

ORIGINAL ARTICLE

Montreal Cognitive Assessment Arabic version: Reliability and validity prevalence of mild cognitive impairment among elderly attending geriatric clubs in Cairo

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Aim: Mild cognitive impairment (MCI) is a clinical label which includes elderly subjects with memory impairment and with no significant daily functional disability. MCI is an important target for Alzheimer's dementia prevention studies. Data on the prevalence and incidence of MCI varies greatly according to cultural difference. The first aim of this study was to assess the reliability and validity of Montreal Cognitive Assessment (MoCA) Arabic version in MCI detection. The second was to determine the prevalence of MCI among apparently healthy elderly people attending geriatric clubs in Cairo.

Methods: In stage I reliability & validity of MoCA Arabic version were assessed in reference to Cambridge Cognitive Examination (CAMCOG). In stage II prevalence of MCI was estimated using Arabic MoCA among apparently healthy elderly attending geriatric clubs. These geriatric clubs were randomly selected from different regions in Cairo governorate.

Results: Test–retest reliability data of the Arabic MoCA were collected approximately 35.0 ± 17.6 days apart. The mean change in Arabic MoCA scores from the first to second evaluation was 0.9 ± 2.5 points, and correlation between the two evaluations was high (correlation coefficient = 0.92, $P < 0.001$). The internal consistency of the Arabic MoCA was good, yielding a Cronbach's α on the standardized items of 0.83. In diagnosing mild cognitive impairment, the Arabic MoCA showed 92.3% sensitivity and 85.7% specificity. The prevalence of MCI among elderly subjects attending geriatric clubs in Cairo is 34.2% and 44.3% of healthy men and women, respectively.

Conclusion: Older age, female sex and less education are the independent risk factors for MCI among apparently healthy elderly subjects attending geriatric clubs in Cairo.

Keywords: elderly, mild cognitive impairment, Montreal Cognitive Assessment Arabic version.

Introduction

Mild cognitive impairment (MCI) is a clinical label which includes elderly subjects with memory

impairment and with no significant daily functional disability. MCI is an important target for future Alzheimer's dementia (AD) prevention studies.^{1–3} Because the majority of MCI individuals show progressive memory decline due to the presence of AD pathology in its earliest stages, this may be the optimum stage at which to intervene with preventive therapies.⁴ Clinical studies reported a conversion rate from MCI to AD of 10–15%/year.^{3,5,6} Data on the prevalence and

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incidence of MCI varies greatly according to cultural difference.⁷

The first aim of this study was to assess the reliability and validity of Montreal Cognitive Assessment (MoCA) Arabic version in MCI detection. The second aim was to determine the prevalence of MCI among apparently healthy elderly people attending geriatric clubs in Cairo governorate.

Methods

This study was conducted in two stages: stage I, in which reliability and validity of the Arabic MoCA were assessed; and stage II, in which the prevalence of MCI was estimated using the Arabic MoCA among apparently healthy elderly attending geriatric clubs. These geriatric clubs were randomly selected from different regions in Cairo governorate.

Case definition

Mild cognitive impairment is a transition stage between the cognitive decline of normal aging and the more serious problems caused by Alzheimer's disease. It is applied to elderly people with short- or long-term memory impairment greater than normally expected with aging, with no significant daily functional disability.⁸ This is objectively detected through Cambridge Cognitive Examination (CAMCOG).⁹

Montreal Cognitive Assessment (MoCA)

The final English version of MoCA (available at <http://www.mocatest.org>) is a one-page 30-point screening test administered in 10 min to identify elderly people with MCI. The total possible score is 30; a score of 26 or above is considered normal; and a score below 26 with no functional impairment indicates MCI. Additionally, a score below 26 with functional impairment indicates early dementia, and an extra point is added if the individual has 12 years or fewer of formal education.

Evaluation of the MoCA Arabic version

The Arabic MoCA was administered in after its translation into Arabic then retranslation into English. The Arabic version is identical to the English version except for the two sentences used in the repetition task that have been replaced by their likes in the Arabic culture but carrying the same meaning as the English version.

Test-retest reliability data were collected after an average of 35 days from a subsample of 26 participants.

The Arabic MoCA was validated in the current study in reference to CAMCOG, which is a diagnostic test for MCI. A score of 90 or more indicates normality, 89–78 is an indication of MCI, and a score lower than 78 is diagnostic for dementia.

The MoCA Arabic version and CAMCOG were administered over a period of 3 months to all participants in stage I of the study ($n = 184$). In stage II, the Arabic MoCA was administered to all participants (Fig. 1 illustrates the Arabic MoCA).

Study participants

In stage I, the participants were recruited from geriatric clubs in Cairo. They were functionally independent. They were divided into two groups depending on their performance in CAMCOG: the MCI group ($n = 94$) as defined by the previously mentioned criteria; and the normal control group ($n = 90$) consisting of healthy elderly subjects with no memory or cognitive complaints. The Arabic MoCA was conducted independent of the diagnostic assessments.

In stage II, a cross-sectional study was conducted to determine the prevalence of MCI among 268 apparently healthy elderly subjects. They attended geriatric clubs in different regions in Cairo governorate and were functionally independent. The Arabic MoCA was used in this stage.

The duration of the study was 9 months starting August 2006.

Data management and statistical analysis

Data collected is described in the form of frequency distribution when qualitative, and mean and standard deviation when quantitative. The χ^2 -test was used to test association between qualitative variables. The Student's *t*-test was used to compare the means of both groups means. Cronbach's α test was used for validation of test items. Logistic regression analysis was performed to identify the independent risk factors and their relative weight. The *P*-value was set at 0.05. All statistical manipulation was performed using the Statistical Package for Social Science ver. 11 (SPSS, Chicago, IL, USA).

Results

Stage I

Psychometric properties of the Arabic MoCA

Case and control participants were tested approximately 35.0 ± 17.6 days apart. The mean change in Arabic MoCA scores was 0.9 ± 2.5 points.

The internal consistency of the Arabic MoCA yielded a Cronbach's α on the standardized items of 0.83. Changing the two repetition sentences did not alter the internal consistency of the test and were highly correlated to the principal component.

Sensitivity and specificity of the Arabic MoCA were determined across CAMCOG as a gold standard. A total of 184 healthy elderly attending geriatric clubs (94 of

<p>الدرجات</p> <p>إرسم ساعة تشير إلى الساعة 11 و 10 دقائق (3 درجات)</p> <p>إرسم هذا المكعب</p> <p>وظائف تنفيذية / وظائف بصرية مكانية</p> <p>نهاية</p> <p>بداية</p>	<p>5 \</p> <p>القارب []</p> <p>الأرقام []</p> <p>الإطار []</p>	<p>[]</p> <p>[]</p>	<p>ج</p> <p>أ</p> <p>ب</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>ث</p> <p>ت</p>
<p>3 \</p>	<p>[]</p> <p>[]</p>	<p>[]</p>	<p>التسمية</p> <p>[]</p>
<p>الذاكرة</p>	<p>أحمر</p> <p>ممتاز</p> <p>كنيسة</p> <p>ناعم</p> <p>وجه</p>	<p>المحاولة (1)</p> <p>المحاولة (2)</p>	<p>اتلو الكلمات التالية، ثم اطلب من الشخص ثلاثتها. قم بإجراء محاولتين. قم باسترجاعهم مرة أخرى بعد خمس دقائق.</p>
<p>2 \</p>	<p>21854 []</p> <p>742 []</p>	<p>على الشخص أن يكرر ثلاثة الأرقام بالترتيب</p> <p>على الشخص أن يكرر ثلاثة الأرقام عكس الترتيب</p>	<p>اقرأ مجموعة الأرقام (بمعدل رقم في الثانية)</p>
<p>1 \</p>	<p>ف ب ا ث م ن ا ج ك ل ب ا ف ا ك د ي ا ا ج ا م و ف ا ب []</p>	<p>على الشخص أن يصف عند كل حرف "ا". تعطي درجة "صفر" إذا أخطأ مرتين أو أكثر.</p>	<p>اقرأ مجموعة الحروف</p>
<p>3 \</p>	<p>65 [] 72 [] 79 [] 86 [] 93 []</p> <p>5-4 طرح صواب : 3-2 طرح صواب: 2 درجة، 1 طرح صواب: درجة واحدة، لا يوجد صواب: صفر درجة.</p>	<p>اطلب من الشخص أن يقوم بطرح رقم 7 من 100 ويكرر عملية الطرح حتى 5 طرحات</p>	<p>اطلب من الشخص أن يردد الجمل التالية</p>
<p>2 \</p>	<p>الفرش الأبيض ينفع في اليوم الأسود []</p> <p>إن غاب القط لعب يا فار []</p>	<p>الفرش الأبيض ينفع في اليوم الأسود []</p> <p>إن غاب القط لعب يا فار []</p>	<p>الساعة في اللغة</p>
<p>1 \</p>	<p>الذكر في دقيقة واحدة أكبر عدد من الكلمات تبدأ بحرف الفاء []</p>	<p>الذكر في دقيقة واحدة أكبر عدد من الكلمات تبدأ بحرف الفاء []</p>	<p>الدرجة النهائية (الطبيعي) 30/26</p>
<p>2 \</p>	<p>وجه الشبه بين الأشياء مثلًا: الموز و البرتقال = فاكهة</p> <p>ما وجه الشبه بين: القطار - العجلة []</p>	<p>وجه الشبه بين الأشياء مثلًا: الموز و البرتقال = فاكهة</p> <p>ما وجه الشبه بين: القطار - العجلة []</p>	<p>الدرجة النهائية (الطبيعي) 30/26</p>
<p>5 \</p>	<p>أحمر []</p> <p>ممتاز []</p> <p>كنيسة []</p> <p>ناعم []</p> <p>وجه []</p>	<p>على الشخص أن يستدعي الكلمات المذكورة من قبل بدون تلميح</p> <p>باستخدام التلميح</p> <p>تلميح باختبارات متعددة</p>	<p>الإستدعاء الموزجّل</p> <p>اختياري</p>
<p>6 \</p>	<p>المدينة []</p> <p>المكان []</p> <p>اليوم []</p> <p>السنة []</p> <p>الشهر []</p> <p>التاريخ []</p>	<p>المدينة []</p> <p>المكان []</p> <p>اليوم []</p> <p>السنة []</p> <p>الشهر []</p> <p>التاريخ []</p>	<p>التوجيه</p> <p>الدرجة النهائية (الطبيعي) 30/26</p>

whom had MCI and 90 who were normal according to CAMCOG) were subjected to the Arabic MoCA. There were 90 women (49%) and 94 men (51%). The mean age of the interviewed elderly was 64.5 ± 6.8 years ranging 60–83 years. They were all married. Only one was illiterate, while 90 had achieved high school education. They were all functionally independent.

Figure 2 shows a scatter plot illustrating the correlation between Arabic MoCA and CAMCOG scores. No outliers were beyond 2 standard deviations ($r = 0.916$, $P < 0.001$).

In Table 1, the total Arabic MoCA score shows a significant correlation with different items of CAMCOG while Table 2 presents the total CAMCOG score correlation with all items of the Arabic MoCA. “Delayed recall” was the only item that showed

no significant correlation with the total CAMCOG score.

Stage II

A total of 268 elderly were interviewed. This was done by the use of the previously validated Arabic MoCA. The participants mean age was 66.8 ± 5.05 years, ranging 60–76 years. One hundred and forty-six (54.5%) were men. The majority were married (51.5%) and achieved a high level of education (secondary school to university). Only two females were current smokers and two were ex-smokers, while 55.7% of men were current smokers and 27.9% were ex-smokers. They were all functionally independent.

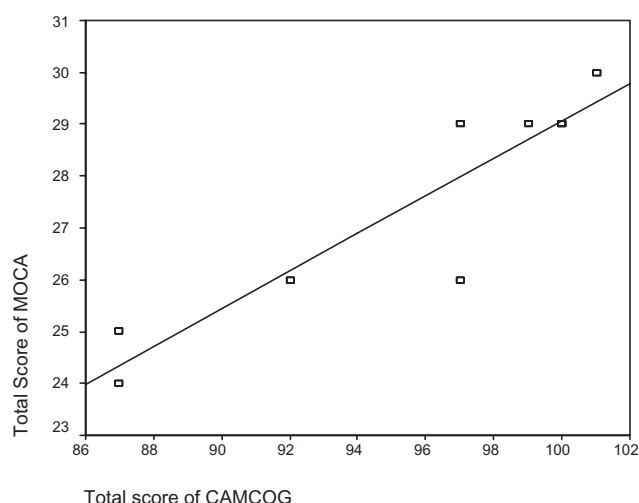


Figure 2 Scatter plot illustrates the correlation between Montreal Cognitive Assessment (MoCA) Arabic version and Cambridge Cognitive Examination (CAMCOG) scores. No outliers were beyond 2 standard deviations ($r = 0.916$, $P < 0.001$).

Table 3 shows the prevalence of MCI in elderly subjects attending geriatric clubs in Cairo to be 34.2% and 44.3% among healthy men and women, respectively.

Table 4 shows different factors affecting cognitive function in MCI individuals. It shows that older age, and less education years are the risk factors for MCI in the selected sample of elderly. This is confirmed by logistic regression analysis (Table 6).

Among elderly subjects with mild cognitive impairment, women recorded significantly lower scores than men in the clock drawing test, reading digits, serial 7 subtraction, verbal fluency and abstraction. Men with MCI recorded significantly lower scores than women in the trill making test, delayed recall, and orientation (Table 5).

Older age, female sex and less education years were the independent risk factors for MCI in the selected sample of elderly (Table 6).

Discussion

The Arabic MoCA demonstrated adequate test-retest reliability and internal consistency. Content validation was established via a close correlation between Arabic MoCA and CAMCOG scores.

The specificity of the Arabic MoCA Arabic was good (85.7%). More importantly, the Arabic MoCA sensitivity in detecting MCI was high (92.3%).

There are several features in the Arabic MoCA that likely explain its higher sensitivity in detecting MCI. The MoCA memory testing involves more words, fewer learning trials and a longer delay before recall than other tests such as the Mini-Mental State Examination (MMSE). Executive functions, higher level language abilities and complex visuospatial processing can also be mildly impaired in MCI participants and are assessed by

Table 1 Correlation of total Montreal Cognitive Assessment (MoCA) Arabic version score with different items of Cambridge Cognitive Examination (CAMCOG)

Items of CAMCOG	Correlation coefficient (R)	P-value
Visuospatial	0.829	<0.001
Executive function	0.807	<0.001
Attention	0.793	<0.001
Reading digits	0.794	<0.001
Serial 7 subtraction	0.499	0.025
Language	0.719	<0.001
Recent memory	0.712	<0.001
Delayed recall	0.845	<0.001
Orientation	0.751	<0.001
Total score	0.937	<0.001

Table 2 Correlation of total Cambridge Cognitive Examination (CAMCOG) score with different items of Montreal Cognitive Assessment (MoCA) Arabic version

Items of MOCA	Correlation coefficient (<i>R</i>)	<i>P</i> -value
Visuospatial	0.644	0.002
Executive function	0.715	<0.001
Attention	0.911	<0.001
Reading digits	0.659	0.002
Serial 7 subtraction	0.833	<0.001
Language	0.686	0.001
Recent memory	0.686	0.001
Delayed recall	0.605	0.019
Orientation	0.611	0.004
Total score	0.937	<0.001

Table 3 Prevalence of mild cognitive impairment (MCI) in elderly attending geriatric clubs in Cairo

	Men	Women
Normal (%)	96 (65.8%)	68 (55.7%)
MCI (%)	50 (34.2%)	54 (44.3%)
<i>P</i> -value	0.061 NS	

NS, not significant.

the Arabic MoCA with more numerous and demanding tasks than the other screening tests. Therefore, in general practice, using the Arabic MoCA as a screening tool provides quick guidance for referral and further investigation of MCI.

The following presents a practical approach to screen patients presented with cognitive complaints. Patients who present with cognitive impairment but no functional impairment are likely to be normal or have MCI. In these patients, one should administer MoCA first because other cognitive assessment scales like the MMSE will most likely be normal in either case. There are currently no other screening tools to quickly and reliably distinguish individuals with MCI from normal controls.⁴ In patients who present with cognitive complaints and functional impairment, and are therefore most likely to be suffering from dementia, the MMSE could be administered first because it is likely to be abnormal. MoCA can detect approximately 90% of MCI subjects. However, in mild AD patients, MoCA sensitivity is 100% and specificity is considered to be 87%.⁴ Measures such as the Short Test of Mental Status (STMS),¹⁰ Memory Impairment Screen,¹¹ and 7-minute Screen have been validated for dementia but not MCI.¹² A recent study showed that neither the STMS nor the MMSE can be used alone to diagnose MCI.¹³ The cognitive Capacity Screening Examination had 74.3% sen-

sitivity for detection of MCI, and when combined with MMSE, it achieved a sensitivity of 83%, but this combined total score was derived from two scales and scored out of 47 points,¹⁴ making it lengthy and potentially cumbersome to use.

Researchers on the prevalence of MCI have reported inconsistent data mainly because of different sampling and assessment procedures as well as different cultures. Prevalence studies of MCI^{15–17} used different operational criteria with different outcomes. For example, the study by Kivipelto *et al.*¹⁵ defined MCI as “an objective impairment of memory or in one other area of cognitive function” and recorded a prevalence rate of 6% in people aged 65–79 years. Ritchie *et al.*¹⁶ related MCI to an isolated memory loss, and reported a prevalence rate of only 3% in people aged 60 years and over. Schönknecht *et al.*¹⁷ used the German version of the Structured Clinical Interview for the 3rd edn of the Diagnostic and Statistical Manual of Mental Disorders, Revised (DSM-III-R) to define MCI and reported a prevalence rate of 13.5% for their study sample, aged 60–64 years.

The prevalence of MCI increases with age as found in this study and was also reported in other studies,^{18–21} while a general decline with age was reported in one study.²² Besides, others found no significant influence of age on the incidence of MCI.^{23,24} The increase in the prevalence rate with age can be explained by the physiological changes of the brain that occur with aging leading to decreases in the cerebral reserve.

In this study, women reported a higher prevalence rate of MCI than men, similar to the results of Di Carlo *et al.*¹⁹ This could be attributed to less educational opportunities being provided for women as well as less cognitive stimulation than men. However, higher prevalence rates for men have been reported by Koivisto *et al.*²² and no sex difference was reported by Ebly *et al.*,²⁵ Hänninen *et al.*²³ and Frisoni *et al.*²⁴

Table 4 Descriptive analysis of different factors affecting cognitive function in mild cognitive impairment (MCI) individuals

	Cognitive function		P-value
	Normal	MCI	
Age group [†]	65.7 (5.5)	68.5 (3.7)	<0.001 HS
Mean (SD)			
Sex [†]			0.061 NS
• Male	96 (65.8%)	50 (34.2%)	
• Female	68 (55.7%)	54 (44.3%)	
Education [†]			
• Illiterate	24 (48.0%)	26 (52.0%)	<0.001 HS
• School education	82 (55.4%)	66 (44.6%)	
• High education	58 (82.9%)	12 (17.1%)	
• Education years			<0.001 HS
Mean (SD)	10.8 (5.4)	8.2 (5.5)	
Marital status			0.262 NS
• Married	80 (58.0%)	58 (42.0%)	
• Single	14 (63.6%)	8 (36.4%)	
• Other	70 (64.8%)	38 (35.2%)	
Smoking [†]			0.364 NS
• Never	104 (64.2%)	58 (35.8%)	
• Ex-smoker	22 (61.1%)	14 (38.9%)	
• Current smoker	38 (54.3%)	32 (45.7%)	

[†]Percentages are calculated from rows.

HS, highly significant; NS, not significant.

Table 5 Main aspects of cognitive impairment in males compared to females among all mild cognitive impairment (MCI) elderly

	Men	women	P-value
	Mean (SD)	Mean (SD)	
Trill making test	0.07 (0.3)	0.32 (0.5)	0.006 S
Clock drawing test	2.55 (1.1)	1.60 (1.1)	<0.001 HS
Naming	2.5 (1.1)	2.8 (0.6)	0.068 NS
Reading digits	2.0 (0.0)	1.6 (0.6)	<0.001 HS
Reading letters	0.85 (0.3)	0.96 (0.2)	0.058 NS
Serial 7 subtraction	2.48 (1.1)	1.80 (1.1)	0.002 S
Statement repetition	1.8 (0.4)	1.9 (0.4)	0.359 NS
Verbal fluency	0.74 (0.4)	0.40 (0.5)	<0.001 HS
Abstraction	1.6 (0.7)	1.2 (0.8)	0.012 S
Delayed recall	0.37 (0.8)	3.2 (1.4)	<0.001 HS
Orientation	5.3 (1.8)	5.6 (1.3)	<0.001 HS

HS, highly significant; NS, not significant; S, significant.

Schröder and coworkers²⁶ found that education is not consistently related to the prevalence of MCI. While Hänninen *et al.*²³ found that the prevalence rate is high with a low level of education. In the present study, less education years was an independent risk factor for MCI. Education increases cerebral capacity as being a well-known stimulus for cognition.

Because it has been postulated that elderly subjects with MCI are at an increased risk of developing demen-

tia, identification of MCI is important for successful preventive strategies and early therapeutic interventions.¹⁷ Therefore, positive MoCA subjects should not be neglected but should be frequently monitored for cognitive function deterioration.

In diagnosing MCI, the Arabic MoCA showed 92.3% sensitivity and 85.7% specificity, with good test-retest reliability as well as internal consistency. The prevalence of MCI is 34.2% and 44.3%

Table 6 Independent risk factors of MCI among elderly population attending geriatric clubs in Cairo by Logistic regression analysis

Independent risk factors	Regression coefficient (B)	SE of B	Significance	OR	95% CI
Constant	-9.77	2.99			
Sex	0.834	0.417	<0.05	2.3	1.0–5.2
Age	0.120	0.036	<0.01	1.13	1.0–1.2
Education Years	-0.078	0.026	<0.01	0.92	0.88–0.97

Overall predictivity of the model, 62.7. CI, confidence interval; SE of B, standard error of regression coefficient; OR, odds ratio.

of healthy men and women, respectively. Older age, female sex and less education years are the independent risk factors for MCI among apparently healthy elderly people attending geriatric clubs in Cairo.

Women with MCI recorded significantly lower scores than men in the clock drawing test, reading digits, serial 7 subtraction, verbal fluency and abstraction. Men with MCI recorded significantly lower scores than women in trill making test, delayed recall and orientation.

Clinical implications

The Arabic MoCA can be used as a screening test for MCI with high sensitivity and specificity. Because the independent risk factors for MCI are age, female sex and less education years, screening those vulnerable groups could be of value for early intervention either by memory exercise or medications to delay progression into dementia. Memory exercise will concentrate on enhancing different cognitive functions, especially executive function, delayed recall and orientation in men, and visuospatial function, attention, concentration, calculation, verbal fluency and abstraction in women.

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