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Functional deficits among patients with mild cognitive impairment

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Abstract

Background—Diagnostic criteria for mild cognitive impairment (MCI) include no significant functional decline, but recent studies suggest subtle deficits often exist. It is not known whether these differ by MCI type. We investigated the level and type of functional impairment among patients with MCI.

Methods—We studied 498 patients, evaluated at the Alzheimer's disease Research Centers of California between 2006 and 2009, who had multidisciplinary evaluations by experts, including neurological examination and neuropsychological testing. Patients were diagnosed with MCI and subtype was determined using cognitive domain scores. In a cross-sectional descriptive study, we examined whether functional impairment differed by MCI subtype, using the Blessed Roth Dementia Rating Scale (range: 0–17, higher scores indicating more impairment).

Results—Among the participants, the mean age was 75.4 years, 50.7% were female and 81.7% were white. Patients with amnesic- (n=392, 78.7%) and nonamnesic-type (n=106, 21.3%) MCI had similar total Blessed Roth Dementia Rating Scale (1.6 and 1.5, respectively; $p=0.84$) and Mini-Mental State Examination (26.5 and 26.7, respectively; $p=0.60$) scores. Patients with amnesic MCI were more likely to have difficulty remembering lists and recalling recent events ($p<0.05$ for both) and less likely to have difficulty in eating and with continence ($p=0.01$ for both), as compared with those with nonamnesic MCI.

Conclusions—Despite the MCI diagnostic criteria suggesting no functional impairment, our results indicate that patients with MCI experience mild functional deficits that vary according to the type of MCI.

Keywords

Mild cognitive impairment; Dementia; Functional impairment; Instrumental activities of daily living; Activities of daily living

1. Introduction

Functional impairment has long been part of the diagnostic criteria for dementia including Alzheimer's disease (AD).¹ Functional decline in more complex activities – commonly known as instrumental activities of daily living (IADLs) – usually occurs first; this includes

housework, leisure activities, planning and financial transactions.¹ Later functional decline affects self-care activities, known as Activities of Daily Living (ADLs) including bathing, dressing, eating, and transferring.¹ Recently, controversy has emerged regarding whether functional impairment is present among patients with Mild Cognitive Impairment (MCI). Diagnostic criteria typically state that functional impairment is not present,² but some are advocating for a revision to the diagnostic criteria of MCI to include minimal functional impairment.^{3, 4} Functional deficits in patients with MCI may go unnoticed or unrecognized for several reasons, such as those occurring at subclinical levels, affecting tasks that go unnoticed by a caretaker, or inaccurate reporting.^{3–5}

Several studies have shown that, as compared with normal healthy controls, patients with MCI experience greater functional deficits.^{3, 4, 6–8} However, these studies have focused primarily on functional deficits in complex IADLs, and few studies have determined whether these patients also experience deficits in ADLs.^{3, 6–8} Thus, what functional deficits are experienced by patients with MCI and whether there are differences by type of MCI (eg, amnesic vs other) still remain unclear. The objectives of our study were to determine what, if any, functional impairments exist in patients with MCI, and to determine whether functional impairment differed by type.

2. Methods

We studied 498 patients with MCI, evaluated at the Alzheimer's disease Research Centers of California (ARCCs) between 2006 and 2009. The ARCCs are state funded clinics located at university medical centers throughout California. All ARCCs have site-specific institutional review board approval and informed consent from all patients.

Using the Minimum Uniform Data Set, demographic, diagnostic, and medication information was collected for all patients. At each center, patients further underwent comprehensive multidisciplinary evaluations by experts, including medical history and neuropsychological testing, which differed slightly at each center. Data related to participant age, gender, race, education, and history of mobility limitation were collected. Clinical diagnoses were determined at multidisciplinary conferences that included neurologists, neuropsychologists, nurses and psychiatrists. Cognitive function was assessed with the Mini-Mental State Examination (MMSE, range: 0–30, higher scores indicating better cognitive function),⁹ and collected as part of the ARCC uniform data set. Other neuropsychological tests were used in the clinical diagnosis, but not collected as part of the ARCC uniform data set.

Patients were diagnosed with MCI only if they had cognitive impairment not meeting criteria for dementia.¹⁰ Patients were then classified into amnesic single and multiple domains or nonamnesic single and multiple domains, based on the cognitive domains affected, measured by neuropsychological testing, including deficits in memory, executive function, language or visuospatial domains (≥ 1 SD below the mean).

Function was assessed with informant reports, using the Blessed Roth Dementia Rating Scale (BRDRS).¹¹ The BRDRS is a 22-item clinical rating scale developed to assess cognitive and behavioral function in patients with dementia, including everyday activities, self-care habits, and changes in personality and habits.¹¹ The BRDRS includes seven items assessing modified IADLs and three items assessing ADLs. The IADLs did not include all traditional IADLs and did include some items related to memory. Specifically, the modified IADLs included performing household tasks, recalling recent outings and visits with family, remembering short lists of items (i.e. groceries), coping with small sums of money, interpreting surroundings, and finding one's way around. Each IADL item was scored on a

scale of 0 (normal function), 0.5 (some trouble) and 1 (unable). For ease of reporting, a score of 0.5 will now be referred to as “minor difficulty” and a score of 1 will be referred to as “major difficulty”. The ADLs included eating, dressing, and continence, and they were each scored on a scale ranging from 0 (no functional impairment) to 3 (needs complete assistance). Scores of 1 and 2 will be reported as “minor difficulty” and a score of 3 will be reported as “major difficulty”. Total BRDRS score ranges from 0 to 16, with higher score indicating greater functional impairment.

We first assessed whether there were differences between amnesic single domain, amnesic multiple domain, nonamnesic single domain, and nonamnesic multiple domain on BRDRS and on demographics and other characteristics. There were no statistically significant differences between the two amnesic groups and the two nonamnesic groups; therefore, we collapsed these four groups into amnesic versus nonamnesic MCI. We also assessed whether BRDRS scores differed significantly among cognitively normal patients ($n = 520$), those with dementia ($n = 1675$), and those with MCI. To determine whether amnesic and nonamnesic patients differed on demographics and other characteristics, as well as functional status, we used either Fischer’s exact or Pearson’s χ^2 test for categorical variables and analysis of variance analysis (ANOVA) for continuous variables.

3. Results

Mean age of the 498 patients with MCI was 75.4 years, 50.7% were women, 81.7% were white, 78.7% ($n=392$) had amnesic, and 21.3% ($n=106$) nonamnesic MCI. Of those patients with nonamnesic MCI, the majority had deficits in the executive function domain (79.2%). Amnesic and nonamnesic patients did not differ on any baseline demographics, comorbidities (i.e., history of stroke, diabetes, hypertension, myocardial infarction, and depression; and use of anti- Alzheimer’s disease medications, statins, antioxidants, and other supplements), or history of mobility limitation, and had similar MMSE score (26.5 ± 2.9 vs 26.7 ± 3.0 , $p=0.60$). Amnesic and nonamnesic patients also had a similar total BRDRS score (1.6 ± 1.8 points vs 1.5 ± 2.1 , $p=0.84$). As compared with patients with MCI, total BRDRS and MMSE scores were significantly different for cognitively normal ARCC participants (0.28 ± 0.97 and 28.7 ± 2.1 , $p<0.01$ for both) and for those with dementia (6.9 ± 4.5 and 18.1 ± 7.3 , $p<0.01$ for both).

Most IADL deficits experienced by patients with MCI were recorded as minor difficulty, as opposed to major difficulty (Table 1). Amnesic patients were more likely to have difficulty with regard to remembering short lists of items and recalling recent events ($p = 0.02$ and 0.001 , respectively), compared with nonamnesic patients (Table 1). Amnesic patients tended to experience a greater total score of modified IADLs as compared with nonamnesic patients (1.36 ± 1.54 vs 1.05 ± 1.36 , $p=0.07$). As a reference, total score of modified IADL difficulties for cognitively normal ARCC participants was 0.25 ± 0.35 and for those with dementia was 3.5 ± 1.3 .

Most ADL deficits experienced by patients with MCI were also recorded as minor difficulty (Table 2). Nonamnesic patients were more likely to have minor difficulty with eating and with continence ($p=0.01$ for both), as compared with amnesic older patients. Nonamnesic patients were also slightly more likely to have minor problems with dressing independently ($p=0.07$; Table 2). Finally, as compared with amnesic, nonamnesic patients experienced a greater total score of ADLs (0.45 ± 1.46 vs 0.19 ± 0.65 , $p=0.003$; Table 2). As a reference, there were no reported ADL difficulties among cognitively normal ARCC participants, and for those with dementia the total score was $0.50 \pm .53$.

4. Discussion

Despite the current diagnostic criteria suggesting no functional impairment, our results indicate that patients with MCI experience mild functional deficits, including deficits in modified IADLs and ADLs; these vary according to MCI subtype. Amnestic patients are more likely to experience problems with remembering lists and recalling recent events, whereas nonamnestic patients experience more difficulty with ADLs such as eating and continence. Although we are uncertain of the clinical significance of these findings, we hypothesize that those with nonamnestic MCI, especially with executive impairment, experience greater subclinical white matter disease, leading to more problems with tasks like eating and continence. These results suggest that it may be useful and necessary to evaluate function in patients with MCI to determine whether and the extent to which functional deficits exist.

Our results support previous studies showing that patients with MCI experience more functional impairment than normal healthy controls, and that the functional deficits typically involve memory-related tasks.⁶⁻⁸ Our results contradict another study that found no significant distinction in the functional impairment experienced by amnestic and nonamnestic patients, but this discrepancy could be because of differences in study population and sample size.⁶ These findings add to current literature because they show that patients with MCI are also experiencing minor deficits in ADLs.

Our findings demonstrate that amnestic patients experience deficits in modified IADLs. Importantly, some of the IADLs measured on the BRDRS are not traditional because they ask questions of memory; these were the impairments experienced most by patients with amnestic MCI. Whether this translates to actual worse functioning in performing related tasks, such as shopping for groceries, is less clear. Conversely, nonamnestic patients experience deficits with basic ADLs. These differences may be explained by different neural structures being affected in nonamnestic as compared with those with amnestic MCI. For example, those patients experiencing executive domain problems most likely have neuropathology in the frontal lobes, whereas those with amnestic MCI have it in hippocampal and entorhinal cortex.^{12, 13}

As mentioned previously, functional deficits in patients with MCI may have gone unrecognized in patients with MCI owing to various reasons such as subclinical symptoms and inaccurate reporting from patients and caregivers.³⁻⁵ It has been shown that patients with MCI are not able to provide objective ratings of their own functional impairments, and informant reports of impairment or objective clinical assessments are necessary.^{5, 14} In an attempt to overcome these difficulties, obtaining information from both patients and caregiver informants on functional status of the patient with MCI will be useful.

There are several strengths to this study including the multidisciplinary evaluation and extensive cognitive testing used to reach a diagnosis of MCI. Furthermore, the sample size is larger than some of the other studies that have investigated functional impairment in patients with MCI, offering more statistical power. Some limitations should also be considered, such as the study population. The ARCCs are academically affiliated hospitals where patients are examined by specialists, thus results may not be generalizable to patients outside of this setting. Lack of functional impairment is used in the MCI diagnostic criteria, thus the BRDRS was one component used in formulating a final MCI diagnosis, which is a limitation. However, we found it interesting that despite this, there was still noticeable functional impairment in the patients with MCI and a distinct difference between patients with amnestic and those with nonamnestic MCI. This was a cross-sectional cohort study,

thus we were unable to address causality. Finally, not all traditional IADLs were assessed and some that were assessed included memory-related tasks.

Patients with MCI experience functional deficits, which differ by subtype of MCI. Because patients with MCI who have more functional impairment may be more likely to progress to dementia, it is critical to fully understand and diagnose functional deficits.¹⁵ On the basis of this evidence, in combination with previous studies, the diagnostic criteria for MCI need to be reexamined, and a revision to include the minimal functional impairment should be considered. Future studies should continue to investigate to what extent function is impaired in these patients or whether they type of functional impairment predicts the type of dementia.

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Table 1

Reported IADL deficits among 498 patients with MCI, by subtype

Blessed Roth Function Item N (%)	Amnesic (N=392)		Nonamnesic (N=106)		p
	Minor	Major	Minor	Major	
Performing household tasks	77 (19.6)	17 (4.3)	23 (21.7)	5 (4.7)	0.53
Recalling recent events (i.e. outings, visits with family)	158 (40.3)	25 (6.4)	27 (25.5)	3 (2.8)	0.001
Remembering short lists of items (i.e. groceries)	164 (41.8)	67 (17.1)	40 (37.7)	10 (9.4)	0.02
Coping with small sums of money	39 (9.9)	18 (4.6)	13 (12.3)	6 (5.7)	0.39
Ability to find way around familiar streets	70 (17.9)	16 (4.1)	12 (11.3)	4 (3.8)	0.23
Finding way indoors	10 (2.6)	16 (4.1)	9 (8.5)	1 (0.9)	0.97
Interpreting surroundings	13 (3.3)	16 (4.1)	6 (5.7)	1 (0.9)	0.39
Average total score (mean, SD; 0–7)	1.36 (1.54)		1.05 (1.36)		0.07

Abbreviations: SD, standard deviation; IADLs, instrumental activities of daily living; MCI, mild cognitive impairment.

Table 2

Reported ADL deficits among 498 patients with MCI, by subtype

Blessed Roth Function Item N (%)	Amnesic (N=392)		Non-Amnesic (N=106)		P
	Minor	Major	Minor	Major	
Eating	7 (1.8)	0	6 (5.7)	0	0.01
Dressing	10 (2.6)	2 (0.5)	7 (6.6)	1 (0.9)	0.07
Continence	31 (7.9)	5 (1.3)	17 (16.0)	1 (0.9)	0.01
Average total score (mean, SD; 0–9)	0.19 (0.65)		0.45 (1.46)		0.003

Abbreviations: SD, standard deviation; ADLs, activities of daily living; MCI, mild cognitive impairment.