Obtaining Information from Family Caregivers Is Important to Detect Behavioral and Psychological Symptoms and Caregiver Burden in Subjects with Mild Cognitive Impairment

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Key Words
Adult day care services · Mild cognitive impairment · Behavioral and psychological symptoms · Family caregiver burden

Abstract
Background: The objectives of this study are to clarify the differences between the difficulties in daily life experienced by patients with both mild cognitive impairment (MCI) and chronic disease and those experienced by healthy elderly individuals. Methods: We assessed (a) cognitive function; (b) gait ability; (c) behavioral and psychological symptoms (observed at home); (d) activities of daily living (observed at home); (e) family caregiver burden, and (f) intention to continue family caregiving of 255 cognitively normal and 103 MCI subjects attending adult day care services covered by long-term care insurance, and compared the two groups. Results: Subjects with MCI display more behavioral and psychological symptoms than cognitively normal subjects, posing a heavy caregiver burden (p < 0.01). Behavioral and psychological symptoms most commonly observed in subjects with MCI are apathy, hallucinations, delusions, agitation, and aberrant motor behavior. Conclusion: Information regard-
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Introduction

Mild cognitive impairment (MCI) can be a transitional state between normal cognition and dementia, which is recognized as an early manifestation of dementia. Early lifestyle intervention and cognitive rehabilitation may prevent the transition to dementia or delay the progression of the disease [1]. The early detection and management of MCI are important issues that need to be addressed to reduce the number of elderly subjects developing dementia.

Other studies reported that chronic diseases increase the risk of developing MCI [2, 3]. Most adult day care users receiving rehabilitation or nursing care are certified as requiring long-term care. Many of them have chronic diseases, such as cerebrovascular disorders and joint disease, and are considered to be presenting signs of MCI during their stay in the day care center. In this center, professional rehabilitation specialists such as physical therapists (PT) and occupational therapists are assigned to provide lifestyle modification advice and rehabilitation to prevent the development and progression of dementia. However, knowledge of and skills to manage dementia are not sufficient in other health-care professionals who do not specialize in dementia care [4], so that elderly subjects with MCI may be overlooked in day care settings. This study aims to clarify the differences between the difficulties in daily life experienced by patients with both MCI and chronic disease and those experienced by healthy elderly individuals.

Methods

Subjects

This study was conducted as a part of the 2009 research programs of the Japanese Physical Therapy Association to understand daily in-home activities of elderly people with dementia [5]. We asked 542 PT working at adult day care and 24-hour residential care facilities throughout Japan for study cooperation, and 324 responses (response rate: 59.8%) were obtained. The 324 PT selected 594 subjects who scored 0 or 0.5 on the Clinical Dementia Rating (CDR) [6], were living with family caregivers, and consented to this study (CDR 0, n = 306; CDR 0.5, n = 288). The cognitively normal and MCI groups were classified as (a) not demented; (b) cognitively normal subjects with a CDR score of 0 and MCI subjects with a CDR score of 0.5; (c) having more than 24 points on the mini-mental state examination (MMSE) [7]; (d) having independent gait, and (e) not being suspected of having depression (<8 points on the Cornell scale for depression in dementia) [8]. In total, 358 subjects (cognitively normal group: 255, MCI group: 103) meeting the above criteria were examined.

Evaluation

Surveys performed between December 2009 and February 2010 by PT were collected using the Internet. Basic information on the subjects (age, gender, level of care needs, underlying cause of the long-term care needs, presence or absence of complications, time the subject reached the present care level, and use of psychoactive drugs), the family caregivers (age,
gender, length of caregiving, and family members living together), and the frequency of attendance at the day care center were investigated. The level of care needs was determined using the classification employed by Japan’s long-term care insurance system. There are seven levels altogether (two ‘needing support’ levels and five ‘needing care’ levels). The higher the level, the more comprehensive the required care (needing support levels 1 and 2: not deemed as needing care, but requiring social support; needing care levels 1 and 2: needs mild care for some aspects of daily living). Measurements of the elderly subjects were performed using the CDR, MMSE, Neuropsychiatric Inventory [NPI; 10 items, score range: 0–120, the higher the score, the severer the behavioral and psychological symptoms of dementia (BPSD)] [9], Timed Up and Go (TUG) test (measurement of the time in seconds for the patient to rise from sitting on a chair, walking 3 m, turning, walking back to the chair, and sitting down; <20 s = independent in transfer) [10], and the Barthel Index (BI; 10 items, score range: 0–100, a higher score indicates more independent activities of daily living) [11]. For family caregivers, their burden was measured using the Zarit Caregiver Burden Interview-8 (ZBI-8; 8 items, score range: 0–32, a higher score indicates a more severe caregiver burden) [12], and their intention to continue caregiving was investigated. The family’s intention to continue caregiving at home was rated on a 4-point rating scale: ‘strongly agree’, ‘agree’, ‘disagree’, and ‘strongly disagree’. The PT assessed the subjects using the CDR scale, NPI, and BI by having an interview with family caregivers about daily in-home activities of the elderly subjects. Regarding the MMSE and TUG, the PT directly assessed the subjects. In this study, assessments were conducted by many PT, so we used measures of subjects’ conditions that have already been confirmed as reliable. PT were issued with and required to follow the assessment procedures detailed in a 19-page manual.

Statistical Analysis

To compare differences between the cognitively normal and MCI groups, the Mann-Whitney U test was used to analyze the rating scale results (MMSE, NPI, BI, and ZBI-8), and the χ2 and Fisher exact test were used to analyze the demographic data, number of subjects corresponding to the NPI subitems, and the family’s intention to continue caregiving at home, using SPSS Statistics for Windows version 18.0. The cognitively normal and MCI groups as dependent variables, age and gender of the subjects and caregivers and the level of care needs as independent variables were forcibly entered in the first set. In the second set, for the items that demonstrated a significant difference in the above univariate analysis as independent variables, a logistic regression analysis was performed using a likelihood ratio step-up procedure.

Statement of Ethics

This study was approved by the Research Ethics Committee of the Society of Physical Therapy Science (approval No. SPTS2009007). Consent for this study was obtained from each PT using the Internet. For the subjects and family caregivers, each PT obtained their consent after explaining the study purpose in written form. Information that can be used to identify any individual was not collected.

Results

Demographic Data of the Cognitively Normal and MCI Groups and the Frequency of Attendance at the Day Care Center

The subjects consisted of 137 males (38.3%) and 221 females (61.7%), with a mean age of 81.2 ± 7.1 years. The underlying causes that led to the need for long-term care (chronic
Diseases) were cerebrovascular disease [146 subjects (40.8%)], bone and joint disease [122 subjects (34.1%)], and other chronic diseases [90 subjects (25.1%)]. Complications such as cerebrovascular disease, heart disease, diabetes, bone and joint disease were observed in 185 subjects (51.7%). The mean TUG and mean BI scores were 19.0 ± 13.3 s and 83.8 ± 16.9, respectively. Half of the subjects had complications in addition to their underlying disease. Gait ability was at the ‘independent gait just possible’ level. Of the total subjects, 84.4% had been at the present care level for over 1 year.

A significant difference was observed in the level of care needs between the cognitively normal and MCI groups. In the cognitively normal group, there were 129 subjects (50.6%) requiring support with a needing support level of 1 and 2, which was higher than those in

Table 1. Demographic characteristics of the subjects and their family caregivers

|                              | Cognitively normal group (n = 255) | MCI group (n = 103) | p     |
|------------------------------|-----------------------------------|---------------------|-------|
| Mean age of subjects ± SD, years | 80.9 ± 7.1                        | 82.0 ± 7.2          | 0.223 |
| Male                         | 92 (36.1)                        | 45 (43.7)           | 0.188 |
| Female                       | 163 (63.9)                       | 58 (56.3)           |       |
| Underlying cause that led to long-term care needs |                          |                    |       |
| Cerebrovascular disease      | 95 (37.3)                        | 51 (49.5)           | 0.089 |
| Bone and joint disease       | 94 (36.9)                        | 28 (27.2)           |       |
| Other                        | 66 (25.9)                        | 24 (23.3)           |       |
| Complications                |                                   |                     |       |
| Present                      | 126 (49.4)                       | 47 (45.6)           | 0.560 |
| Absent                       | 129 (50.6)                       | 56 (54.4)           |       |
| Level of care needs          |                                   |                     |       |
| Support levels 1, 2          | 129 (50.6)                       | 37 (35.9)           | 0.042 |
| Care levels 1, 2             | 101 (39.6)                       | 53 (51.5)           |       |
| Care level >3                | 25 (9.8)                         | 13 (12.6)           |       |
| The time the subject reached the present care level |                          |                    |       |
| More than 1 year             | 219 (85.9)                       | 85 (82.5)           | 0.412 |
| Within 1 year                | 36 (14.1)                        | 18 (17.5)           |       |
| Use of psychoactive drugs    | 9 (3.5)                          | 8 (7.8)             | 0.080 |
| Mean age of caregivers ± SD, years | 63.9 ±11.7                      | 64.0 ±12.4          | 0.879 |
| Male                         | 67 (26.3)                        | 17 (16.5)           | 0.054 |
| Female                       | 188 (73.7)                       | 86 (83.5)           |       |
| Mean length of caregiving ± SD, years | 4.8 ± 4.3                       | 4.7 ± 4.0           | 0.694 |
| Number of family members living together |                          |                    |       |
| 1                            | 9 (3.5)                          | 7 (6.8)             | 0.453 |
| 2                            | 83 (32.5)                        | 37 (35.9)           |       |
| 3                            | 65 (25.5)                        | 25 (24.3)           |       |
| >4                           | 98 (38.4)                        | 34 (33.0)           |       |

Values are n (%) of subjects, unless otherwise stated. Age, length of caregiving: Mann-Whitney U test; other: χ² and Fisher’s exact test. Other diseases as an underlying cause that led to the long-term care need included cardiovascular disease, respiratory disease, cancer, and Parkinson’s disease. Complications included cerebrovascular disease, heart disease, diabetes, and bone and joint disease. Each of these complications was found to be suffered by approximately 10% of all study subjects. Level of care needs was determined using the classification employed by Japan’s long-term care insurance system. Needing support levels 1 and 2: not deemed as needing care, but requiring social support; needing care levels 1 and 2: needs mild care for some aspects of daily living.
Eighty-three subjects (32.5%) presented at least one symptom on the NPI in the cognitively normal group, which was significantly lower than in the MCI group [61 subjects (59.2%); \( \chi^2 = 21.7, p < 0.01 \)]. The most common symptoms observed on the NPI in the MCI group were apathy in 36 (35.0%), followed by depression in 23 (22.3%), irritability in 15 (14.6%), and agitation in 14 (13.6%) subjects.

Symptoms observed at a higher rate in the subjects of the MCI group than in the cognitively normal group were as follows: apathy in 46 cognitively normal subjects and agitation in 44 MCI subjects. Symptoms observed at a lower rate in the subjects of the MCI group than in the cognitively normal group were as follows: depression in 28 cognitively normal subjects and irritability in 21 MCI subjects.

The mean MMSE score was 27.8 ± 1.9 in the cognitively normal group and 26.3 ± 1.8 in the MCI group. The mean NPI score was 1.4 ± 3.1 in the cognitively normal group and 2.4 ± 3.4 in the MCI group. The mean BI was 85.1 ± 15.7 in the cognitively normal group and 78.0 ± 18.3 in the MCI group. The mean ZBI-8 score was 5.2 ± 5.4 in the cognitively normal group and 8.3 ± 6.5 in the MCI group. No significant difference was observed in the TUG and the family's intention to continue home-based care (table 3).

### Table 2: Frequency of day care center attendance

| Types of day care | Frequency | Hours of use |
|------------------|-----------|-------------|
| Only basic care  | 2 days/week | 6–8 hours |
| Rehabilitation   | 3 days/week | >8 hours   |

| Cognitively normal group (n = 103) | MCI group (n = 255) |
|------------------------------------|---------------------|
| Subjects who presented symptoms on the NPI | Subjects who presented symptoms on the NPI |
| 83 subjects (32.5%) | 61 subjects (59.2%) |
| \( \chi^2 = 21.7, p < 0.01 \) |  

The most common response to the time spent at the day care center was 6–8 h (264 subjects (74.7%)).

The results of the above rating scales indicated a poor condition in the MCI group (p < 0.01). No significant difference was observed in the TUG and the family's intention to continue home-based care (table 3).
normal (18.0%) and 36 MCI subjects (35.0%; \( \chi^2 = 11.883, p < 0.01 \)), hallucinations in 4 cognitively normal (1.6%) and 8 MCI subjects (7.8%; \( \chi^2 = 8.701, p < 0.01 \)), delusions in 6 cognitively normal (2.4%) and 8 MCI subjects (7.8%; \( \chi^2 = 5.723, p < 0.05 \)), agitation in 16 cognitively normal (6.3%) and 14 MCI subjects (13.6%; \( \chi^2 = 5.117, p < 0.05 \)), and aberrant motor behavior in 4 cognitively normal (1.6%) and 7 MCI subjects (6.8%; \( \chi^2 = 6.732, p < 0.05 \)) (table 4).

**Differences between the Cognitively Normal and MCI Groups**

Logistic regression analysis was performed, with the following parameters as independent variables to compare the two groups: level of care needs, MMSE, presence or absence of NPI symptoms, total score of the NPI, BI, and ZBI-8, which were shown to be significantly different in bivariable analyses, as shown in the results section, presence or absence of the NPI subitems (apathy, hallucinations, delusions, agitation, and aberrant motor behavior).
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As a result, the p values for the $\chi^2$ test and Hosmer-Lemeshow test were 0.01 and 0.789, respectively, with an identification accuracy of 76.4%. The MMSE ($p < 0.01$), presence or absence of NPI symptoms ($p < 0.05$), and ZBI-8 ($p < 0.01$) were selected as independent variables in a regression equation (Table 5).

**Discussion**

This study aims to clarify the differences between the difficulties in daily life experienced by patients with both MCI and chronic disease and those experienced by healthy elderly individuals. Bivariate analyses showed that the MCI group had significantly poorer results regarding the level of care needs, MMSE, NPI, BI, and ZBI-8 than the cognitively normal group. As a result of logistic regression analysis, the MMSE, presence or absence of NPI symptoms, and ZBI-8 were identified as significant independent variables for comparing the cognitively normal and MCI groups attending day care services. The MMSE is reported to have a ceiling effect that makes it insensitive to the signs of MCI [13]. The results suggested that MCI may be detectable in subjects suspected of having a reduced cognitive function by investigating BPSD on collecting information from the family caregivers and assessing their caregiving burden.

BPSD, which are more frequently observed in the elderly with MCI than in healthy elderly individuals, are apathy, depression, anxiety, irritability, and agitation [14]. Apathy is reportedly a risk factor for progression from MCI to dementia [15, 16]. Another epidemiological study of MCI reported that the presence or absence of apathy can be a predictive marker for discriminating patients with MCI, because elderly subjects with apathy have a higher incidence of diseases than those with delusions or hallucinations, and apathy is also often observed in patients with MCI compared with healthy individuals [14]. In this study, the most common BPSD in the MCI group was apathy (35.0%), followed by depression (22.3%), irritability (14.6%), and agitation (13.6%), and the symptoms observed in a higher percentage of the subjects in the MCI than the cognitively normal group were apathy ($p < 0.01$), hallucinations ($p < 0.01$), delusions ($p < 0.05$), agitation ($p < 0.05$), and aberrant motor behavior ($p < 0.05$). The identification of BPSD is considered important for the early detection of MCI.

Regarding caregiving for patients with MCI, the objective caregiver burden such as care of the physical condition or severe BPSD was reported to be generally low, while the

| Partial regression coefficient | p     | Odds ratio | 95% confidence intervals |
|-------------------------------|-------|------------|-------------------------|
| Age of the subjects           | –0.003| 0.879      | 0.997                   | 0.958                   | 1.037                   |
| Gender of the subjects        | –0.371| 0.270      | 0.690                   | 0.357                   | 1.334                   |
| Age of the caregivers         | –0.005| 0.719      | 0.995                   | 0.970                   | 1.021                   |
| Gender of the caregivers      | 0.424 | 0.229      | 1.527                   | 0.766                   | 3.045                   |
| Level of care needs           | 0.234 | 0.233      | 1.264                   | 0.860                   | 1.857                   |
| MMSE                          | –0.393| <0.001     | 0.675                   | 0.585                   | 0.779                   |
| NPI                           | 0.651 | 0.018      | 1.917                   | 1.116                   | 3.295                   |
| ZBI-8                         | 0.364 | 0.005      | 1.440                   | 1.114                   | 1.860                   |
| Constant                      | 8.457 | 0.006      |                         |                         |                         |

Model $\chi^2$ test: $p < 0.01$; identification accuracy: 76.4%.
subjective caregiver burden concerning the patient's memory problems was becoming a source of concern, including asking the same question repeatedly, difficulty remembering recent events, and losing or misplacing things [17]. The family's intention to continue caregiving was maintained in caregivers of the MCI subjects, but their caregiver burden was significantly elevated compared with that of caregivers of cognitively normal subjects, suggesting the need of intervention for family caregivers during the early stage of cognitive impairment. The main purpose of day care is respite. Evaluation of patients' functioning and abilities is carried out in the day care setting, but similar evaluation in the home environment is sadly lacking. We should collect information from family caregivers and assess their caregiving burden.

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**Disclosure Statement**

The authors have no conflicts of interest to disclose.

**References**

1. Suzuki T, Shimada H, Makizako H, Doi T, Yoshida D, Ito K, Shimokata H, Washimi Y, Endo H, Kato T: A randomized controlled trial of multicomponent exercise in older adults with mild cognitive impairment. PLoS One 2013; 8:e61483.
2. Kittilstved K, Helkala EL, Hänninen T, Laakso MP, Hallikainen M, Ahlainen K, Soininen H, Tuomilehto J, Nisinen A: Midlife vascular risk factors and late-life mild cognitive impairment: a population-based study. Neurology 2001; 56:1683–1689.
3. Ott A, Stolk RP, van Harskamp F, Pols HA, Hofman A, Breteler MM: Diabetes mellitus and the risk of dementia: the Rotterdam Study. Neurology 1999; 53:1937–1942.
4. The Ministry of Health, Labour and Welfare: A report on ‘the comprehensive strategy to accelerate dementia services from the Ministry of Health, Labour, and Welfare: a report of the research team program for understanding daily in-home activities of elderly people with dementia’ (in Japanese). Tokyo, 2010, pp 8–12.
5. Hughes CP, Berg L, Danziger WL, Coben LA, Martin RL: A new clinical scale for the staging of dementia. Br J Psychiatry 1982; 140:566–572.
6. Folstein MF, Folstein SE, McHugh PR: ‘Mini-mental state’: a practical method for grading cognitive state of patients for clinician. J Psychiatr Res 1975; 12:189–198.
7. Alexopoulos GS, Abrams RC, Young RC, Shamoian CA: Cornell scale for depression in dementia. Biol Psychiatry 1988; 23:271–284.
8. Cummings J, Mega M, Gray K, Rosenbloom-Thompson S, Carusi DA, Gornbein J: The neuropsychiatric inventory: comprehensive assessment of psychopathology in dementia. Neurology 1994; 44:2308–2314.
9. Shumway-Cook A, Brauer S, Woollacott M: Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. Phys Ther 2000; 80:896–903.
10. Mahoney FI, Barthel DW: Functional evaluation: the Barthel Index. Md State Med J 1965; 14:61–65.
11. Arai Y, Tamiya N, Yano E: The short version of the Japanese version of the Zarit Caregiver Burden Interview [J-ZBI _8]: its reliability and validity (in Japanese). Jpn J Geriat 2003; 40:497–503.
13 Tombaugh TN, McIntyre NJ: The mini-mental state examination: a comprehensive review. J Am Geriatr Soc 1992; 40: 922–935.

14 Geda YE, Roberts RO, Knopman DS, Petersen RC, Christianson TJ, Pankratz VS, Smith GE, Boege BF, Ivnik RJ, Tangalos EG, Rocca WA: Prevalence of neuropsychiatric symptoms in mild cognitive impairment and normal cognitive aging: population-based study. Arch Gen Psychiatry 2008; 65: 93–1198.

15 Palmer K, Di Iulio F, Varsi AE, Gianni W, Sancesario G, Caltagirone C, Spalletta G: Neuropsychiatric predictors of progression from amnestic-mild cognitive impairment to Alzheimer’s disease: the role of depression and apathy. J Alzheimers Dis 2010; 20: 175–183.

16 Vicini Chilovi B, Conti M, Zanetti M, Mazzù I, Rozzini L, Padovani A: Differential impact of apathy and depression in the development of dementia in mild cognitive impairment patients. Dement Geriatr Cogn Disord 2009; 27: 390–398.

17 Garand L, Dew MA, Eazor LR, DeKosky ST, Reynolds CF: Caregiver burden and psychiatric morbidity in spouses of persons with mild cognitive impairment. Int J Geriatr Psychiatry 2005; 20: 512–522.