Archives of Gerontology and Geriatrics 56 (2013) 38–43

Contents lists available at SciVerse ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Cross-cultural difference and validation of the Chinese version of Montreal Cognitive Assessment in older adults residing in Eastern China: Preliminary findings

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ARTICLE INFO

Article history:
Received 25 March 2012
Received in revised form 14 May 2012
Accepted 17 May 2012
Available online 13 June 2012

Keywords:
Mild cognitive impairment
Montreal Cognitive Assessment
Validity
MMSE
Screening
Cultural differences

ABSTRACT

To evaluate the psychometric properties of the Chinese Montreal Cognitive Assessment (MoCA-C) and assess cross-cultural differences in a community-based cohort residing in the Eastern China. The study included 72 patients with Alzheimer's disease (AD), 84 patients with mild cognitive impairment (MCI) and 146 cognitively normal controls. Sensitivities and specificities were calculated using the recommended cut-off scores. Receiver operator characteristic (ROC) curve analyses were performed to determine optimal sensitivity and specificity. Criterion validity, inter-rater, test–retest reliability and internal consistencies of the MoCA-C were examined, and clinical observations made. The influence of age, education level and gender on MoCA score was examined. Using the recommended cut-off score of 26, the area under the ROC (AUC) for predicting MCI groups using the MoCA-C was 0.930 (95%CI: 0.894; 0.965). The MoCA-C demonstrated 92% sensitivity and 85% specificity in screening for MCI. Cultural differences from the original MoCA affected the test response rate. The MoCA-C appears to have utility as a cognitive screen for early detection of AD and for MCI and warrants further investigation regarding its applicability in primary care settings in elderly Chinese people. It will be necessary to revise the contents of the questionnaire to account for by local characteristics.

1. Introduction

MCI is defined as cognitive decline greater than expected for an individual's age and education level, that does not interfere notably with activities of daily life. The prevalence of MCI in population-based epidemiological studies ranges from 3% to 19% in adults older than 65 years (Gauthier et al., 2006). MCI is recognized as a risk factor for AD (Levey, Lah, Goldstein, Steenland, & Bliwise, 2006), prompting many researchers to screen for MCI in order to provide early treatment and reduce the risk of progression to dementia (Ritchie, Artero, & Touchon, 2001). However, owing to the subtle decline in cognitive function during the initial stages of MCI, improvements in recognition and diagnosis are still needed if the economic and psychosocial burdens associated with AD are to be reduced. This will only be possible if treatment is initiated prior to the onset of full-blown dementia syndrome. The benefits are minimal once the disease progression is underway since available treatments are unable to reverse disease progression and restore individuals to their premorbid level (Luis, Keegan, & Mullan, 2009).

The Montreal Cognitive Assessment (MoCA), developed and validated by Nasreddine et al., 2005, is a brief and potentially useful screening tool with high sensitivity and specificity for detecting MCI in persons performing in the normal range on the Mini-Mental State Examination (MMSE). The validity of the MoCA has been studied in various clinical settings (Cumming, Bernhardt, & Linden, 2011; Gaviria, Pliskin, & Kney, 2011; Gill, Freshman, Blender, & Ravina, 2008; Nazem et al., 2009; Olson, Chhanabhai, & McKenzie, 2008; Popovic, Seric, & Demarin, 2007; Videnovic et al., 2010). In Western countries the MOCA has been shown to have good sensitivity and specificity in detecting MCI and is widely used in various fields. However, because of cultural background and lifestyle differences in Eastern and Western countries, it is necessary to assess the scale in patients from different cultures. Studies undertaken in Asian countries (including Japan, Korea, Singapore and China Hong Kong) show that the reliability and validity of MoCA in screening for MCI is superior to that of the MMSE. However, to account for the cultural differences in these studies the recommended cut-off values were different to those in the original paper (Dong et al., 2010; Fujiwara et al., 2010; Lee et al., 2008; Wong et al., 2009).

The primary purpose of our study was to evaluate the psychometric properties of the Chinese version of the MoCA

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http://dx.doi.org/10.1016/j.archger.2012.05.008

(MoCA-C) in a community-based cohort residing in the Eastern China. We also used the MoCA-C to investigate cross-cultural differences between Western and Eastern countries.

2. Methods

2.1. Participants

Seventy-two patients with AD patients were recruited from consecutive referrals to our hospital. Each met Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text revision (DSM-IV-TR) criteria (American Psychiatric Association, 2000) and the National Institute of Neurological and Communicative Disorders and Stroke-Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) diagnostic criteria (McKhann et al., 1984).

Case definitions for MCI were based on Petersen et al. (2001) criteria. Subjects in our study were required to have subjective memory complaints proven using an abbreviated memory inventory from the Chinese MMSE and confirmed using the Clinical Dementia Rating (CDR). Objective memory impairment was determined by a composite memory score derived from the Alzheimer's Disease Assessment Scale-cognitive subscale (ADAS-Cog) mean immediate recall and recognition test scores, and by a 10-min delayed recall score. The conventional cut-off level for memory performance of MCI patients was set at the −1.5 standard deviations (SDs) below the mean for education-matched groups.

None of the MCI subjects in our study showed evidence of dementia; all had a CDR score of 0, together with close to normal scores for activities of daily living (ADL) that were above the level for clinical AD. Subtle changes in complex ADL did not exclude subjects from the study. However, all subjects with MCI were required to be able to perform basic self-care.

In order to include subjects with possible non-amnestic MCI, those with memory scores above the −1.5 SD criteria were recruited into the MCI group provided there were two or more non-memory domains of CDR rated as 0.5 or above. Patients with significant depression or other psychiatric disorders assessed by the (DSM-IV) or those with MRI evidence of cortical infarct or a history of hemorrhagic stroke were excluded.

The final determination of diagnoses at entry was based on a consensus meeting involving a neurologist, psychiatrist, neuropsychologist, and radiologist, when applicable. A study coordinator collected demographic data and performed all screening measures (MMSE and MoCA-C) prior to diagnostic work-up.

Sixty cases were subjected to a retest 4 weeks after the initial visit to assess the test–retest reliability.

A control group comprised 146 subjects recruited from the community in Hangzhou who were independent in ADL, had no history of psychiatric or neurological disease and no memory complaints. They performed in the normal range on standardized neuropsychological tests.

The study was approved by the Domain Specific Review Board and Ethics Committee of the Healthcare Group of China. Written informed consent was obtained from all participants or their legally acceptable representatives.

2.2. Neuropsychological assessment

A battery of neuropsychological tests, conducted by trained psychologists, consisted of the MMSE, CDR, MoCA-C, ADL scale, ADAS-Cog and the Auditory Verbal Learning Test (AVLT). There was a break of about 5 min after each test to eliminate the possibility of interaction effects. To avoid experimental bias, the investigators performing and scoring the cognitive tests were blind with respect to each participant's background.

2.3. Translation and cultural modifications of the MoCA

The MoCA is a instrument that evaluates seven cognitive domains on a single page. The domains are: visuospatial/executive functions, naming, verbal memory registration and learning, attention, abstraction, 5-min delayed verbal memory, and orientation. Scores of the MoCA range from 0 to 30. The Chinese Beijing Version used in the study is available from http://www.mocatest.org. Items in the MoCA-C were identical to the English version with the exception of the following four cultural and linguistic modifications:

In Item 1 (visuospatial/executive functions – Alternating Trail Making), Chinese character sequences replaced Roman alphabets. The number of steps required for completion of task was retained.

In Item 4 (Attention-Auditory Vigilance), Arabic numerals were used instead of English alphabet letters. The number and positions of responses remained identical to those in the English version.

In Item 5 (Language – Sentence repetition), the names were changed to a more common Chinese names to reflect local familiarity.

In Item 5 (Language – Verbal fluency), semantic fluency using the animal category replaced phonemic letter fluency as there are no letter-equivalent linguistic units in the Chinese language. In order to avoid the influence on the score of the naming task contains figures of animals, the subjects were informed three animal names in the naming task cannot be mentioned again, otherwise were not scored.

2.4. Statistical analysis

All statistical analyses were performed using SPSS version 13.0. Differences between groups in demographic variables, MoCA-C, and MMSE scores were examined using one-way analysis of variance (ANOVA) or chi square (χ^2) analyses, depending on the level of variable measurement. Statistically significant demographic variables were used as covariates in examining group differences in the MoCA-C and MMSE.

Cronbach's alpha was used to assess the internal consistencies of MoCA-C. Test–retest and inter-rater reliability were evaluated by calculating intra-class correlation coefficients (ICCs) for scores at the baseline and at follow-up. A nonparametric ROC analysis appropriate for small sample sizes was utilized to assess the ability of the MoCA-C and MMSE to differentiate MCI and AD from normal cognition (Hanley and McNeil, 1983). This type of analysis was also used to identify the optimal balance between sensitivity and specificity. Area under the curve (AUC) was used to compare the diagnostic performance of each test. Values of $P < 0.05$ were considered statistically significant.

3. Results

Demographic information, MMSE and MoCA scores for the three groups are shown in Table 1. The mean age and education level for the total sample was 64.4 years and 9.4 years, respectively. No differences were found between groups in terms of education level, or gender, but on average patients with MCI (60.7 years) were significantly younger ($P < 0.001$) than those with AD (68.4 years) or normal cognitive function (67.2 years). Gender was not related to MMSE or MoCA-C scores. However, age was found to correlate with performance on MMSE but not on MoCA-C. In addition, education level impacted performance on both the MMSE and MoCA-C with individuals with 6 years of education or less performing less well on both measures.