Community based measures for managing mild cognitive impairment
Kenichi Meguro
Geriatric Behavioral Neurology, Tohoku University CYRIC

Abstract
A cross-sectional study of aged patients with mild cognitive impairment in a local community was undertaken to investigate the clinical features of the condition, in addition to a longitudinal study to research its progression to cognitive deficit. Impairment of the basic functions of attention and executive function was confirmed, as opposed to impairment in the cognitive domain itself. Magnetic resonance imaging (MRI) findings showed a pattern close to that of healthy persons in their 80s, rather than that of patients with cognitive deficit. The results of the longitudinal study showed more progression to cognitive deficit when the clinical dementia rating was 0.5 in domains other than memory. No effects of lifestyle, internal diseases or psychosocial intervention were confirmed. In progression to Alzheimer's disease, generally low cognitive function and general atrophy were involved, whereas frontal lobe function, atrophy of the frontal and temporal lobes, white matter changes and cerebral infarction were related to progression to vascular dementia. Excessive dependence on primary prevention should be avoided for aged patients with mild cognitive impairment; rather, secondary prevention, using clinical dementia rating, psychological testing and MRI are desirable.

Introduction: concept of mild cognitive impairment and its history
‘Cognitive deficit’ is defined as a condition in which a person cannot lead a normal social life due to cognitive deficit, whereas a borderline condition is defined as a low-level cognitive deficit causing no problems in terms of leading a social life. This is a logical idea based on the definition of cognitive deficit (DSM-III-R), which is defined as a functional disorder of multiple cognitive domains as the necessary condition and impairment of social activities as the sufficient condition. Cognitive function is evaluated by observation of daily life and neuropsychological tests, whereas social activities are assessed mainly by observation of daily life.

Flicker et al. first used the term ‘mild cognitive impairment’ (MCI) for the borderline condition.¹ Originally, MCI referred to severity classified as level 3 on the basis of the clinical observation scale called the Global Deterioration Scale.² Later, Petersen et al. proposed a slightly different idea of MCI.³ Recently, the term ‘MCI’ has been widely used as either a cross-sectional term to denote people whose condition is somewhere between that of healthy people and patients with cognitive deficit or as a longitudinal term for a predementia stage that predicts further decline to dementia. However, MCI originated as a concept
based on a longitudinal paradigm and was used to try to determine how early it was possible to identify those patients who would progress to cognitive deficit, especially Alzheimer’s disease (AD).

When Petersen et al.\textsuperscript{3} suggested the use of the term MCI, it was defined as describing people who met the following five criteria, based on a longitudinal paradigm of early detection of the group of patients who develop AD, who display the following: (i) subjective memory complaints; (ii) a decrease in objective memory test results; (iii) generally normal cognitive function; (iv) normal daily life activity; and (v) no dementia. However, in January 2005, Petersen and Knopman\textsuperscript{4} suggested to the MCI Expert Committee of the International Psychogeriatric Association (IPA) that, rather than being a single disease, MCI is a broad category of conditions that develop in the cognitively impaired not demented (CIND), although it partially includes age-associated memory impairment and age-associated cognitive decline (AACD). So, people who could be described as displaying AACD are less impaired than those with MCI, who, in turn, are less impaired than those described by the term CIND. Conversely, Dubois and Albert argued that ‘MCI status’ would exist as the mildest condition of individual neurological disorders and there would be no one disease concept (entity) of MCI that would progress to AD, vascular dementia (VaD) or dementia with Lewy bodies (DLB).\textsuperscript{5} I agree with this theory developed by Dubois and Albert (except for VaD). Neurodegenerative diseases, such as AD, are defined on the basis of a clinicopathological theory. During the development of neurofibrillary tangles in the brain or senile plaques, a range of symptoms can be observed, including normal clinical symptoms,\textsuperscript{6} cognitive impairment that is not so severe as to cause problems in daily life (MCI status) or changes in a person’s ability to participate in daily life (dementia level). That is, MCI is not an independently established disease that may progress to cognitive deficit like an anaplastic cell. There are ‘diseases’, such as AD, VaD and DLB, that have ‘MCI status’. This follows the same logic as the suggestion that there are various neurological diseases that can act as underlying causes for dementia.

Cross-sectional study
Cognitive deficit
With regard to cognitive deficits, MCI is considered to be a condition that falls on the borderline between healthy people and patients with dementia. Based on epidemiology, the most common background pathology of dementia is AD with cerebrovascular diseases (CVD). We assume that this is also the case for MCI.\textsuperscript{7} In aged MCI outpatients, no clear differences are observed in test results between patients who are almost healthy and those who almost qualify as having dementia. However, one of the features of neuropsychoepidemiology
undertaken in the Tajiri project is the cognitive deficit test for aged people who were selected from aged people in the community with a small selection bias. Using the ADAS-Cog word list learning test to confirm language memory, MCI patients showed good results in a recognition test, but the level of free recall was low. In addition, words that were never recalled in three tests (never-recall words) were confirmed in MCI patients. Because education must have an impact on the language task, the learning effect was evaluated using nonsense figures (Rey figure). As a result, a learning effect was confirmed in healthy people, whereas no such effect was observed in MCI patients. In addition, an assessment of free writing results in the Mini Mental State Examination (MMSE) from standpoints of wrong shapes and the use of words, such as wrong declensional Kana ending, suggested low or disturbed ability to pay attention in writing. In addition, distinctive ability was assessed using the Benton visual form discrimination test with small burden on memory. The assessment results confirmed a significant difference in total points, even in the group who showed normal results in the test of delayed recall of three words.

A common feature of the aforementioned test results was the disorder of attention that is considered to be the basis of cognitive domains, such as memory, language and visual–spatial cognitive function. Attention may be classified as sustained attention, divided attention or shifting. It has been reported that divided attention and shifting would be damaged in early stages of AD. It is supposed that a base of cognitive deficit may be developed even in patients with broad MCI.

Problems in daily life
As mentioned above, MCI is defined as a condition that produces no problems in daily life, although patients may have cognitive dysfunction. However, broad MCI includes cases with mild disorders in daily life, although these patients do not have severe problems, as seen for patients with dementia. Although no difference was found between healthy people and MCI patients with regard to memory complaints, a feature of MCI patients was distinctively expressed awareness of problems in daily life. The clinical dementia rating (CDR), a scale for the observation of daily life, examines the ability of patients to participate in activities relating to the domains of ‘home’, ‘hobbies’ and ‘social life’. In household tasks of daily life, sequencing (e.g. washing, hanging out to dry, folding laundry for storage), parallel activity (e.g. cooking while using a washing machine) and planning (e.g. shopping after setting the menu and then starting to cook) are required. These processes are referred to neuropsychologically as executive functions. The ability to operate home appliances, such as a television remote control and electrical switches, is considered to be instrumental ADL. People with broad MCI may show mild
disorder in both executive function and instrumental ADL. Another feature of MCI patients is moderately passive participation and lowered interest in their favorite activities. In addition, careful attention should be paid to cases of broad MCI to prevent non-compliance with medication regimens. Some patients have a reduced ability to manage schedules and therefore may sometimes visit a physician on the wrong day, or are reluctant to participate in voluntary tasks as, for example, a member of an aged group. Another feature of patients with broad MCI is decreased activity due to lowered desire to participate in local activities etc.  

Magnetic resonance imaging findings
Independent of the CDR assessment, the MRI findings of atrophy were assessed by neurologists visually on a four-point scale as follows: 0, no atrophy; 1, an intermediate level of atrophy; 2, obvious atrophy; and 3, significant atrophy. Findings having scores of 2 or 3, which were considered clinically obvious atrophy, were assessed as positive. As a result, it was confirmed that the AD group showed atrophy of the medial temporal lobe and that the findings of MCI patients were close to those of healthy people aged in their 80s. Obvious differences in atrophy in the medial temporal lobe between healthy people aged in their 80s and AD patients are clinically important.

Longitudinal study
When the mildest symptoms of a specified disease may be assumed based on distinctive neurological symptoms, such as visual hallucinations and parkinsonism, individual criteria can be used to diagnose each disease. The problematic case is a patient who meets no clear diagnostic criteria and therefore follow-up observations are required. Specifically, these cases include patients with the mildest AD or those with vascular MCI; however, not all these cases necessarily progress to dementia. An investigation performed 5 years after the initial prevalence survey in 1998 showed that approximately 40% of MCI patients progressed to cognitive deficit. As a result of assessing which features observed in patients during the initial period were related to a tendency for the progression to dementia, it was determined that older patients and those patients with CDR 0.5 in domains such as ‘memory’, ‘home and hobbies’ and ‘social activities’ were more likely to progress to dementia. Subjects also underwent detailed assessment regarding their living habits (e.g. smoking, alcohol consumption, diet and social support), their history of systemic diseases (e.g. hypertension and diabetes) and the effects of psychosocial intervention. No significant effects of these parameters on the progression to cognitive deficit were found.

Next, logistic regression analysis was performed for AD and VaD to
assess the possibility of predicting progression to dementia based on the results of neuropsychological tests and MRI findings during the initial period. No significant relationship was found between progression to dementia and white matter diseases or cerebrovascular disorder, although the MRI findings suggested a relationship between generally low cognitive function and overall atrophy in AD patients. However, in VaD patients, a significant relationship was confirmed between cognitive functions, especially frontal lobe functions (e.g. fluency), and atrophy of the frontal and temporal lobes, severe white matter diseases and cerebrovascular disorders.

In progression to VaD, we found two patterns: (i) some patients met the National Institute for Neurological Disorders and Stroke/Association Internationale pour la Recherche et l'Enseignement en Neurosciences (NINDS-AIREN) criteria as a result of developing cerebral infarction in the cortex; and (ii) CDR 0.5 patients with cerebrovascular disorder who met the diagnostic criteria of subcortical VaD and subsequently progressed to dementia as a result of the poor control of vascular risk factors. As mentioned above, neuropsychologically it may be considered that executive functions and instrumental ADL (IADL) would cause problems in daily life. It is supposed that executive dysfunction, in particular, may be caused by damage to the frontal subcortical network or the hippocampal parietal/frontal network. Executive dysfunction may cause a disorder of social adjustability. Concretely, this is often suggested as problems relating to the performance of household work, in home life or decreased local activities. In particular, intervention against risk factors for vascular diseases is important. Specifically, there may be a vicious cycle in which aggravation of risk factors occurs as a result of difficulties visiting medical institutions or management of medication regimens, resulting in reoccurrence of the disease. Support, such as local intervention, to enable patients to cope is required. Executive dysfunction may cause a disorder of social adjustability. Intervention for risk factors is particularly important. Specifically, there may be a vicious cycle in which aggravation of risk factors occurs as a result of difficulties visiting medical institutions or managing medication regimens, resulting in recurrence of the disease. Support to enable patients to cope with these issues is required. CVD, cerebrovascular disease.

**Conclusion and concerns**
First, what type of support should be provided and to which groups needs to be discussed. Regular observation is required while always considering the possibility of specific neurological disorders and possible diagnosis criteria. For subcortical and other types of VaD, the management of risk factors, such as hypertension and diabetes, and support to enable patients to manage their
medication is very important. Some patients with broad MCI may progress to clinical AD. A combination of observation of daily activities based on CDR, neuropsychological tests and MRI findings is effective in identifying the group of MCI patients most likely to progress to cognitive deficit.

Although the focus tends to be on primary prevention when considering dementia prevention, it is important to encourage a correct understanding of the disease without an excessive burden being placed on patients. This is because ‘self-responsibility of patients with dementia’ may be suggested when primary prevention is focused in connection with their daily habits. To examine the effect of lifestyle-related diseases, a long-term study is required that should start when subjects are in middle age. In addition, to assess the possibility that psychosocial intervention may delay the onset of cognitive deficit, careful consideration should be given to the design of future prospective studies. These matters should be discussed sufficiently, but it is important for local citizens to encourage the development of local societies to provide individuals with a venue for safe social interaction, even after they develop cognitive deficits, rather than recommending therapies for the prevention of cognitive deficit. To this end, a correct understanding of dementia and appropriate support systems are necessary.

References
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