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Original Study

Diagnostic Utility of Montreal Cognitive Assessment in the Fifth Edition of Diagnostic and Statistical Manual of Mental Disorders: Major and Mild Neurocognitive Disorders

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A B S T R A C T

Objectives: The Montreal Cognitive Assessment (MOCA) is a screening tool for mild cognitive impairment (MCI) and dementia. The new criteria for Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition (DSM-5) mild neurocognitive disorder (NCD) define participants with cognitive decline but no dementia, and major NCD (dementia). We explored the usefulness of MOCA to detect major and mild NCD.
Design: Cross-sectional test research.
Setting: Tertiary hospital memory clinic and community-based Singapore Longitudinal Aging Study (SLAS).
Participants: Participants with questionable dementia (clinical dementia rating, CDR = 0.5) and early dementia (CDR ≤1) over a period of 1 year were identified from the memory clinic registry. The patient records were reviewed and the diagnostic labels of major and mild NCD were applied accordingly. Healthy controls (HC) (CDR = 0, Mini-Mental State Examination >26) were recruited from the on-going SLAS.
Measurements: Major and mild NCD were diagnosed based on medical history, clinical examination, basic and instrumental activities of daily living, locally validated bedside cognitive tests (Mini-Mental State Examination, Frontal Assessment Battery, and Clock Drawing Test), relevant laboratory investigations and standardized neuropsychological assessment.
Results: Two hundred fifty-one participants were included (41 mild NCD, 64 major NCD, 146 HC). On receiver operating characteristic curve analysis, the diagnostic performance by area under the curve (AUC) for MOCA was 0.99 [95% confidence interval (CI) 0.98–1.0] for major NCD and 0.77 (95% CI 0.67–0.86) for mild NCD. For diagnosis of mild NCD, MOCA performed better in those with lower education (primary and below) (AUC 0.90) compared with those with secondary education and beyond (AUC 0.66).
Conclusion: MOCA has high diagnostic utility for major NCD but its usefulness in detecting mild NCD is more modest. Possible reasons include greater heterogeneity in participants with mild NCD and how "quantified clinical assessment" in the DSM-5 mild NCD criteria is interpreted and operationalized.

With the recent release of Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition (DSM-5), the diagnostic criteria of cognitive impairment were revised to keep pace with research findings in recent years and to better reflect current understanding on the participant. The new criteria for DSM-5 encompass major neurocognitive disorder (NCD) and mild NCD.[1] The former replaces but is synonymous with dementia, whereas the latter defines participants with modest cognitive impairment but no dementia, akin to the widely used mild cognitive impairment (MCI) concept.

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Compared with the Diagnostic and Statistical Manual of Mental Disorders-Fourth edition, the major NCD criteria in DSM-5 places less emphasis on memory impairment, includes complex attention, learning, perceptual-motor, and social cognition in the criteria for cognitive impairment and involves a change in the clause "socio-occupational dysfunction" to "interference with independence." On the other hand, mild NCD, which defines participants with no dementia, entails the following: (1) mild decline in cognitive function, (2) modest impairment in cognitive performance, and (3) no interference with capacity for independence. It is noteworthy that DSM-5 criteria for both major and mild NCD included the necessity for standardized neuropsychological testing, or in its absence, another quantified clinical assessment.

Montreal Cognitive Assessment (MOCA), a convenient bedside cognitive test, has been shown in several populations to have good diagnostic utility for dementia, especially Alzheimer's disease, and MCI.[2–8] Given MOCA's broader coverage of the main cognitive domains assessed, it can potentially overcome the inherent issues with the widely utilized Mini-Mental State Examination (MMSE), in particular, inadequate assessment of executive function and ceiling effects. These features make MOCA an ideal and convenient bedside test to identify persons with early cognitive deficits, such as those with mild NCD.

To our knowledge, there has yet been any published literature on the diagnostic utility of MOCA for DSM-5 major and mild NCD. Hence, this study aims to explore the usefulness of MOCA to detect DSM-5 major and mild NCD in patients presenting to a tertiary hospital memory clinic.

Methods

Participants and Procedures

Participants with questionable dementia and early dementia, as defined by clinical dementia rating scores of 0.5 and 1.0, over a period of 1 year were identified from the memory clinic registry of a tertiary hospital in Singapore. Participants with delirium, reversible causes of cognitive impairment, and major psychiatric illnesses, such as major depressive disorder or schizophrenia, were excluded. Ethics approval was obtained from the National University of Singapore Institutional Review Board.

The database records of the participants were carefully reviewed and the diagnostic labels of major and mild NCD were applied accordingly on the basis of medical history, clinical examination, basic, and instrumental activities of daily living, locally validated bedside cognitive tests (Mini-Mental State Examination, Frontal Assessment Battery, and a bedside clock drawing task, CLOX),[9–11] relevant blood investigations and brain imaging. Results of standardized neuropsychological assessment covering the major cognitive domains of attention, memory, language, visuospatial and constructional abilities, and executive function were also reviewed. However, this information was available in only 25% participants because many patients in the memory clinic did not undergo the assessment. This was because patients had to pay for neuropsychological assessment and many opted out of it.

The healthy control (HC) participants were recruited from the on-going community based Singapore Longitudinal Aging Study (SLAS). The detailed methodology of SLAS has been described in prior publications[12] and is described briefly herein. The SLAS is a community-based prospective cohort study of aging and health whereby residents aged 55 years and above in the south-east region, south-central, and south-west region of Singapore are identified in a door-to-door census and invited to participate in a comprehensive set of assessments covering demographic, health, behavior, functional, and cognitive domains. A total of 6000 participants were recruited and regular follow-up assessments were conducted at 2- to 4-year intervals. For this study, all HC scored $\geq$27 in the MMSE, had a clinical dementia rating score = 0, had no history of significant head injury, stroke or evidence of cerebrovascular disease, other neurologic disease, systemic illness, or medical conditions that may affect cognitive functioning and activities of daily living, clinical depression, or other psychiatric and substance-related disorders, which affect cognitive functioning, and use of long-acting benzodiazepines or barbiturates within the past 2 years. MOCA was administered to all participants, and the results were not taken into consideration in applying the DSM-5 criteria to avoid circularity in the diagnostic process.

Cognitive Assessment Instruments

The MOCA was modified for Singaporeans by a senior psychologist and a specialist/neurologist providing dementia care. The adaptations of the test items were made in consultation with the original MOCA test developer and have been reported previously.[13] The translation and back-translation of the Chinese and Malay versions of the MOCA were undertaken by bilingual psychologists and 3 equivalent versions (in English, Chinese, and Malay) of the MOCA were established.

The MMSE is a widely used cognitive assessment tool. It has a maximum score of 30, with individual items covering orientation, memory, concentration, language and constructional praxis. The area under the curve (AUC) of MMSE was 95% on the receiver operating characteristic (ROC) curve in an earlier study in Singapore.[9]

Frontal Assessment Battery (FAB) was developed as a brief bedside test to assess frontal lobe function.[14] It comprises 6 subtests: (1) conceptualization [conceptualization links between 2 objects from the same category, (eg an orange and a banana)], (2) mental flexibility (animal naming in a 1-minute trial), (3) motor programming (Luria's 'fist-edge-palm' motor series), (4) sensitivity to interference [conflicting instructions in which participants must provide an opposite response to the examiner's alternating signal (eg tapping once when the examiner taps twice)], (5) inhibitory control [go/no-go paradigm where the participant must inhibit a response that was previously given to the same stimulus, (eg not tapping when the examiner taps twice)], and (6) environmental autonomy (placing your hands out and instructing the participant not to touch them, looking out for abnormal behavior such as imitation, utilization, and prehension behavior). Each subtest is scored from 0 to 3, yielding a total score of 18. FAB achieved AUC of 84% to 94% on the ROC curve in a previous Singapore study.[10]

CLOX is a clock drawing task developed by Royall et al.[15] The test is divided into 2 parts, CLOX1, where participant is required to draw on a blank surface a clock face showing "1:45", and CLOX2, where participant is asked to copy a clock face. CLOX is scored with respect to (1) its resemblance of visual attributes to a standard analogue clock and (2) the constructional sequence (making the 4 quadrants by placing the numbers 12, 6, 3 and 9 first in order to facilitate the positioning of the entire number set). Each CLOX subtest is scored on a 15-point scale. Lower CLOX scores denote greater cognitive impairment. CLOX1 and CLOX2 was previously validated in Singapore with AUC of 84% and 85%, respectively, on the ROC curve.[11]

DSM-5 Diagnostic Criteria[1]

Major NCD was diagnosed using the DSM-5 criteria as follows: (A1) concern of the individual, a knowledgeable informant or the clinician that there has been a significant decline in cognitive function, (A2) a substantial impairment in cognitive performance preferably documented by standardized neuropsychological testing or,