting the amount of care needed, care providers carry out comprehensive assessments of activities of daily living (ADL), instrumental activities of daily living (IADL), cognition, behavioral and psychological symptoms of dementia (BPSD), functions of sensory organs important for communication (particularly hearing and visual acuity), nutritional status, and existence of pain.[6,10] It is important that such assessments are comprehensive in order to evaluate a broad range of functions in elderly people; however, the complex nature of these assessments and the complex condition of the elderly might hamper a simple description of care needs of dementia patients. Care needs of most of dementia patients might instead be assessed in terms of cognitive impairment and ambulatory problems if BPSD are appropriately treated. In the present report, we compare the level of care required, which determines the care allocated, with indices of cognition and frailty. We also intended to carry out this analysis to provide information for the international comparison of care assurance systems that could contribute to their improvement.

Methods

Participants

Participants were 201 patients with cognitive impairment regularly followed up at the outpatient memory clinic in Kyoto University Hospital, Kyoto, Japan. Types of dementia were Alzheimer's disease (AD, $n = 144$), vascular dementia (VD, $n = 9$), mixed type dementia ($n = 10$), dementia with Lewy bodies (DLB, $n = 13$) and other types of dementia ($n = 3$; a semantic dementia, a Fahr disease and an alcohol dementia). A total of 22 patients with mild cognitive impairment (MCI) were also included. The diagnosis of AD, VD, DLB and MCI was made according to the following criteria: AD, Diagnostic and Statistical Manual of Mental Disorders, 4th edition, and National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association;[11,12] VD, National Institute of Neurological Disorders and Stroke, and Association Internationale pour la Recherché et l'Enseignement en Neurosciences;[13] DLB, McKeith's;[14] and MCI, Petersen's.[15] The diagnosis of mixed-type dementia was made when patients were found to have dementia not explained solely by AD or VD. The present study was approved by the ethics committee of Kyoto University, and written informed consent was obtained from participants.

Measures

Participants were evaluated at a regular outpatient consultation from April to July, 2008. The evaluation consisted of measurements of frailty and an interview of caregivers to obtain information relevant to the patients care. Cognitive status was evaluated by the MMSE[16] carried out within 6 months of this evaluation, usually on another visit. Timed Up & Go test (TUG) and grip strength were used for the assessment of frailty.[17,18] Body mass index (BMI) and waist circumference were also measured. The caregiver interview consisted of questions on living arrangements, frequency of care provided by family members not living with the patient and level of care required in the LTCIP. We also asked about the number of family members who provided care, but did not live with the patient, and how far these family members lived from the patients' home, although some of this information was not included in the present report.

LTCIP in Japan

The care requirement was determined by a national system (Fig. 1). The LTCIP was implemented in Japan in 2000 and underwent major reform in 2005.[6,10] The original version listed seven ranks of care required (not eligible, needing support and needing care levels 1–5). After the reform, these ranks were expanded to eight (not eligible, needing support levels 1 and 2, and needing care levels 1–5). As level of required care is evaluated every 6–24 months, depending on the stability of the physical and mental conditions of the elderly, all participants in the present study had their level of care required assessed after the reform. In the Japanese LTCIP, the first step to assessing level of care required involves a computer algorithm to determine the estimated time assumed necessary for the care of an individual elderly person. In this assessment, the time is estimated by trained municipal officers using a 79-item checklist consisting of basic and instrumental ADL, cognitive function, BPSD, and auditory acuity. In the

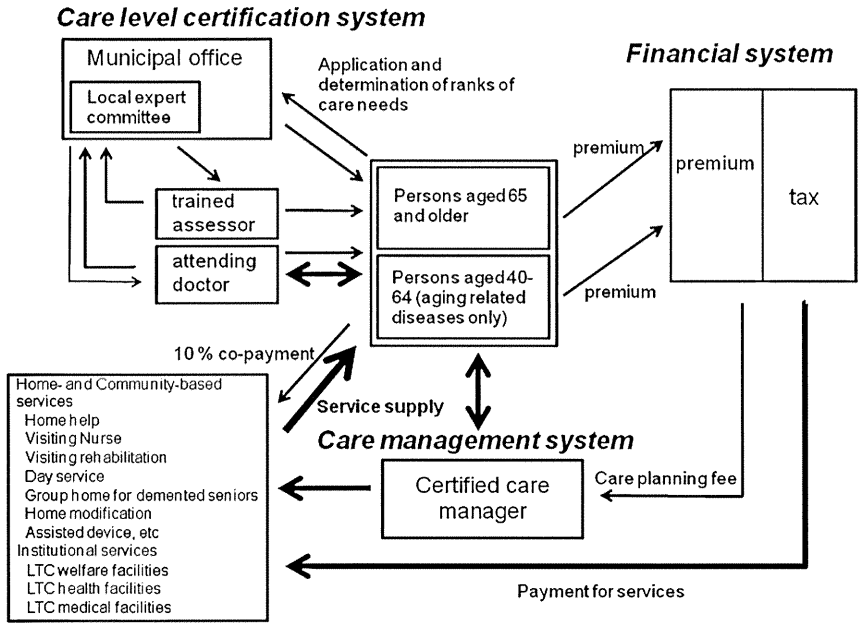

Figure 1 Schema of the long-term care insurance program in Japan.

second step, a local expert committee checks the results of the first step and a medical certificate from the elderly person's attending physician, and finally decides on the level of care required (Fig. 1). If the elderly person applies for certification, and their physical and cognitive status is not frail enough for level 1 of care support, they are not eligible for LTCIP services. There were no such patients in the present series of participants. However, there were patients who opted not to apply for care certification, because they or their family did not think that they needed social services, and we designated these patients as rank 0. Care support levels 1 and 2 are designated here as ranks 1 and 2, and care needs levels 1 to 5 are designated as ranks 3 to 7, respectively.

In the Japanese LTCIP, care benefits are provided in kind, and the upper limit of the benefit available in a month expressed as the amount of money equivalent to the cost of services is determined according to the level of care required. The upper limits per month are 49 700 yen (552 US dollars ($) at an exchange rate of 90 yen to 1 US dollar) for rank 1; 104 000 yen ($1156) for rank 2; 165 800 yen ($1842) for rank 3; 194 800 yen ($2164) for rank 4; 267 500 yen ($2972) for rank 5; 306 000 yen ($3400) for rank 6 and 358 300 yen ($3981) for rank 7, respectively. The benefits in kind are provided as home- and community-based services, such as home help, visiting nurse, day services and group home service, or as institutional services, such as long-term care welfare facilities, health facilities and medical facilities. The charges for each service are uniform throughout Japan. People using care services usually ask their certified care manager to draw up a care plan (Fig. 1).

Statistical analysis

All data are presented as mean ± standard deviation (SD). Student's *t*-tests were used to assess differences between group means for continuous variables. Pearson's χ^2-tests were used to assess differences between groups for categorical variables. Because of the small sample size, patients in care ranks 1 and 2, and those in care ranks 6 and 7 were combined for analysis. One-way analysis of variance (ANOVA) was used to analyze differences between groups. Post-hoc comparisons were made using the Tukey–Kramer test. Finally, a multiple regression analyses was carried out with care rank as the dependent variable, and age, education, sex, MMSE score, grip strength and TUG score as independent variables.

Results

Demographic information and basic characteristics of participants are shown in Table 1. No significant differences were found in age, education or sex among the diagnostic entities. There were, however, significant differences in MMSE score between AD and MCI. There were no statistical differences in TUG or grip strength among the groups. In DLB patients, the mean of MMSE score was higher than that in AD, but the frailty indices were worse than in AD. When MMSE scores were divided by the reciprocal of TUG and compared between diagnoses, significant differences were apparent among the groups ($F = 6.577$, $P < 0.001$). This modified score was significantly higher in DLB than in AD (AD 250.2 ± 110.5, DLB 404.3 ± 245.7,

Table 1 Demographic information and basic characteristics of participants

n	Total 201	AD 144	MCI 22	MIX 10	VD 9	DLB 13	Other 3
Age (years)							
Mean (SD)	78.7 (7.0)	78.9 (7.3)	77.7 (5.7)	78.9 (7.5)	80.6 (6.6)	79.3 (5.2)	69.0 (1.7)
Sex							
Female	132	96	15	5	5	11	0
Male	69	48	7	5	4	2	3
MMSE*							
Female (%)	65.7	66.7	68.2	50.0	55.6	84.6	0.0
Mean (SD)	19.7 (6.1)	18.0 (5.8)	26.7 (1.5)	21.0 (2.6)	23.6 (2.4)	22.2 (6.2)	18.0 (8.7)
TUG (s)							
Mean (SD)	14.4 (6.4)	14.6 (6.6)	12.0 (4.1)	13.9 (2.9)	15.4 (5.3)	17.1 (9.0)	9.3 (2.2)
Grip strength (kg)							
Mean (SD)	16.9 (7.5)	16.7 (7.7)	19.1 (9.0)	16.8 (5.9)	16.9 (6.6)	13.9 (4.6)	20.7 (3.1)
BMI* (kg/m^2)							
Mean (SD)	22.4 (3.5)	22.1 (3.5)	22.5 (2.8)	24.9 (4.0)	25.0 (1.9)	22.0 (3.2)	20.4 (4.0)
Waist circumference* (cm)							
Mean (SD)	84.1 (9.0)	83.1 (9.3)	85.1 (7.0)	89.5 (10.8)	89.5 (5.0)	83.4 (6.6)	92.7 (6.6)
Living arrangement							
Living alone	33	20	7	1	1	4	0
Other	168	124	15	9	8	9	3
Living alone (%)	16.4	13.9	31.8	10.0	11.1	30.8	0.0
Care rank*							
Mean (SD)	2.4 (2.1)	2.6 (2.1)	0.4 (0.8)	2.8 (1.5)	2.7 (2.3)	3.5 (1.5)	1.7 (2.1)

*$P < 0.05$ P values were calculated by one-way ANOVA and χ^2-test. AD, Alzheimer's disease; BMI, body mass index; DLB, dementia with Lewy bodies; MCI, mild cognitive impairment; MIX, mixed type dementia; MMSE, Mini-Mental State Examination; TUG, Timed Up & Go; VD, vascular dementia.

MCI 321.1 ± 107.7, MIX 289.4 ± 79.2 and VD 359.2 ± 107.5). Although there were significant differences in BMI and waist circumferences among disease groups, with both indices being higher in VD and MIX, post-hoc analysis failed to find a significant difference between specific groups. The percentage of elderly people living alone did not vary among the groups. Care rank in MCI was lower than in the other groups.

A total of 70 patients had not applied for LTCIP certification (rank 0). When patients were divided according to care rank (Table 2), there was no overall tendency for increased age to be associated with higher care rank, although patients in ranks 3, 4 and 5 were significantly older than patients in care rank 0. There was a clear tendency that the higher the care rank, the worse the MMSE score and frailty indices, with the exception of MMSE scores from care ranks 0 to 3. Neither waist circumference nor BMI differed among care ranks. The percentage of patients living alone differed significantly according to care rank; beyond rank 4, very few patients lived alone. In contrast, there were also fewer patients in rank 0 who lived alone. When ranks 0, 1–2 and 3 were analyzed separately, patients in rank 0 were younger and less likely to live alone than those in rank 3 (data not shown), although they had similar levels of cognitive impairment (Table 2).

Finally, we analyzed factors that correlated with care rank by multiple regression analysis. In this analysis, patients in rank 0 were excluded, as this rank was related to non-cognitive and non-physical factors (age and living arrangement), as described earlier. The analysis showed that MMSE, grip strength and living arrangement were independent predictors of care rank (Table 3).

Discussion

In the present report, we presented the distribution of care ranks determined according to the Japanese LTCIP certification in outpatients of a memory clinic, and the relationship between these ranks and conventional indices of cognition and frailty. Although LTCIP certification is carried out through a complex comprehensive assessment system consisting of two independent pathways, one by a certified assessor and one by an attending physician,[5,6] the present results showed a strong correlation between the results of this

Table 2 Relationship between care ranks and clinical and demographic variables

Care rank	0	1–2	3	4	5	6–7	*P*-value
n	70	18	48	31	22	12	
Age (years)							
Mean (SD)	75.3 (6.8)	79.8 (4.7)	80.1* (6.1)	79.6* (7.1)	83.5* (5.8)	80.5 (6.7)	<0.001
Sex							
Female	41	11	35	21	14	10	0.466$
Male	29	7	13	10	8	2	
Female (%)	58.6	61.1	72.9	67.7	63.6	70.6	
MMSE							
Mean (SD)	21.9 (4.9)	23.1 (3.3)	21.1 (4.1)	17.4*†‡ (5.6)	14.1*†‡ (6.6)	8.6*†‡§ (4.2)	<0.001
TUG (s)							
Mean (SD)	12.2 (5.0)	13.2 (4.7)	14.3 (5.7)	16.4* (8.0)	17.6* (6.8)	21.9*†‡ (7.6)	<0.001
Grip strength (kg)							
Mean (SD)	20.3 (8.2)	18.8 (6.9)	15.7* (6.8)	14.1* (4.5)	12.7* (5.5)	9.6*† (5.8)	<0.001
BMI (kg/m2)							
Mean (SD)	22.8 (3.3)	22.0 (3.9)	22.2 (3.8)	22.5 (3.3)	21.7 (3.2)	21.9 (3.7)	0.806
Waist circumference (cm)							
Mean (SD)	84.2 (7.7)	87.3 (11.4)	83.5 (10.3)	83.9 (8.4)	82.8 (7.0)	82.8 (12.6)	0.681
Living arrangement							
Living alone	7	7	15	3	0	1	<0.001$
Other	63	11	33	28	22	11	
Living alone (%)	10	38.9	31.3	9.7	0	8.3	

*$P < 0.05$ versus 0, †$P < 0.05$ versus 1–2, ‡$P < 0.05$ versus 3, §$P < 0.05$ versus 4. *P*-value was calculated by one-way ANOVA and χ^2-test ($). BMI, body mass index; MMSE, Mini-Mental State Examination; TUG, Timed Up & Go.

Table 3 Factors correlated with care rank on multiple regression analysis

Independent variable	Care rank ($R^2 = 0.41$)	
	β	*P*
Age (years)	−0.09	0.324
Sex (male)	0.05	0.624
Education (years)	0.06	0.465
MMSE score	−0.49	0.001
Grip strength (kg)	−0.27	0.005
TUG (s)	0.14	0.105
Living alone	−0.18	0.03

β, Standard partial regression coefficient; MMSE, Mini-Mental State Examination; TUG, Timed Up & Go.

assessment expressed as care rank and simple conventional indices. As those with dementia and related disorders are the largest population requiring care, this simple assumption could be beneficial for daily clinical practice and also useful in comparing care assurance systems among countries. We found specific tendencies among disease groups. DLB patients were frailer and had higher care ranks despite a smaller decline in cognitive function as measured by MMSE score than AD patients. DLB patients might be frailer than AD patients, because DLB often accompanies Parkinsonism. Another explanation is that disability of DLB patients might not be highly associated with MMSE. A recent report shows relative preservation of MMSE scores in DLB patients despite overall severity of the disease.[19] MCI patients showed, as expected, better cognitive and physical function concomitant with a lower care rank when compared with dementia patients.

Most developed countries have introduced care assurance systems, although these systems differ significantly among countries because of factors including their history, nationality, culture and economic status. Countries differ in many aspects, including assessment systems, check-points for assessment, people responsible for assessment, number of levels of care required, source of funding (tax or insurance), severity of condition for those certified to receive care, how patients with dementia are taken into account, methods of care supply (in-kind, cash or personal budget), existence of a care management system and types of care services provided.[3,4] Although it is difficult to determine which care system is more appropriate in each country, it is essential to know the relationship between fundamental abilities of patients and possible care supply in order to carry out international comparisons of the care supply to dementia patients.

In the present study, we used MMSE as the index of cognitive function, because it is a widely used cognitive assessment tool worldwide and is easy to administer.[16] We used TUG and grip strength as the indices of frailty, because these assessment tools are simple and often used for assessment.[17,18] The present results showed that the higher the level of care required, the lower the MMSE, the longer the TUG and the weaker the grip strength. Intriguingly, these results are in line with recent reports that both cognitive function and frailty are intimately related during the clinical course of dementia.[20–24] There might be several reasons why TUG was not significantly associated with care ranks in the present multiple regression analysis. First, as there are few patients in the present study cohort who suffer from gait disturbance as a result of hemiparesis or musculoskeletal disease, which are popular causes of dependency, TUG might not have been related to care ranks in our analysis. Second, because TUG is a complex marker affected by not only muscle weakness, but also balance and executive functions, sarcopenia as represented by grip strength might be more important to determine care ranks in cognitively impaired elderly patients. Third, we might not have had a sufficient power to detect the significance of TUG in the present cohort.

When we look more closely at the results, the correlation between care levels as certified by the LTCIP and simple indices of cognition and frailty was not clear from ranks 0 to 3, although it was apparent at the care needs level (ranks 3–7). Instead, the present data suggest that age and living arrangement have a significant effect on patients in care ranks 0–3. As far as we know, there are no reports showing that younger dementia patients are more reluctant to use care services than older patients. However, in the future, it should be considered whether younger dementia patients might be reluctant to use care services or whether the actual contents of these care services do not match their needs. It is also important to think about living arrangements. In the current series, only one patient who lived alone had a care rank beyond 4, suggesting that dementia patients with higher care needs find it difficult to live alone. In contrast, people in the lowest level, rank 0, were also less likely to live alone than those in other ranks. These patients were those who had not applied for certification, irrespective of their cognitive and physical abilities, and a significant proportion of such patients would have been provided care by informal caregivers. In the Japanese LTCIP, all care services are in kind and cash payments do not occur. Future studies must therefore consider how to estimate the contribution of informal caregivers.[25,26]

The following limitations were recognized. We did not assess ADL and IADL of patients, and because these factors might be related to cognitive and physical abilities, direct assessment would provide more information for analysis. We also did not assess BPSD despite the fact that this is included in the first stage assessment of care level certification and should accordingly have a certain effect on care need.[5,6] Although the patients in the present study were treated appropriately in terms of BPSD, including an assessment of BPSD would give more information to construct simple explanatory models of care ranks. Finally, this was a cross-sectional study of outpatients of one memory clinic. A further multicenter study is required to confirm the results obtained.

As the number of dementia patients is anticipated to increase dramatically, it is important to establish social support systems in all countries. What kinds of services and what extent of such services are required for dementia patients in various stages of the disease? How much are we prepared to pay for providing these services? To consider these issues, international comparisons are necessary. Despite the influence of age and living arrangements, the present correlations between certified care levels, which reflect appropriate available benefits, with simple cognitive and physical parameters could contribute to international comparisons and to improvement of care systems.

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Disclosure statement

None of the authors have a personal or financial conflict of interest with regard to this manuscript.

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Original article

Identifying cognitive dysfunction using the nurses' rapidly clinical judgment in elderly inpatients

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ABSTRACT

Background/Purpose: The aim of this study was to examine the relationship between nurses' clinical judgment on cognitive function by fall risk assessment and mini-mental state examination (MMSE) scores in elderly inpatients.
Methods: We studied 61 consecutive hospitalized patients who received both comprehensive geriatric assessment (CGA) and fall risk assessment at the Department of Geriatric Medicine in Kyoto University Hospital from January 2006 to June 2010. During the fall risk assessment at admission, primary nurses evaluated the cognitive function by four items (with or without disorientation, impaired judgment, lack of comprehension, and memory loss), while a trained clinical assistant performed CGA including MMSE. Patients were divided into three groups according to the MMSE scores. The association between the four items of judgment by nurses and MMSE scores was then studied.
Results: The mean age was 80.1 years and 55.7% of the patients were female. The percentage of patients judged to have impaired judgment, lack of comprehension, and memory loss was higher in patients with lower MMSE scores (impaired judgment, p for trend = 0.001; lack of comprehension, p for trend = 0.043; memory loss, p for trend = 0.001). The percentage of patients judged to have at least one of the four abnormalities was also significantly higher in patients with lower MMSE scores (p for trend <0.001). However, no significant relationship was found between disorientation and the MMSE scores. Further, nurses could not detect impaired cognition by the four items in one-third of the patients with mild impairment determined by MMSE.
Conclusion: These data indicate that a comprehensive evaluation using all the four items on cognitive impairment is more effective in detecting cognitive impairment in elderly than using individual items, although one-third of cognitively impaired elderly patients may miss detection despite the use of the four items. Better approaches should be developed to identify cognitively impaired elderly patients by nurses.

1. Introduction

Falls are one of the most common complications of elderly in hospitals, with rates per 1000 patient-days estimated between 1.5 and 7.0,[1–3] and approximately 30% of those lead to physical injury, with 2.4–6.8% being serious.[4,5] Falls are associated with cognitive dysfunction, and approximately 60% of the elderly with cognitive impairment fall annually; this incidence is approximately twice higher than those without cognitive impairment.[6–10] The increase of elderly population and demented patients in hospital can therefore lead to an increase in falls and fracture events. Accordingly, it is important for nurses to assess cognition in elderly patients to prevent such complications.

Many fall risk screening tools are used as part of fall prevention programs in hospitals. Available screening and fall risk assessment tools used in different settings have been subjected to systematic reviews that reveal considerable differences in practicability and validity, thus raising the question of their usefulness.[11,12] To identify high-risk patients for falls in institutionalized settings, our hospital developed a fall risk assessment tool. For the assessment, nurses collected information on age, history of falls, visual and hearing

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disturbance, cognition, transfer, and urinary continence, which are risk factors of falls identified by previous studies. Most items were evaluated by nurses' subjective judgment. The advantage of this tool is that nurses can finish the assessment in a relatively short period of time at an early phase of hospitalization and repeat the assessment during hospitalization. However, it was not clear how accurate nurses can assess the cognitive function of elderly patients with this tool. To this end, we tried to investigate whether or not nurses can accurately judge cognitive impairment in elderly patients using this tool by comparing the data independently obtained by mini-mental state examination (MMSE)[13] performed by a trained clinical assistant.

The aim of this study was, therefore, to examine the relationship between the clinical judgment of nurses on cognitive function during fall risk assessment and independently MMSE scores in elderly inpatients.

2. Methods

2.1. Designs

The design of this study was a cross-sectional study.

2.2. Participants and data collection

In this study we collected data from medical records for 63 inpatients who received comprehensive geriatric assessment (CGA) during hospitalization at the Department of Geriatric Medicine of Kyoto University Hospital from January 2006 to June 2010. The data was collected from CGA of inpatients judged as frail by attending physicians. All inpatients received fall risk assessment as usual care.

Of 63 inpatients, one patient was excluded because CGA was performed after more than one month of clinical judgment and the other was due to missing information. The remaining 61 inpatients were analyzed for this study.

The approval for this study was obtained from Kyoto University Graduate School and Faculty of Medicine Ethics Committee (No. E1042, 2010). Patients were informed about our study at Kyoto University Hospital and the Department of Geriatric Medicine, Kyoto University website.

2.3. Measurements

Cognitive function was evaluated by four items in the fall risk assessment tool on admission, at least within 24 hours after admission by primary nurses, in which nurses clinically judged cognitive function of each patient. The nurses judged the presence or absence of disorientation, impaired judgment, lack of comprehension, and memory loss. The fall risk assessment tool including these items was applied to prevent falls for almost all patients in our hospital.

CGA was conducted less than 30 days of the initial hospital stay. The mean ± standard deviation of the period from admission to evaluation was 8.0 ± 6.0 days. The information was collected on socio-demographic data, living environment, health status and hospitalization data. We collected data to assess functional and cognitive status, and depressed mood by MMSE and geriatric depression scale (GDS), and so forth. MMSE was performed by a trained clinical assistant and the patients were divided into three groups according to MMSE scores. Patients with MMSE scores from 0 to 17 points were classified as moderate to severe impairment, those from 18 to 23 points as mild impairment, and those from 24 to 30 points as slight or no impairment.[14]

2.4. Statistical analysis

We described mean ± standard deviation or median, minimum and maximum for the continuous variable and numbers and percentages for the discrete variable. Liner regression models were constructed to examine the association of nurse's judgments on cognitive function with the MMSE scores. Additionally, at least one of the four abnormalities of judgment by nurses was compared in the two groups according to the MMSE scores using Chi-square test. The cutoff of these groups was 24.

The Statistical Package for Social Sciences, version 18.0 J (SPSS Japan Inc., Tokyo, Japan) was used for statistical analysis. All probability values were two-tailed with a significant level of $p < 0.05$.

3. Results

Table 1 shows the characteristics and main measurements of the patients. The mean age was 80.1 years and 55.7% of them were female. The median of their hospitalization length was 19 days. Of the 61 patients, 56 were discharged to home (91.8%). In terms of their cognitive function, 36% of the patients were judged to have memory loss, which was the highest among the four items. Twenty-six percent of the patients were judged to have impaired judgment, 21% lack of comprehension, and 13% disorientation. Furthermore, 43% of the patients were judged to have at least one of the four abnormalities. The median of MMSE scores was 26.

Table 2 shows the percentage of cognitive impairment judged by nurses in each group of patients classified according to their MMSE scores. Twenty-five percent of patients with moderate to severe impairment, 21% with mild impairment, and 9.3% with slight or no impairment were judged to be disoriented, respectively. Although no statistically significant association was found between disorientation and MMSE scores (p for trend = 0.053), the percentage of patients judged to have disorientation in the moderate to severe impairment group tended to be higher than those with slight or no impairment. In terms of impaired judgment, 75% of the patients with moderate to severe impairment, 36% with mild impairment, and 19% with slight or no impairment were judged to have impaired judgment, respectively. As a result, the percentage of patients judged to have impaired judgment was significantly higher in patients with lower MMSE scores (p for trend = 0.001). In lack of comprehension, 50% of the patients with moderate to severe impairment, 21% with mild impairment, and 19% with slight or no impairment were judged to have lack of comprehension,

Table 1
Characteristics and main measurements of the inpatients

	All n = 61
Age; years	80.1 ± 6.0
Gender, female (%)	34 (55.7)
Length of stay in the hospital, days	19 [5, 56]
Place after discharge from the hospital	
Home	56 (91.8)
Other hospitals	3 (4.9)
Other departments	2 (3.3)
Cognitive function of judgment by nurses	
Disorientation	8 (13.1)
Impaired judgment	16 (26.2)
Lack of comprehension	13 (21.3)
Memory loss	22 (36.1)
At least one of the 4 abnormalities	26 (42.6)
Mini-Mental State Examination scores	26 [13, 30]

Number(%).
Mean ± standard deviation or median [minmum, maximum].

Table 2
Relationship between nurses' clinical judgment and Mini-Mental State Examination scores

	Moderate to severe impairment n = 4	Mild impairment n = 14	Slight or no impairment n = 43	p for trend
Cognitive function of judgment by nurses				
Disorientation	1 (25.0)	3 (21.4)	4 (9.3)	0.053
Impaired judgment	3 (75.0)	5 (35.7)	8 (18.6)	0.001
Lack of comprehension	2 (50.0)	3 (21.4)	8 (18.6)	0.043
Memory loss	3 (75.0)	7 (50.0)	12 (27.9)	0.001
At least one of the 4 abnormalities	4 (100)	9 (64.3)	13 (30.2)	<0.001

Number (%).
All patients were divided into 3 groups according to MMSE scores.
0-17points: moderate to sever impairment
18-23points: mild impairment
24-30points: slight or no impairment
A liner trend test was used with the discrete value in each groups according to the MMSE scores in liner regression models.

respectively. The percentage of patients judged to have lack of comprehension was significantly higher in patients with lower MMSE scores (p for trend = 0.043). In memory loss, 75% of patients with moderate to severe impairment, 50% with mild impairment, and 28% with slight or no impairment were judged to have memory loss, respectively. The percentage of patients judged to have memory loss was significantly higher in patients with lower MMSE scores (p for trend = 0.001). Finally, all patients with moderate to severe impairment, 64% with mild impairment, and 30% with slight or no impairment were judged to have at least one of the four abnormalities, respectively. The percentage of patients judged to have at least one of the four abnormalities was significantly higher in patients with lower MMSE scores (p for trend <0.001).

In the 14 patients with mild impairment, nine were judged to have at least one of the four abnormalities and five were not. Although those five patients were not judged to have impaired cognition using the four items by nurses at admission, four were judged to have at least one of the four abnormalities at the second time of evaluation by nurses during hospitalization. The second evaluation by nurses was performed from 1 to 2 weeks after admission. Thus, most of the patients were judged to have at least one of the four abnormalities by nurses at the second assessment (data not shown). Therefore, we assume that it takes time for nurses to assess the cognitive function of inpatients.

Fig. 1 shows how many of the patients with mild to severe impairment or slight to no impairment can be judged to have at least one abnormality by nurses. The patients with mild to severe impairment determined by MMSE were more likely to be judged to have at least one of the four abnormalities than those with slight or no impairment (p = 0.002). However, nurses could not detect impaired cognition using the four items in one-third of the patients with mild to severe impairment determined by MMSE, while they judged to have some kind of cognitive impairment in one-third of the patients with slight to no impairment.

Fig. 2 shows the number of items judged to have abnormality in four items on cognitive function by nurses in each group of patients classified according to their MMSE scores. There was no relationship between the number of items judged to have abnormality and the level of cognitive function according to MMSE scores.

4. Discussion

In the present study, we demonstrated that the percentage of patients judged by nurses to have cognitive impairment were

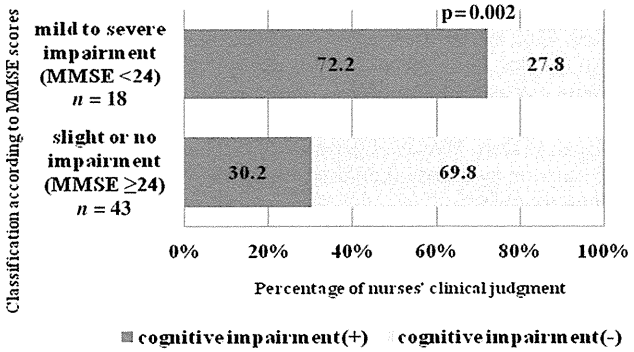

Fig. 1. The percentage of patients to be judged to have at least one abnormality by nurses in patients with mild to severe cognitive or slight to no impairment by MMSE. The difference was determined using Chi-square test.

higher in elderly patients with lower MMSE scores than those with higher MMSE scores. Despite using the four items to detect cognitive impairment, our study demonstrated that the assessment used by nurses was not completely successful to evaluate the cognitive function of elderly patients.

According to our data, nurses could not detect impaired cognition with the four items in one-third of the patients with mild impairment determined by MMSE. This percentage was unexpectedly high. We assume that it is difficult for nurses to accurately assess patient's cognitive function at admission; however, nurses could detect impaired cognition in patients with mild impairment at the second assessment, which was done 1 to 2 weeks after admission. Thus, it is conceivable that nurses may not have obtained sufficient information for the assessment at admission. However, most falls in hospital occur within a week.[15] In addition, demented patients have a markedly increased fall and fracture risk, almost two times more in comparison with nondemented elderly.[16–18] Furthermore, diminished motor control is related to cognitive status in older adults. Thus, changes in cognitive function may contribute to an increased fall risk. Accordingly, it is necessary

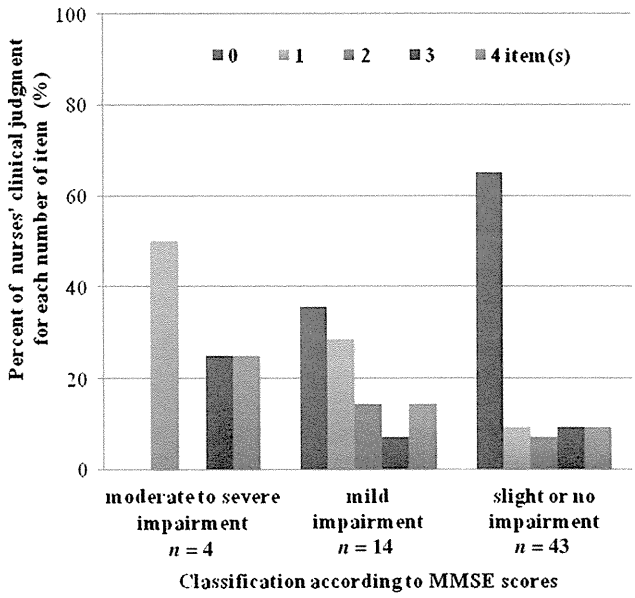

Fig. 2. The number of items judged to have abnormality in four items on cognitive function by nurses in each group of patients classified according to their MMSE scores.

for nurses to assess even mild cognitive impairment as well as severe impairment at an early stage of admission.[19] According to these results, it is conceivable to think that we should develop a better fall assessment tool to detect mild cognitive impairment and educate nurses to assess patients with cognitive impairment more accurately. However, generally speaking, screening of cognitive function by nurses should be aimed for higher sensitivity than higher specificity.

Although all patients with moderate to severe impairment were judged to have at least one of the four abnormalities, they were not completely judged to have each abnormality. It is suggested that a comprehensive evaluation using all of the four items of cognitive impairment is better to evaluate than using each item at admission. The percentage of patients judged by nurses to have memory loss was the highest among the four items. In contrast, the percentage of patients judged by nurses to have disorientation was the lowest. Nurses obtain information of patients during nursing care including active daily life assistance. It is extremely difficult to confirm whether a patient recognizes date, a day of the week, and a place during active daily life assistance. However, it is easy to assess whether or not a patient forgets recent episodes, to repeat the same questions and talks, and forgets where he or she puts something. The most likely explanation is that the judgment of disorientation is more difficult to assess than memory loss. Therefore, the judgment of disorientation might be unnecessary in this tool.

Many studies have shown the development of effective several assessment tools to identify fall risk in the elderly at high risk in institutionalized settings.[11,12] Many hospitals have implemented routine screening to assess fall risk for a patient, followed up with a more focused assessment of those deemed to be at high risk.[11,12] In addition, previous study showed that nurses' clinical judgments could predict falls of a patient as well as fall risk assessment tool.[20–22] However, these studies did not indicate how nurses made successful predictions. They only implicated that the intuition by nurses can predict falls. Because of this, we thought it necessary to show the validity of nurses' clinical judgment by performing MMSE in frail geriatric patients.

Several potential limitations should be considered when interpreting these results. First, the two measurements used in this study, four items of cognitive impairment in the fall risk assessment tool and MMSE, were not evaluated at the same time so information bias could occur. However, we excluded the data in which CGA was performed after more than one month of clinical judgment. Clinical judgment by nurses was also performed at admission, and all of the patients were judged by nurses before MMSE. The nurses were not informed of the patients' MMSE scores. Thus, the evaluation of MMSE did not affect nurses' clinical judgment. Second, we did not investigate the experience of nurses which might have affected the results. Third, the education level in the patients was also a confounding factor in this study. Information about the education levels of the patients was not obtained, because the literacy rate is extremely high in Japan and the education levels of Japanese patients is quite similar. Therefore, we assumed that the effect of educational levels would be minimal. Finally, the patients were limited those who admitted only to the Department of Geriatric Medicine in one university hospital and selected for CGA. It could be difficult to generalize these results.

In conclusion our data indicated that a comprehensive evaluation using all of the four items on cognitive impairment more effective in detecting cognitive impairment in elderly than using individual items. However, one-third of cognitively impaired elderly patients based on the result of MMSE were not accurately assessed by nurses despite using the four items on cognition, while the presence of disorientation assessed by nurses was not able to predict cognitive impairment based on the results of MMSE. Therefore, disorientation in this tool should be deleted in the future. Furthermore, it is important to repeat nurses' assessment on cognition after 1 or 2 weeks of admission because cognition levels might change after the acute phase. It is important to educate nurses to assess patients with cognitive impairment more accurately.

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ORIGINAL ARTICLE: EPIDEMIOLOGY, CLINICAL PRACTICE AND HEALTH

Indications and practice for tube feeding in Japanese geriatricians: Implications of multidisciplinary team approach

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Aim: The aim of this study was to examine how geriatricians decide the indication of tube feeding in the elderly with eating difficulty as a result of several disorders, and to determine the factors associated with their decision making and interventions for dysphagia.

Methods: The design was a cross-sectional study. All board-certified geriatricians in the Japan Geriatrics Society were recruited to this study in September 2010. We sent questionnaires to 1469 geriatricians. Among them, 629 agreed to participate. The survey consisted of self-administered questionnaires regarding demographic information, indications of tube feeding and interventions for dysphagia before tube feeding.

Results: We analyzed the remaining 555 questionnaires after excluding incomplete ones. Over 90% of geriatricians answered that "neurological disorder" and "stroke" are indications, whereas 46.8% of them answered that "dementia" is an indication for tube feeding. Geriatricians who organize a multidisciplinary team conference tended to carry out more "interventions for dysphagia before the prescription of tube feeding" compared with the reference group (odds ratio 2.1–8.7) after multivariate adjustment.

Conclusions: The results show that approximately half of the geriatricians prescribe tube feeding when the patient has dementia with loss of appetite or apraxia for eating. There is no consensus among Japanese geriatricians about the indication of tube feeding for demented people. We suggest that guidelines for tube feeding in the elderly should be established. Furthermore, a multidisciplinary approach would be desirable for decision making for tube feeding. **Geriatr Gerontol Int 2012; 12: 643–651.**

Keywords: elderly, geriatrician, multidisciplinary team, percutaneous endoscopic gastrostomy, tube feeding.

Introduction

Many older patients have nutritional problems caused by eating difficulties as a result of stroke, cancer, dementia and other conditions. When the patients have a functional gastrointestinal tract and they cannot take sufficient nutrition orally, tube feeding is an option. Percutaneous endoscopic gastrostomy (PEG) is the preferential route when enteral nutrition is expected to last for a longer period of time, because it is associated with better nutritional status and a lower incidence of aspiration than nasogastric tube (NGT).[1] PEG was originally developed for pediatric use by Gauderer in 1980.[2] However, thereafter PEG has become the most

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common way to supply artificial enteral nutrition in the elderly, including dementia patients. The number of people on PEG is increasing because of the improved simplicity and safety. Approximately 5–30% of the advanced dementia patients in nursing homes are on tube feeding in Europe and the USA; whereas, in Japan, approximately 50% of those are on tube feeding.[3–6] Thus, the percentage of tube feeding including PEG for dementia patients is higher in Japan than that in Western countries. However, recent studies have questioned the appropriateness of tube feeding in these patients. The decision of the practice or the withholding of tube feeding in patients with dementia is a difficult challenge among geriatricians and many other health-care professionals, as they need to make a decision with clinical ethical dilemmas. Furthermore, the quality of life (QOL) in the elderly with tube feeding and its effect on long-term survival have not yet been clarified,[7–13] and neither has a guideline for tube feeding in the elderly, especially in dementia patients. Accordingly, tube feeding is the focus of some extremely complex legal and ethical questions. Therefore, it is important to study the current situation of tube feeding for the elderly in Japan.

When we make a decision on tube feeding, comprehensive assessment of the patient, such as nutrition, cognition and swallowing function, is important and the assessment should be based on a multidisciplinary team approach. Previous studies showed the effectiveness of inpatient geriatric evaluation and management; that is, comprehensive geriatric assessment (CGA).[14] A multidisciplinary approach might be required for medical and nursing care of elderly patients, especially when we need to make a complicated decision, such as that of tube feeding. However, it is unknown whether the team approach can affect the decision making for tube feeding and interventions for dysphagia.

Therefore, the aim of the present study was to examine how geriatricians decide on the indication of tube feeding in the elderly with eating difficulty as a result of various disorders, and to determine whether the team approach can affect their decision making and interventions for dysphagia.

Methods

The design was a cross-sectional study. All board-certified geriatricians in the Japan Geriatrics Society were recruited to the present study in September 2010. We separately sent self-administered questionnaires to 1469 geriatricians by post and collected them from October to December 2010. These geriatricians were chosen because of their experience in taking care of patients who require tube feeding, and carry out CGA by organizing multidisciplinary team conferences. The present study was approved by the Ethics Committee of Kyoto University Graduate School and Faculty of Medicine (no. E984, 2010).

The questionnaires included demographic information, such as age, sex, place of employment, and clinical experience, reference guidelines for tube feeding, aims and indications of tube feeding in geriatrics, interventions for dysphagia before tube feeding, and multidisciplinary team approach if tube feeding is indicated. It was explained in the questionnaires that the term "elderly" was defined as people over the age of 75 years and those who require nursing care, and tube feeding included NGT, PEG and enterostomy tube.

We carried out descriptive analyses for each item in the questionnaire. The χ^2-test or t-test was used to compare the differences of place of employment and clinical experience. Logistic regression analyses were carried out to evaluate the differences of the frequencies and conference members according to the indication for tube feeding, and the interventions for dysphagia before tube feeding. Each item in the indication for tube feeding or interventions for swallowing disorder was adjusted for sex, working place and clinical experience of geriatricians. The frequency and number of members in a multidisciplinary conference were divided into five categories: not at all, occasional and less than five different health-care professionals, occasionally and ≧5 different health-care professionals, every time and less than five different health-care professionals, and every time and ≧5 different health-care professionals. The Statistical Package for Social Sciences version 18.0J (SPSS Japan, Tokyo, Japan) was used for statistical analysis. All probability values were two-tailed with a significant level of $P < 0.05$, and all confidence intervals were estimated at the 95% level.

Results

We sent a questionnaire to 1469 board-certified geriatricians, and 51 were returned as a result of being undeliverable because of wrong address. Among the rest, 629 agreed to participate in the present study. The response rate was 44.4%. After excluding the questionnaires with missing data, we analyzed the remaining 555 questionnaires. The prevalence of doctors aged over 60 years and male doctors was 34.6% and 89.2%, respectively. We found that 43.8% of the geriatricians had a clinical experience of more than 30 years, and 63.7% were working in acute hospitals, 30.7% in a clinic and 3.9% in long-term care facilities.

Table 1 shows the percentage of geriatricians who follow the guidelines and the purpose for tube feeding according to the geriatrician's place of employment and clinical experience. A total of 68% of geriatricians did not use any guideline for tube feeding. Among geriatricians following guidelines for tube feeding, 137 used "Guideline of Parenteral and Enteral Nutrition (EN) in

Table 1 Use of guidelines and the aims of tube feeding according to place of employment and clinical experience

Questions	Characteristics of geriatricians								Total
	Place of employment					Clinical experience			
	Hospital $n = 360$	Clinic $n = 166$	Long-term care $n = 20$	Other† $n = 9$	*P*-value	<30 years $n = 317$	≧30 years $n = 238$	*P*-value	$n = 555$
Do you use any guidelines for TF in geriatrics?‡									
Guideline of Parenteral and EN in Japan*1	84 (23.3)	48 (28.9)	4 (20.0)	1 (11.1)	ND	87 (27.4)	50 (21.0)	0.082	137 (24.7)
Guideline of PEG in Japan*2	51 (14.2)	21 (12.7)	4 (20.0)	1 (11.1)	ND	41 (12.9)	36 (15.1)	0.460	77 (13.9)
Guideline of Parenteral and EN in America*3	13 (3.6)	11 (6.6)	0 (0.0)	0 (0.0)	ND	11 (3.5)	13 (5.5)	0.253	24 (4.3)
Guideline of Parenteral and EN for elderly in Europe*4	9 (2.5)	11 (6.6)	0 (0.0)	1 (1.1)	ND	9 (2.8)	12 (5.0)	0.178	21 (3.8)
Not using guideline for TF	253 (70.3)	106 (63.9)	10 (50.0)	7 (77.8)	ND	209 (65.9)	167 (70.2)	0.291	376 (67.7)
What are the aims of TF in geriatrics?§									
Improvement of survival	63 (17.5)	29 (17.5)	6 (30.0)	0 (0.0)	ND	54 (17.0)	44 (18.5)	ND	98 (17.7)
Improvement of general condition and prevention of complications	201 (55.8)	93 (56.0)	12 (60.0)	3 (33.3)	–	163 (51.4)	146 (61.3)	–	309 (55.7)
Improvement of activities of daily living	17 (4.7)	9 (5.4)	0 (0.0)	1 (11.1)	–	22 (6.9)	5 (2.1)	–	27 (4.9)
Improvement of quality of life	24 (6.7)	9 (5.4)	2 (10.0)	2 (22.2)	–	24 (7.6)	13 (5.5)	–	37 (6.7)
Satisfaction of patient	15 (4.2)	13 (7.8)	0 (0.0)	2 (22.2)	–	19 (6.0)	11 (4.6)	–	30 (5.4)
Burden of caregiver	5 (1.4)	9 (5.4)	0 (0.0)	0 (0.0)	–	6 (1.9)	8 (3.4)	–	14 (2.5)
Length of hospital stay	3 (0.8)	0 (0.0)	0 (0.0)	0 (0.0)	–	3 (0.9)	0 (0.0)	–	3 (0.5)
Living will	27 (7.5)	3 (1.8)	0 (0.0)	1 (11.1)	–	20 (6.3)	11 (4.6)	–	31 (5.6)
Other	5 (1.4)	1 (0.6)	0 (0.0)	0 (0.0)	–	6 (1.9)	0 (0.0)	–	6 (1.1)

Number (%). *P*-values were tested by χ^2-test. †Other included part-time doctors, retired doctors, researchers and so on. ‡Multiple answers were allowed. §Simple answer was allowed for nine items. *1 From Japanese Society for Parenteral and Enteral Nutrition *2 From Japan Gastroenterological Endoscopy Society *3 From American Society for Parenteral and Enteral Nutrition *4 From European Society for Gastroenterological Endoscopy Society. EN, enteral nutrition; ND, not determined; PEG, percutaneous endoscopic gastrostomy; TF, tube feeding.