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Comparison of Montreal Cognitive Assessment Test and Mini Mental State Examination in Detecting Cognitive Impairment in Relapsing-Remitting Multiple Sclerosis Patients

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ABSTRACT

Background and purpose: Cognitive impairment (CI) is one of the causes of disabilities in multiple sclerosis patients (MS). Therefore, early detection and evaluation of cognitive performance is very important in patients with MS. The aim of the present study is to compare Montreal Cognitive Assessment (MoCA) test and Mini Mental Status Exam (MMSE) in Relapsing Remitting (RR) MS patients.

Methods: Fifty RRMS patients who met inclusion and exclusion criteria were recruited in this study. MMSE and MoCA were administrated to all subjects. Also demographic data, disease duration and EDSS were recorded. The results of both tests were compared.

Results: The mean score of MoCA and MMSE was 22.86±3.85 and 27.64±2, with a significant difference ($p<0.0005$). With using MoCA 60% of subject had CI, whereas with MMSE only 34% were impaired ($p<0.0005$). There was an inverse significant association between education and CI detected by both MMSE and MoCA (for MMSE $r=0.535$ and $p<0.0005$, for MoCA $r=0.544$ and $p<0.0005$). A significant association was also found between disease duration and CI on both tests (for MMSE $r=0.394$ and $p<0.0005$, for MoCA $r=0.538$ and $p<0.0005$).

Conclusion: This study suggests that the MoCA has superiority to the MMSE for evaluating cognitive function in RRMS patients.

Keywords: Cognitive Impairment; Montreal Cognitive Assessment; Mini Mental Status Exam; Multiple Sclerosis; Relapsing Remitting.

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INTRODUCTION

Multiple Sclerosis (MS) is a chronic progressive neurodegenerative disease of central nervous system (CNS) that typically affects white matter, axons and causes brain atrophy [1]. Relapsing remitting (RR), the most common MS subtype, occurs in about 85% of the patients [2]. RRMS is defined as acute relapses of symptoms between periods of remission.

Cognitive impairment (CI) is one of the MS comorbidities, with prevalence of about 30% to 70% [1]. Impairment of cognitive domains such as memory, processing speed, attention, and executive function can occur from the early stage of the MS disease [3]. Therefore, it is important to have a brief and reliable test for detecting CI and assessing cognitive function status in MS patients.

Most of the tests that are created for diagnosing CI takes a long time and are not useful in clinics. Therefore, conventional neuropsychological tests have been remained the gold standard, yet. Among neuropsychological batteries, Mini Mental State Exam (MMSE) is a short test that extensively used in clinics; but it is insensitive for

detecting mild cognitive impairment (MCI) [4]. Otherwise, Montreal Cognitive Assessment (MoCA) test, created by Nasreddine et al [5], is a cognitive screening instrument that developed to overcome MMSE limitations, and is available in http://www.mocatest.org. The MoCA assesses memory and language function but not executive function [6] that is frequently involved in MS patients [7].

The MoCA is a short 30 point test which evaluates 8 cognitive domains; including visuospacial abilities, executive functions, naming, attention, language, abstraction, short term memory and orientation [5]. Also, according to previous studies, MoCA is more sensitive than MMSE in diagnosis of MCI [5-8].

This study was conducted to compare two brief and widely used tests (MMSE and MoCA) for detection of MCI in RRMS patients, and assessing MoCA vs. MMSE for evaluating cognition in MS patients. Also, determining the correlation between MoCA and MMSE score with other corresponding factors (years of education and disease duration), was another objective of this study.

MATERIAL AND METHODS

Subjects

With considering of 30% prevalence of CI in RRMS patients [9], acceptable difference 15% and type one error 0.05, fifty samples were calculated in this study. Patients with RRMS diagnosis according to revised McDonald 2005 Criteria [10] without any relapsing episode were included. All subjects were selected from out-patient in neurology clinic of Shohada Tajrish hospital.

Patients with at least one of these criteria were excluded from study: (1) history of neuropsychological problems according to the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV); (2) history of relapsing episode for at least two months prior to interview; (3) patients with other brain pathology (of significant head trauma or intracranial malignancy); (4) patients under treatment with neuropsychological drugs (neuroleptics, anticholinergics or other central nervous system depressants); (5) history of treatment with steroid at least two months before the assessment; (6) habitual drug or alcohol consumption.

The study protocol approved by the ethic committee of the functional neurosurgery research center (Shohada Tajrish Hospital, Shahid Beheshti University of Medical Sciences) and written informed consent was obtained from all subjects.

Then, demographic data such as age, gender, years of education and data related to disease duration (from first attack to the date of cognitive assessment) were collected. Also, severity of disabilities was measured using Expanded Disability Status Scale (EDSS) according to Kurtzke study [11].

Cognitive assessment

All subjects undertaken Persian version of MMSE and MoCA by an expert clinician. The MMSE is a routinely used 30-point test that examines 7 domains of cognition: orientation, registration, attention and calculation, recall, language, naming and visuospatial [12]. A score less than 26 is considered optimal cutoff point for diagnosis of cognitive impairment [13].

The MoCA is a 30-point test with cut off point<26 for detection of MCI. According to MoCA instruction to correct for educational effects one score was added for subjects who have 12 or fewer years of education.

In the Persian version of MoCA test, some modifications were made to establishing better compatibility for culture and language. In the visuospatial /executive item Arabic numbers and Persian alphabets were used for modified trail making test. Also, in the attention item for letter taping part English alphabets were replaced with Persian alphabet.

Data Analysis

Kolmogrov smirnov test was employed to assess normal distribution of data. Independent sample t-test and Paired samples t-test were performed for normally distributed data and in the absence of normality, Mann-Whitney test and Sign test were used.

We compared descriptive data using Chi-square and we used logistic regression model for assessing the correlation between tests score and related variables. To assess statistics reliability, cronbach's alpha was calculated. P-value < 0.05 considered statistically significant. All statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 21.

RESULTS

Of the fifty patients enrolled in the study, 70% were female with a mean age of 31.74±8.36 years (range, 19-50 yr). 34% patients had education under 12 years, 36% had education between 12 to 16 years and 30% had above 16 years education. The mean of EDSS (1.11±0.97) showed this population was mildly impaired by MS. Table 1 presents other variables in both genders.

Thirty subjects (60%) were cognitively impaired with MoCA while seventeen subjects (34%) were impaired

Table1. Subject's characteristics in both genders.

	Female	Male	*P* value
Age (mean±SD)	31.45 ± 8.32	32.40 ± 8.69	0.718
Years of Education (mean±SD)	11.94 ± 4.70	11.06 ± 3.78	0.373
Disease duration (mean±SD)	15.97 ± 12.56	22.80 ± 15.82	0.112
MoCA score (mean±SD)	23.34 ± 3.91	21.73 ± 3.57	0.092
MMSE score (mean±SD)	28.00 ± 2.26	26.80 ± 2.27	0.097
MMSE <26 (%)	28.6	46.7	0.22
MoCA <26 (%)	51.4	80	0.061

with MMSE. 39.39 % of subjects with a normal MMSE score showed cognitive impairment on the MoCA.

Comparison of MoCA and MMSE

The range of MMSE scores (24-30) were higher than MoCA scores (15-29). No cases with MoCA≥26 obtained MMSE score less than 26 while all subjects with MMSE≥26 got MoCA score≥26. The mean score of MMSE (27.64±2.31) was significantly higher than the mean score of MoCA (22.86±3.85) (p-value <0.0005).

All domains of MoCA have shown significant difference between subjects with and without cognitive impairment except Naming, attention and orientation, while with MMSE language domain was the only domain that differ significantly in both groups (p-value=0.001) (Table 2).

Association between cognitive impairments with other variables

Binary logistic model analysis revealed that age, sex and EDSS were not associated with cognitive impairments detected by both tests, in contrast with years of education and disease duration (Table 3).

DISCUSSION

Superiority of MoCA than MMSE has been shown in some diseases, formerly [14-16]. To our best knowledge, no prior studies have compared MoCA vs. MMSE in MS. Most studies compare MoCA with MMSE in other neuropsychological disorders such as: Parkinson, Alzheimer, stroke, transient ischemic attack (TIA), brain tumor and etc. Dagenais et al evaluated MoCA test to assess cognitive function in MS patients and compare

Table 2. Comparison of different items of cognition in cognitively impaired patients and healthy group using MMSE and MoCA.

MOCA	CI (n=30)	NCI (n=20)	*P* value	MMSE	CI (n=17)	NCI (n=33)	*P* value
Visuo-excutive/5	3 (0-5)	5 (3-5)	0.0005	Visuo-spatial/1	0 (0-1)	1 (0-1)	1
Naming/3	3 (1-3)	3 (2-3)	1	Naming/2	2 (1-2)	2 (1-2)	1
Memory/5	2 (0-5)	3 (2-5)	0.027	Recall/3	2 (1-3)	3 (1-3)	1
Attention/6	4 (2-6)	6 (3-6)	1	Attention and Calculation/5	4 (2-5)	5 (4-5)	1
Language/3	1 (0-3)	2 (1-3)	0.001	Language/6	5 (3-6)	6 (5-6)	0.001
Abstraction/2	1 (0-2)	2 (1-2)	0.009	Registration/3	3 (2-3)	3 (2-3)	1
Orientation/6	6 (4-6)	6 (5-6)	1	Orientation/10	9 (8-10)	10 (8-10)	1

Table 3. Association between cognitive impairment and other variables.

	Odds ratio	95% Confidence Interval	*P* value
Cognitive impairment (MoCA)			
Sex (male)	8.648	-1.002 – 5.316	0.181
Age	1.008	-0.134 – 0.151	0.908
Years of education	0.439	-0.213 – -1.433	0.008
Disease Duration	1.484	-0.081 – -0.708	0.014
EDSS	1.051	-2.134 – 2.235	0.964
Cognitive impairment (MMSE)			
Sex (male)	1.450	-1.352 – 2.095	0.672
Age	0.950	-0.156 – 0.053	0.337
Years of education	0.631	-0.744 – -0.176	0.001
Disease duration	1.141	0.028 – 0.236	0.013
EDSS	0.460	- 2.014 – 0.462	0.219

that with EDSS and MSNQ-P (Multiple Sclerosis Neuropsychology Questionnaire-patient version) and MSNQ-I (informant version). They suggested MoCA as a valuable cognitive screening tool in MS patients [17]. In another study, Kaur et al concluded that short version of MoCA is a useful, brief and quick instrument to detect mild cognitive impairment (MCI) in early stages of CI and it is applicable in MS patients who suffer from motor and visual dysfunction [18]. According to our results, the MoCA was superior to the MMSE to detect CI in cognitively intact subjects with MMSE. It seems reasonable, because the MoCA showed statistically significant difference between CI and none-CI subjects in more cognitive domains than MMSE. Among these domains, Visuo-excutive function which is more commonly involves in MS patients, just evaluated by MoCA while MMSE has no item to evaluate this function.

Difference between men and women in CI in MS patients has been shown by Beatty et al [19], whereas, in our study, we found no significant association between gender and CI.

In the present study, CI detected with both tests was inversely associated with years of education. This finding was confirmed in a similar study in patients with cardiovascular risk factors [15].

Also, the association between disease duration of MS with CI in our study has been documented before [20].

We have some limitations: First, our study sample was just confined to the RR subtype of MS. Second, most patients didn't remember relapsing frequency, so we could not evaluate this variable. Third, it was better to consider intellectual state for evaluating cognition when using MMSE in MS patients [21].

This study showed the advantages of MoCA versus MMSE for evaluating cognitive function in MS patients. Finally, we recommend clinician to use MoCA for evaluate cognitive function in MS patients.

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