Complex activities of daily living in the elderly with mild cognitive impairment

Złożone czynności życia codziennego osób starszych z łagodnymi zaburzeniami poznawczymi

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Wstęp. Prognozowane starzenie się społeczeństw, rosnące rozpowszechnienie i brak efektywnych możliwości terapeutycznych sprawia, że demencja staje się rosnącym problemem zdrowia publicznego. Stan przejściowy pomiędzy fizjologicznym starzeniem się a otępieniem, określany jest mianem łagodnych zaburzeń poznawczych. Bardzo ważna wydaje się więc identyfikacja czynników predykcyjnych konwersji MCI do demencji, co stanowi obecnie najważniejszą strategię opóźniania postępu otępień i zapobiegania im.

Cel. Obecnie brak konsensusu co do stopnia pogorszenia czynnościowego, które byłoby akceptowalne w kontekście definicji MCI. Istnieje także duże zapotrzebowanie na identyfikację czynności najczęściej upośledzonych w MCI oraz określenie wytycznych dotyczących natury tych zaburzeń. Celem pracy był przegląd dotychczasowych badań dotyczących złożonych czynności życia codziennego u osób starszych z MCI pod kątem możliwości interpretacji ich wyników w celu: prognozy zdolności funkcjonalnych na podstawie testów oceniających funkcje poznawcze; identyfikacji czynności najczęściej upośledzonych i akceptowalnego w kontekście definicji MCI stopnia pogorszenia funkcjonalnego; identyfikacji predyktorów konwersji w otępienie.

Wyniki. Przytoczone badania niejednoznacznie wskazują, iż osoby z MCI wykonują złożone czynności życia codziennego (IADL) znacząco gorzej niż osoby bez zaburzeń poznawczych. Niektóre badania identyfikują pogorszenie funkcji wykonawczych lub pamięci jako główne czynniki przyczyniające się do upośledzenia IADL. Doniesienia dotyczące dysfunkcji IADL typowych dla MCI i ich podtypów są niespójne. Zmiany w IADL znacząco poprawiają prognozowanie przyszłego pogorszenia poznawczego i demencji.

Wnioski. Różnicowanie upośledzenia sprawności funkcjonalnej w MCI, demencji i normalnym starzeniu jest, z wielu względów, wyzwaniem metodologicznym. Istnieje jednak potrzeba dalszych badań nad złożonymi czynnościami życia codziennego w MCI.

Słowa kluczowe: *łagodne zaburzenia poznawcze (MCI), instrumentalne czynności życia codziennego (IADL), funkcjonowanie codzienne*

Background. Predicted aging of modern societies, a rising global prevalence and lack of effective curative treatment options constitute dementia a growing public health concern. An intermediate state between the cognitive changes of normal aging and dementia is known as mild cognitive impairment (MCI). There is an increasing call for a stronger consideration of impairment in certain functional abilities in MCI to improve dementia prediction ability.

Aim. There is a need for consensus regarding the degree of functional decline that can be considered to be acceptable within the context of the MCI definition. There is a demand for identification of MCI – specific functional impairments, and their nature, as well as associations between cognitive processes and functional abilities in MCI. Also, there is heightened interest in investigating IADL impairment amongst MCI subtypes and determining their predictive capability for dementia. The aim of the study was to conduct literature review with respect to the above issues.

Results. Excerpted studies unequivocally indicate that individuals with MCI perform IADL significantly worse than matched controls. Some studies identify decline in executive processes or memory as key cognitive contributors to impairment in IADL. The findings concerning IADL dysfunctions typical for MCI, and its subtypes are inconsistent. Excerpted data implicate that combining MCI with IADL impairment significantly improves the prediction of future dementia.

Conclusions. Distinguishing a significant decline in functional abilities in individuals with MCI is a methodological challenge. Still much is left to be discovered about the nature and extend of complex functional difficulties in this group.

Key words: *mild cognitive impairment (MCI), instrumental activities of daily living (IADL), everyday functioning*

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Wykaz skrótów

MCI – Mild Cognitive Impairment
AD – Alzheimer's Disease
IADL – Instrumental Activities of Daily Living
ADL – Activities of Daily Living
DAD – Disability Assessment for Dementia Scale
PADL – Personal Activities of Daily Living Scale
DOT – Day-Out Task
FAQ – Pfeffer Functional Activities Questionnaire
TMT – Trial Making Test
DRS – Dementia Rating Scale

Introduction

Mild cognitive impairment (MCI) denotes an intermediate state between the cognitive changes of normal cognitive aging and dementia. Initially, this term referred to a state prior to the clinical diagnosis of Alzheimer's Disease (AD), while nowadays it is identified as a distinct clinical entity, much more varied than preclinical AD. MCI refers to a clinical condition in which individuals experience memory or other cognitive process (e.g., executive functions, visuospatial skills) loss to a greater extent than expected for age, yet the criteria for dementia are not met. In an effort to improve the diagnostic specificity, MCI has been further divided into subtypes based on the presence or absence of memory deficits and number of impaired cognitive domains. The four subtypes are: amnestic single – domain, amnestic multiple – domain, non-amnestic single – domain and non – amnestic multiple – domain [1].

About 15% of individuals between the ages of 70 and 89 years have MCI [2]. The rates at which they progress from normal aging to MCI is alarmingly high - approximately 5.3% per year. This problem will certainly grow in importance due to aging of modern societies and rising global prevalence. Individuals with MCI constitute a high risk group because they develop dementia at a rate of 10% to 15% per year compared with 1% to 2% per year in the general population [3]. The ability to predict which MCI subjects are more likely to progress to dementia more rapidly than others remains a major area of interest within the field of MCI research. Several potential factors useful for predicting progression have emerged. Amongst apolipoprotein (ApoE4) carrier status, hippocampal atrophy, older age or clinical severity, functional ability level can also serve as a potential candidate for predicting conversion to dementia [4].

General guidelines for the diagnosis of MCI, apart from the previously mentioned presence of objective cognitive impairment, include essentially intact basic activities of daily living (ADL) [1]. ADLs are understood as self-maintenance abilities such as dressing or bathing. Cognitive deficits present in MCI, although apparent for both afflicted persons and their environment, do not therefore result in inability to exist independently. However, they can significantly affect quality of life by influencing high-level functional abilities (instrumental activities of daily living, IADL). Instrumental ADLs are more complex everyday tasks, such as preparing a meal, managing finances or shopping. Identifying the extent, severity, type, and correlates of complex functional deficits that occur in MCI is of important applicable value, as it is supposed to aid in an early detection of incipient dementia [5]. The methods of assessing IADL comprise self-reported questionnaires, performance-based assessment and informant-based questionnaires. To date, though, the number of clinical trials that target IADL in MCI is still limited.

Aim

As previously mentioned, individuals with MCI may show subtle changes in instrumental, but not basic, activities of daily living. The revised diagnostic criteria allow for some "minimal impairment" in carrying out complex functional tasks. However, there is a need for consensus regarding the degree of functional decline that can be considered acceptable within the context of the MCI definition. There is a demand for identification of MCI – specific functional impairments, and their nature, as well as assessment of associations between cognitive processes and functional abilities in MCI. Also, there is heightened interest in investigating IADLs amongst the MCI subtypes and determining predictive capability of the MCI and IADL impairment for dementia. This type of work can enable the application of empirical findings to accurate diagnosis of MCI, prediction of functional abilities from cognitive tests as well as identification individuals at risk of a future cognitive decline [6]. Thus, the aim of the study was to conduct literature review with respect to the above issues.

Method

Authors conducted a literature review of publications indexed in Ebsco and PubMed from the last three years (2010-2013) using the search phrases "MCI and IADL" and "MCI and everyday functioning".

Recent literature

The influence of cognition on activities of daily living was investigated in a Swedish study of 85-year-olds with the Personal Activities of Daily Living Scale (PADL). A larger number of participants with cognitive impairment, compared to the group without cognitive impairment, reported they needed assistance in IADL. Impaired cognition was significantly related to problems in functional abilities in this study [7].

Another study [8], using caregiver Seoul Instrumental Activities of Daily Living (S-IADL) questionnaire, demonstrated that the possibility of MCI was reflected specifically by dysfunction in "using household appliance" and "using public transportation" [8].

Schmitter-Edgecombe et al. (2012) carried out the IADLs assessment by a direct measure requiring multitasking in a real-world setting with the use of the Day-Out Task (DOT). The participants prioritized, organized, initiated, and completed a number of subtasks in a campus apartment to prepare for a day

out. They also completed tests assessing cognitive constructs important in multitasking (i.e., retrospective memory, prospective memory, planning). As compared with controls, the MCI group required more time to complete the DOT and demonstrated poorer task accuracy, performing more subtasks incompletely and inaccurately. The DOT measures, but not the cognitive tests, were predictive of knowledgeable informant report of everyday functioning. According to authors, these findings suggest that difficulty remembering and keeping track of multiple goals and subgoals may contribute to the poorer performance of individuals with MCI in complex everyday situations [9].

There is data suggesting that a key contributor to impairment in IADL is executive dysfunction. Significant relationship between executive function and IADL in normal older controls, amnestic MCI, and mild Alzheimer's disease (aged 55-91 inclusively) was proved across all subjects and within the MCI group specifically by Marshall et al. (10 2011).

Associations between cognition and functional abilities were also examined by another study [11]. The ability to perform seven IADL tasks (traveling, shopping, preparing meals, doing housework, taking medications, handling personal finances, and using the telephone) was assessed in community-dwelling adults aged 65 years and older. The participants with MCI were found to be more likely dependent in at least one IADL task, as well as in each individual IADL task, than the cognitively normal subjects. Lower odds of the IADL dependence in MCI were associated with better memory and executive functioning. Across the subtypes of MCI, most likely dependent in all IADL tasks turned out those with the multiple-domain amnestic subtype. The authors conclude that mild impairment in cognition is associated with difficulty performing the IADL tasks [11].

The study by Greenaway et al. (2012) documented the utility of cognitive evaluation in predicting IADL in individuals with single-domain amnestic MCI. The participants were administered the Dementia Rating Scale-2 (DRS-2) and modified Everyday Cognition assessment form (E-Cog). Regarding the IADL changes, most prevalent difficulties were reported by informants in "remembering appointments", "balancing the checkbook", "financial records", and "use of an organized strategy of medication management". The DRS - 2 total scores and Initiation/Perseveration and Memory subscales were found to be predictive of IADLs, with total scores accounting for 19% of the variance in IADL performance on average. According to authors, these findings suggest that performance on the DRS - 2, and specific subscales related to executive function and memory, are significantly related to IADLs in individuals with MCI [12].

The functional profiles of amnestic MCI were also investigated in Chinese study [13]. Both single-domain aMCI and multiple-domain aMCI groups showed more impaired IADL items than controls. The sd-aMCI subjects presented deficits in 7 items of Disability Assessment for Dementia Scale (DAD) involving "meal preparation", "telephoning", "finance", "medications", "housework", and "leisure" subscales. The md-aMCI subjects presented deficits in 14 items involving all subscales of daily activities. The authors concluded that in order to identify the groups at high risk of developing AD, comprehensive neuropsychiatric assessments should be conducted when patients presented deficits in 3 or more IADL items of DAD, especially when the 3 main different items (one "going on an outing" and two "leisure" items) between sd-aMCI and md-aMCI were affected. The authors propound that including the functional ability assessment in the evaluation of MCI may help clinicians provide appropriate suggestions to maintain daily functioning and suggest that functional disability in amnestic MCI predicts Alzheimer's disease [13].

Amnestic MCI patients were also one of the groups targeted by Brown et al. (2011). The group was administered the informant – reported 10 – item Pfeffer Functional Activities Questionnaire (FAQ). The authors found mild IADL deficits common in individuals with aMCI and postulated their incorporation into the MCI criteria. Two IADLs: "remembering appointments, family occasions, holidays, and medications" and "assembling tax records, business affairs, or other papers" appeared to be characteristic of clinically significant cognitive impairment. Impairment in memory and processing speed were associated with greater IADL deficits [5].

FAQ was used by Teng et al. (2010) in order to compare IADLs amongst the MCI subtypes and examine associations between IADL and neuropsychological indices. The IADL deficits were greater in amnestic than nonamnestic MCI, but within these subgroups, did not differ between single or multiple domains of cognitive impairment. The FAQ indices correlated significantly with memory and processing speed/executive function. According to the authors, the IADL deficits, although present in both amnestic MCI and non-amnestic MCI, are not related to the number of impaired cognitive domains [14].

The contribution of three domains of executive cognition (planning/problem-solving, working memory, and judgment) to everyday functioning was investigated in another study [15]. Performance of everyday activities and everyday cognition was rated with two separate informant-reported IADL assessments. All MCI subtypes had more difficulties in everyday activities than cognitively normal elderly participants.

Multiple domain MCI patients had more functional impairments than single domain MCI patients. Only one executive function component-working memory, which included measures of sequencing (TMT-B) and inhibition (D-KEFS Stroop) – contributed significantly to functional status. The authors conclude that functional abilities are compromised in all MCI subtypes. Although working memory may be associated with functional impairments, general cognitive measures account for more unique variance [15].

Review by Gold (2012) extensively explored the reasons for the inconsistent findings in the literature as well as the challenges of IADL investigation. The authors, having reviewed 29 studies using questionnaire-based assessments to examine IADL in MCI, concluded that MCI could be distinguished statistically from healthy older adults and dementia. The individuals with multiple domain MCI subtype were more impaired on IADL than those with single domain. Mild IADL changes were identified predictive of future cognitive decline. Impairment in the ability to manage finances was found to be amongst the earliest IADL changes in MCI and a strong predictor of conversion to dementia [6].

Reppermund et al. (2013) aimed to explore whether functional abilities were predictors of MCI and dementia over a 2-year period in individuals who were cognitively normal at baseline. This Australian study examined IADL in MCI and cognitively normal older individuals using an informant–rated interview with the Bayer Activities of Daily Living Scale (B-ADL). The questionnaire items were divided into two categories: those with high and low cognitive demand. According to the authors, activities from the first group require more cognitive resources than simple IADL and are, therefore, more vulnerable to early cognitive changes. The authors found that significantly more deficits in IADL with high cognitive demand were present in MCI compared with cognitively normal individuals at baseline and a 2-year follow-up. Functional ability in cognitively normal individuals at baseline, particularly in activities with high cognitive demand (like doing two things at the same time or giving directions if asked the way) predicted amnestic MCI and dementia at follow-up. Difficulties in performing activities of low cognitive demand (like preparing food or personal hygiene) did not predict MCI or dementia. They concluded that IADLs are affected in individuals with MCI, and IADL with a high cognitive demand show impairment predating the diagnosis of MCI [16].

Having more difficulties in IADL, especially those with higher demand on cognitive capacities, was found to be associated with MCI and overall cognitive functioning by Reppermund et al. in an earlier study (2011), also using the B-ADL scale [17].

Determining the predictive capability of MCI and IADL impairment for incident dementia was also the objective of Luck et al (2012, 2011). They followed up a group of individuals aged 75 years and older over a period of 4.5 years and found that the MCI and IADL impairment were significantly associated with higher conversion to, shorter time, and better predictive power for future dementia. Regarding IADL, a significant impact was particularly found for impairment in responsibility for one's own medication, shopping, and housekeeping, and in the ability to use public transport. The highest risk for a shorter time to incident dementia was found again for amnestic MCI combined with the IADL deficits. The study documented that the consideration of MCI and IADL impairment might help to improve the prediction of dementia [18, 19].

Discussion

Recent research concerning IADL and MCI is focused on comparing the IADL performance in MCI subjects and matched controls, examining associations between cognitive processes (particularly memory and executive functions) and functional abilities, identifying MCI – specific functional impairments, investigating IADLs amongst the MCI subtypes, and determining predictive capability of MCI and IADL impairment for dementia. The literature is complicated by inherent differences in sampling methods, sample sizes, measures used, diagnostic criteria for MCI, and population demographics across studies. The findings concerning some of the above issues are therefore inconsistent.

Associations between cognitive processes and instrumental activities of daily living were studied extensively. The excerpted studies unequivocally indicate that individuals with MCI perform IADL significantly worse than matched controls [e.g. 5, 7, 9, 11, 13-16]. Impaired cognition is significantly related to problems in functional abilities in many studies [5, 7-17], with some of them identifying MCI - specific IADL dysfunctions as: "using household appliance" and "using public transportation" [8] "remembering appointments, family occasions, holidays, and medications", "assembling tax records, business affairs, or other papers" [5], "responsibility for one's own medication", "shopping", "housekeeping", "ability to use public transport" [18, 19], "remembering appointments", "balancing the checkbook", "financial records", and "use of an organized strategy of medication management" [12], and "ability to manage finances" [6]. As to the nature of functional ability changes, some studies identify decline in executive processes [5, 10-12,14, 15], and memory [5, 11, 12, 14, 15] as key cognitive contributors to impairment in IADL.

As shown, despite differences in correlation measures, impaired cognition seems to be significantly related to problems in functional abilities. The excerpted work in elderly populations generally emphasizes the importance of executive or memory function in the performance of complex functional tasks. The findings concerning IADL dysfunctions typical for MCI are inconsistent. Differences in culture background of the measures used may be a part of an explanation here.

There is growing evidence that functional abilities are differentially affected in various subtypes of MCI. Studies that have addressed the above issue have yielded mixed results. Many [6, 11, 13, 15] but not all [14] investigators have reported greater IADL deficits in multiple-domain than in single-domain MCI, without regard of amnestic/nonamnestic type. However, there is data suggesting that the IADL deficits may be more prevalent, or earlier manifested in amnestic MCI than in nonamnestic MCI, without regard of number of impaired cognitive domains [11, 14, 18]. These discrepancies may partly be result of differences in the IADL measures used.

The ability to predict which MCI individuals are more likely to progress to dementia more rapidly than others remains a major area of interest within the field of MCI research. As to the predictive capability for dementia, there is a general consensus that even mild IADL changes can predict future cognitive decline. The excerpted data implicate that combining MCI with the IADL impairment significantly improves the prediction of future dementia [6, 14, 18, 19] or even can be a better conversion predictor than cognitive functioning measures [6, 16]. Some studies identified impairment in "ability to manage finances" as strong dementia conversion predictor [6], whereas others suggest that functional disability predicts specifically Alzheimer's disease (AD) in amnestic MCI [13].

Conclusions

The ability to independently perform IADL is a key component to successful aging. The IADL questionnaires play an important role in assessing functional abilities of older adults and evaluating the impact of cognitive impairment on routine activities [6]. However, rendering decisions about capabilities during MCI is complicated, and much is still to be discovered about the nature and extend of complex functional difficulties in this group [12]. Understanding the associations between cognitive changes and functional abilities can help improve prediction of the outcomes of MCI, identify the transition from functional independence to dependence, and predict which individuals will be at risk of a future cognitive decline. It may also allow appropriate targeting of interventions in MCI to potentially help preserve functional independence [11]. Despite the fact that distinguishing a significant decline in functional abilities in individuals with MCI is a methodological challenge, the need to conduct further research on instrumental activities of daily living in MCI is evident. Since MCI and dementia are on a spectrum of disease progression, the identification of the earliest signs of cognitive deterioration is becoming a crucial issue as it may offer an opportunity for preventative interventions with significant public health implications.

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