The relationship between health-related quality of life and higher-level functional capacity in elderly women with mild cognitive impairment

KAZUYOSHI KAMEYAMA, OTR1), AKIMITSU TSUTOU, MD2), HIDEMI FUJINO, PhD2)*

1) Hakuhokai Medical College, Japan
2) Department of Rehabilitation Science, Kobe University Graduate School of Health Sciences: 7-10-2 Tomogaoka, Suma-Ku, Kobe 654-0142, Japan

Abstract. [Purpose] To clarify health-related quality of life (HR-QOL) in subjects with mild cognitive impairment (MCI), using EuroQOL (EQ-5D), and to investigate the relationship between HR-QOL and Tokyo Metropolitan Institute Gerontology Index of Competence (TMIG-IC) scores. [Subjects and Methods] The subjects included 25 women with MCI or frail constitutions. A variety of methods were used to assess mental states and activities of daily living (ADL). [Results] EQ-5D scores were significantly lower in the MCI group than in the normal cognitive (NC) group. Among the assessed subscales, the percentages of participants with “moderate problems” during self-care and “moderate and extreme problems” during usual activities were significantly higher in the MCI group. TMIG-IC scores were significantly lower in the MCI group than in the NC group. There was a positive correlation between TMIG-IC and EQ-5D scores in the MCI group. There were also significant positive correlations between instrumental activities of daily living and social roles between EQ-5D and TMIG-IC scores in the MCI group. [Conclusion] TMIG-IC scores may reflect cognitive disorders earlier than BI and FIM. The decline of TMIG-IC scores, especially for IADL and social roles, affects HR-QOL even in the early phases of cognitive impairment.

Key words: Mild cognitive impairment, Health-related quality of life, Higher-level functional capacity

INTRODUCTION

Petersen et al. reported that, although subjects with mild cognitive impairment (MCI) have memory impairment beyond that expected for their age and education, these individuals are not demented1). An international working group made the specific recommendations regarding the general MCI criteria2). The term MCI is generally used to refer to a transitional zone between normal cognitive function and clinically probable Alzheimer’s disease3). Therefore, subjects with MCI are at increased risk of progressing to Alzheimer’s disease. Recent clinical and population-based studies suggest that the global prevalence of MCI is 10–29% among persons aged >65 years; however, the lack of standardized diagnostic criteria and differences in sample characteristics across studies have led to significant uncertainty regarding these estimates4–6). In 2012, the estimated prevalence of dementia and MCI were 15% and 13%, respectively, in Japan7). However, Bruscoli et al. reported a 10.24% mean annual conversion rate of MCI to dementia8). Therefore, there is an urgent need to find ways to suppress or delay the progression of dementia in subjects with MCI. Because activity of daily living (ADL) deteriorates with dementia progression, it is necessary to evaluate ADL in subjects with dementia. The Barthel Index (BI) and Functional Independence Measure (FIM) are generally used to evaluate ADL. The Tokyo Metropolitan Institute Gerontology Index of Competence (TMIG-IC), which is designed to measure three factors (instrumental self-maintenance, intellectual activity, and social roles) of higher-level competence, is also commonly used to evaluate ADL9).
Psychotropic drugs, including anti-dementia drugs, are often prescribed to patients with cognitive impairment for treatment of both core symptoms as well as behavioral and psychological symptoms of dementia (BPSD). In combination with drug treatment, cognitive stimulation, training, and rehabilitation have also been used in dementia care. To date, although these drugs can attenuate or interrupt the progression of symptoms, they typically only have limited and transient symptomatic effects. The health-related quality of life (HR-QOL) scale, together with evaluation of improvement in core symptoms and BPSD, has generally been used as one outcome index for evaluating the effects of interventions.

Subjects with MCI have significantly higher Alzheimer Disease Related Quality of Life (ADRQL) scores compared to those of subjects with dementia. However, using the Thai version of the World Health Organization Quality of Life scale, Muangpaisan et al. reported that subjects with MCI had lower psychological QOL scores compared to those of normal subjects. Moreover, they reported observing significant correlations between the Thai version of the Geriatric Depression Scale (TGDS) and physical QOL, TGDS and psychological QOL, and TGDS and total QOL scores in individuals aged ≥50 years with or without MCI diagnosis. Similarly, Teng et al. reported that multiple linear regression analysis in the MCI group revealed that both subject and informant Quality of Life Alzheimer’s Disease (QOL-AD) ratings correlated with depressive symptoms and that informant QOL-AD ratings correlated with a broader spectrum of behavioral symptoms and IADL performance. Although subjects with MCI often present with behavioral changes such as depression, dysphoria, apathy, irritability, and anxiety, they do not always present with BPSD. Among the four aspects of social activity (personal activities, socially-related activities, learning activities, and job activity), higher levels of engagement in the personal activities among elderly women aged 65–84 years living in urban areas were significantly related to life satisfaction. However, none of these aspects of social activity were significantly related to life satisfaction in elderly men. Thus, the differential effects of gender on QOL were confirmed. Moreover, parts of the Philadelphia Geriatric Center (PGC) Morale Scale that evaluate subjective well-being were significantly higher in men than in women, also suggesting the differential effects of gender on subjective well-being. Previous studies did not clarify whether HR-QOL and IADL of subjects with MCI were influenced by the presence of BPSD or gender difference.

The purpose of this study was to clarify (1) whether scores of EuroQol (EQ-5D), which can be used to represent HR-QOL, are maintained, (2) whether TMIG-IC scores used to measure higher-level competence reflect cognitive disorder earlier than BI and/or FIM, and (3) whether TMIG-IC scores reflect HR-QOL status in elderly female subjects with MCI and without BPSD.

SUBJECTS AND METHODS

The subjects included 25 women aged 65 years and over who were diagnosed with no obvious cognitive impairment or frail constitutions. All subjects were recruited from among community residents living in Okayama prefecture, who attended day-care facilities. The subjects were first assessed using the Mini-Mental State Examination (MMSE) and Functional Assessment Staging Test (FAST). They were then assessed using the Neuropsychiatric Inventory (NPI) to confirm the complete absence of emotional changes such as BPSD. Subsequently, the Barthel Index (BI) and Functional Independence Measure (FIM) were used to evaluate ADL.

The TMIG-IC was used to evaluate higher-level functional capacity. The TMIG-IC is a multidimensional, 13-item scale that comprises three subscales: instrumental ADL (IADL; five items), intellectual activity (four items), and social role (four items). The response to each item is either “yes” (able to perform, 1 point) or “no” (unable to perform, 0 points) for a maximum score of 13 points. The IADL subscale score ranges from 0 to 5 points, the intellectual activity subscale score ranges from 0 to 4 points, and the social role subscale score ranges from 0 to 4 points. Higher scores reflect higher levels of competence. A person is defined as having a disability for scores ≥1 below the respective full mark. A score of ≤4 out of 5 for ADL or a score of ≤3 out of 4 for intellectual activity or social role are considered to indicate disability within the respective subscales.

HR-QOL was assessed using the EQ-5D. The EQ-5D defines health status in terms of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each of these five dimensions is further divided into three levels: no problem, moderate problems, and extreme problems. Each subject is scored, with points ranging from 1 for full health (no problems in any dimension) to −0.111 for severe problems based on conversion tables for all five dimensions.

In general, MMSE scores ≥27 points (out of 30) indicate normal cognition. Lower scores can indicate severe (≤9 points), moderate (10–18 points), or mild (19–24 points) cognitive impairment. Therefore, the present study categorized the subjects into groups with no cognitive impairment (MMSE scores ≥27, FAST stage = 1) and with MCI (MMSE scores ≤ 26, FAST stage = 3).

Independent-sample Mann–Whitney U-tests were used to compare the mean MMSE, BI, EQ-5D, and TMIG-IC scores between the two groups. Fisher’s exact probability tests were used to compare the percentage of cases between the MCI and NC groups in the three categories of each EQ-5D domain. Spearman’s correlation coefficients were used to determine the concordance between EQ-5D and TMIG-IC. Differences were considered statistically significant when the p-value was <0.05.

This study was approved by the ethics committee of Kobe University Graduate School of Health Sciences (No. 136-1).
RESULTS

The subject characteristics are presented in Table 1. In total, 25 subjects who met the study conditions were enrolled. Among these, 11 were without cognitive impairment (normal cognitive group, NC group), whereas 14 had MCI (MCI group). Apart from a lower MMSE scores in the MCI group compared with those of the NC group, there were no significant differences in the background variables of both groups.

In addition to the total EQ-5D scores, Table 2 compares the EQ-5D domain scores between the NC and MCI groups. The mean EQ-5D score in the MCI group was significantly lower than that of the NC group (0.709 ± 0.01 vs. 0.804 ± 0.10). No significant differences were observed between the two groups regarding mobility, pain/discomfort, and anxiety/depression scores. However, self-care and usual activity scores were significantly lower in the MCI group compared with those of the NC group; i.e., more subjects with MCI had problems related to self-care and usual activity.

The comparison of the TMIG-IC domain scores in both groups is shown in Table 3. The TMIG-IC score in the MCI group was lower than that of the NC group (5.9 ± 2.5 vs. 9.1 ± 3.8). The IADL score was significantly lower in the MCI group than that of the NC group. However, there were no significant differences in scores related to intellectual activity and social roles.

The correlation coefficients between the EQ-5D score and each score of the other measures are shown in Table 4. A positive correlation between the TMIG-IC and EQ-5D scores (r = 0.745) was found in the MCI group.

As shown in Table 5, there was a positive correlation in the MCI group between IADL (r = 0.59) and social role (r = 0.75) scores in the analysis using TMIG-IC and EQ-5D, respectively.

Table 1. Demographics of normal cognitive and mild cognitive impairment subjects

|                | NC (n = 11)     | MCI (n = 14)    |
|----------------|-----------------|-----------------|
| Age (years)    | 82.1 ± 5.3      | 85.2 ± 4.3      |
| MMSE **        | 28.8 ± 1.1      | 23.9 ± 2.1      |
| BI             | 96.4 ± 3.8      | 94.6 ± 5.4      |
| FIM            | 123.5 ± 2.5     | 119.3 ± 7.0     |

Values are means ± SD. **p < 0.01
MMSE: Mini Mental State Examination, BI: Barthel index, FIM: Functional Independence Measure

Table 2. Comparison of EQ-5D domains scores of normal cognitive and mild cognitive impairment subjects

|                | NC (n = 11) | MCI (n = 14) |
|----------------|------------|-------------|
| EQ-5D *        | 0.804 (0.10) | 0.709 (0.11) |
| Mobility       |             |             |
| No problems (% of cases) | 9 (81.8%) | 10 (71.4%) |
| Moderate problems (% of cases) | 2 (18.2%) | 4 (28.6%) |
| Extreme problems (% of cases) | 0 (0%) | 0 (0%) |
| Self-care *    |             |             |
| No problems (% of cases) | 11 (100%) | 9 (64.2%) |
| Moderate problems (% of cases) | 0 (0%) | 5 (35.8%) |
| Extreme problems (% of cases) | 0 (0%) | 0 (0%) |
| Usual activity * |             |             |
| No problems (% of cases) | 9 (81.8%) | 4 (28.6%) |
| Moderate problems (% of cases) | 2 (18.2%) | 8 (57.1%) |
| Extreme problems (% of cases) | 0 (0%) | 2 (14.3%) |
| Pain/discomfort |             |             |
| No problems (% of cases) | 6 (54.5%) | 4 (28.6%) |
| Moderate problems (% of cases) | 5 (45.5%) | 10 (71.4%) |
| Extreme problems (% of cases) | 0 (0%) | 0 (0%) |
| Anxiety/depression |             |             |
| No problems (% of cases) | 9 (81.8%) | 13 (92.3%) |
| Moderate problems (% of cases) | 2 (18.2%) | 1 (0.7%) |
| Extreme problems (% of cases) | 0 (0%) | 0 (0%) |

EQ-5D: EuroQOL. *p < 0.05

and all subjects provided informed consent.
Subjects with MCI are nearly independent in daily life, and although there is a slight decline in their cognitive function, they are not demented. For MCI, the agreement between patient- and informant-rated QOL was not statistically significant\(^{26}\). Therefore, this study only assessed self-reported EQ-5D.

Previous studies have suggested that BPSD influences HR-QOL\(^{13, 16}\). However, our study subjects were elderly women without BPSD. The MCI group had lower EQ-5D scores compared to those of the NC group. This finding suggests that subjects with MCI without BPSD had lower HR-QOL compared with normal elderly people and that a factor other than BPSD was likely related to the low HR-QOL.

Comparison of EQ-5D domains revealed that scores pertaining to self-care and usual activity were lower in the MCI group compared with those of the NC group. In addition, there were no significant differences in BI and FIM, and the basic ADL of all subjects were normal. Therefore, our results suggest a correlation between HR-QOL and higher-level functional capacity.

Regarding IADL, Lawton and Brody proposed a model of competence for human behaviors\(^{27}\). They described the following hierarchy: life maintenance as the lowest level, followed by successively more complex levels of functional health, perception cognition, physical self-maintenance, instrumental self-maintenance, effectance (activity emanating from the motivation to explore), and social behavior. TMIG-IC is designed to cover the last three subscales of Lawton’s model\(^9\). A previous study reported that TMIG-IC scores decrease with age, reporting that the total mean value for women aged 80–84 years is 8.1 ± 4.4 points\(^9\). In this study, the TMIG-IC scores were lower in the MCI group than those of the NC group; the scores were lower than the aforementioned mean value. In addition, there was a correlation between EQ-5D and TMIG-IC (total score, IADL, and social role) in the MCI group.

Our data showed that the IADL and social role subscales of the TMIG-IC were associated with EQ-5D in the MCI group. We conclude that in people with MCI without BPSD, IADL and social role affect HR-QOL.

This study had several limitations. First, the sample size was small (n = 25). Second, our study subjects included only elderly women. Future studies are necessary to address these limitations.

In conclusion, the findings of the current study suggest the following: (1) TMIG-IC is superior to BI and FIM for estimating QOL in subjects with MCI without BPSD, and (2) IADL and social roles deteriorate in the early phases of cognitive impairment. Previous studies have reported that cognitive rehabilitation is an effective intervention to improve the QOL in elderly people with early dementia\(^{28, 29}\). We suggest that consideration of these points may be useful for designing rehabilitation programs for subjects with MCI without BPSD.

**REFERENCES**

1) Petersen RC, Smith GE, Waring SC, et al.: Mild cognitive impairment: clinical characterization and outcome. Arch Neurol, 1999, 56: 303–308. [Medline] [CrossRef]
2) Winblad B, Palmer K, Kivipelto M, et al.: Mild cognitive impairment—beyond controversies, towards a consensus: report of the International Working Group on Mild Cognitive Impairment. J Intern Med, 2004, 256: 240–246. [Medline] [CrossRef]

3) Kirova AM, Bays RB, Lagalwar S: Working memory and executive function decline across normal aging, mild cognitive impairment, and Alzheimer’s disease. Biomed Res Int, 2015, 2015: 748212. [Medline] [CrossRef]

4) Langa KM, Levine DA: The diagnosis and management of mild cognitive impairment: a clinical review. JAMA, 2014, 312: 2551–2561. [Medline] [CrossRef]

5) Petersen RC: Clinical practice. Mild cognitive impairment. N Engl J Med, 2011, 364: 2227–2234. [Medline] [CrossRef]

6) Plassman BL, Langa KM, Fisher GG, et al.: Prevalence of cognitive impairment without dementia in the United States. Ann Intern Med, 2008, 148: 427–434 Erratum in: Ann Intern Med, 2009, 151: 291–292. [Medline] [CrossRef]

7) Asada T: Investigation of the prevalence of dementia. http://www.mhlw.go.jp/file.jsp?id=146270&name=2r9852000033t9m_1.pdf#search='www.mhlw.go.jp%2Ffile.jsp%3Fid%3D146270%26name.'

8) Bruscoli M, Lovestone S: Is MCI really just early dementia? A systematic review of conversion studies. Int Psychogeriatr, 2004, 16: 129–140. [Medline] [CrossRef]

9) Koyano W, Shibata H, Nakazato K, et al.: Measurement of competence: reliability and validity of the TMIG Index of Competence. Arch Gerontol Geriatr, 1991, 13: 103–116. [Medline] [CrossRef]

10) Aguirre E, Woods RT, Spector A, et al.: Cognitive stimulation for dementia: a systematic review of the evidence of effectiveness from randomised controlled trials. Ageing Res Rev, 2013, 12: 253–262. [Medline] [CrossRef]

11) Bottino CM, Carvalho IA, Alvarez AM, et al.: Cognitive rehabilitation combined with drug treatment in Alzheimer’s disease patients: a pilot study. Clin Rehabil, 2005, 19: 861–869. [Medline] [CrossRef]

12) Pusswald G, Tropper E, Krystyn-Exner I, et al.: Health-related quality of life in patients with subjective cognitive decline and mild cognitive impairment and its relation to activities of daily living. J Alzheimers Dis, 2015, 47: 479–486. [Medline] [CrossRef]

13) Teng E, Tassniyom K, Lu PH: Reduced quality-of-life ratings in mild cognitive impairment: an analyses of subject and informant responses. Am J Geriatr Psychiatry, 2012, 20: 1016–1025. [Medline] [CrossRef]

14) Báriros H, Narciso S, Guerreiro M, et al.: Quality of life in patients with mild cognitive impairment. Aging Ment Health, 2013, 17: 287–292. [Medline] [CrossRef]

15) Missotten P, Squeulard G, Ylieff M, et al.: Quality of life in older Belgian people: comparison between people with dementia, mild cognitive impairment, and controls. Int J Geriatr Psychiatry, 2008, 23: 1103–1109. [Medline] [CrossRef]

16) Muangpaisan W, Assantachai P, Intalapaporn S, et al.: Quality of life of the community-based patients with mild cognitive impairment. Geriatr Gerontol Int, 2008, 8: 80–85. [Medline] [CrossRef]

17) Hwang TJ, Masterman DL, Ortiz F, et al.: Mild cognitive impairment is associated with characteristic neuropsychiatric symptoms. Alzheimers Dis Assoc Disord, 2004, 18: 17–21. [Medline] [CrossRef]

18) Lyketsos CG, Lopez O, Jones B, et al.: Prevalence of neuropsychiatric symptoms in dementia and mild cognitive impairment: results from the cardiovascular health study. JAMA, 2002, 288: 1475–1483. [Medline] [CrossRef]

19) Geda YE, Roberts RO, Knopman DS, et al.: Prevalence of neuropsychiatric symptoms in mild cognitive impairment and normal cognitive aging: population-based study. Arch Gen Psychiatry, 2008, 65: 1193–1198. [Medline] [CrossRef]

20) Okamoto H: [Effects of social activities on life satisfaction among the elderly: four aspects in men and women]. Nippon Koshu Eisei Zasshi, 2008, 55: 388–395. [Medline]

21) Nagata A, Yamagata Z, Nakamura K, et al.: [Sex differences in subjective well-being and related factors in elderly people in the community aged 75 and over]. Nippon Ronen Igakkai Zasshi, 1999, 36: 868–873. [Medline] [CrossRef]

22) EuroQol Group: EuroQol—a new facility for the measurement of health-related quality of life. Health Policy, 1990, 16: 199–208. [Medline] [CrossRef]

23) Koyano W, Hashimoto M, Fukawa T, et al.: Functional capacity of the elderly: measurement by the TMIG Index of Competence. Nihon Koshu Eisei Zasshi, 1993, 40: 468–474.

24) Folstein MF, Folstein SE, McHugh PR: “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res, 1975, 12: 189–198. [Medline] [CrossRef]

25) Mungas D: In-office mental status testing: a practical guide. Geriatrics, 1991, 46: 54–58, 63, 66. [Medline]

26) Ready RE, Ott BR, Grace J: Patient versus informant perspective of quality of life in mild cognitive impairment and Alzheimer’s disease. Int J Geriatr Psychiatry, 2004, 19: 256–265. [Medline] [CrossRef]
27) Lawton MP, Brody EM: Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist, 1969, 9: 179–186. [Medline] [CrossRef]

28) Kim S: Cognitive rehabilitation for elderly people with early-stage Alzheimer’s disease. J Phys Ther Sci, 2015, 27: 543–546. [Medline] [CrossRef]

29) Yoon JE, Lee SM, Lim HS, et al.: The effects of cognitive activity combined with active extremity exercise on balance, walking activity, memory level and quality of life of an older adult sample with dementia. J Phys Ther Sci, 2013, 25: 1601–1604. [Medline] [CrossRef]