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Original Article

Evaluation of cognitive impairment in relapsing-remitting multiple sclerosis patients by using the montreal cognitive assessment test

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Abstract

Aim: Evaluating the cognitive functions of patients with relapsing-remitting multiple sclerosis (RRMS) by using the Montreal Cognitive Assessment (MoCA) Test.
Material and Methods: This cross-sectional study consisted of 28 RRMS patients who were diagnosed based on the revised McDonald 2017 criteria and 30 healthy volunteers. The MoCA test and the Expanded Disability Status Scale (EDSS) were applied.
Results: The mean age of the RRMS patients was 37.21±5.61, while the mean age of the healthy volunteers was 35.6±10.09 (p=0.459). 17 (60.7%) of the RRMS patients were female, 11 (39.3%) were male, while 16 (63.3%) of the control group were female, and 14 (46.7%) were male (p=0.571). The median total MoCA score was 24 (min: 15, max: 30) for the RRMS patients and 27 (min: 19, max: 30) for the healthy volunteers, and the difference was significant (p=0.006). The scores of the RRMS patients were significantly lower in terms of the MoCA sub-dimensions of executive functions, attention, language and delayed recall. There was a negative, medium-level significant correlation between the total MoCA scores and EDSS scores (r: -0.583; p<0.001).
Conclusion: The results of this study showed that, in the cognitive dysfunction process in RRMS patients, especially executive functions, attention, language and delayed recall are affected, and there is also a relationship between cognitive dysfunction and disability. Furthermore, these results emphasize the significance of cognitive impairment in RRMS patients and show that the MoCA test may be a practical test that can be used for cognitive monitoring of RRMS patients.

Keywords: Orientation; language; memory; learning; attention; cognitive dysfunction.

INTRODUCTION

Multiple sclerosis (MS) is a chronic demyelinating and inflammatory disease, and it is the most prevalent immune-mediated disease of the central nervous system that affects more than 2 million people (1). In addition to motor, sensory, visual and cerebellar impacts in MS, cognitive dysfunction is also one of the significant causes of disability (2). Cognitive dysfunction may be seen even at the early stage of the disease (3). In MS patients, learning, attention, visuospatial functions, memory, executive functions and information processing rate are affected the most (4).

The Montreal Cognitive Assessment (MoCA) Test is more comprehensive and sensitive in comparison to the Mini-Mental Status Examination (MMSE) (5). With the MoCA Test, executive functions, naming, attention, language, abstract thinking, delayed recall and orientation may be assessed. MoCA is a very sensitive test for assessment of cognitive functions, and its sensitivity level in detecting mild cognitive disorders is about 90% (6).

This study aimed to assess cognitive functions in MS patients using the MoCA Test and determine the characteristics of cognitive dysfunction.

MATERIAL and METHODS

This prospective and cross-sectional study was carried out at the Neurology outpatient clinic of a tertiary healthcare institution between the dates of 1 June 2019 and 1 August 2019. The study was approved by the Ethics

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Board of the Faculty of Medicine at University (protocol number: 2017-KAEK-189_2019.06.19_09). The principles of the Declaration of Helsinki were followed throughout the study period, and informed consent was obtained from all participants.

The study was planned to include 28 Relapsing-Remitting Multiple Sclerosis (RRMS) patients and 30 healthy volunteers. Patients who satisfied the 2017 revised McDonald criteria and received a definite diagnosis of RRMS were included (7). While 2 of the patients was not receiving any prophylactic treatment, 8 were taking glatiramer acetate, 5 were taking interferon beta-1a, 5 were taking interferon beta-1b, 4 were taking teriflunomide, 3 were taking fingolimod and 1 patient was taking dimethyl fumarate.

Patients who were not literate, were using medication that could affect their cognitive functions (excluding MS medications), had anemia, vitamin B12 and folic acid levels or thyroid function disorders were excluded. The study also excluded patients with Parkinson's disease, vascular diseases, dementia, epilepsy or psychiatric diseases. Other exclusion criteria were congenital anomalies of the brain, history of head trauma in the last one year and pregnant women. All the exclusion criteria mentioned above were also valid for the control group.

The sociodemographic and clinical characteristics of all participants were recorded to included age, sex, disease duration and scores in the Expanded Disability Status Scale (EDSS). A complete neurological examination was made, and the disability rates were assessed by using EDSS for all MS patients. EDSS is scored between 0 and 10, and high scores indicate high disability levels (8). For the purposes of determining cognitive functions, all participants were included in the MoCA Test.

Montreal Cognitive Assessment (MoCA) Test

The Montreal Cognitive Assessment (MoCA) Test was developed as a fast screening test for mild cognitive disorders. MoCA evaluates different cognitive functions as attention and concentration, executive functions, memory, language, visual configuration skills, abstract thinking, computation and orientation. The highest possible score in the test is 30. Accordingly, scores of higher than 21 are considered to be normal. The test was analyzed for validity and reliability in Turkish by Selekler et al. (9).

Statistical Analysis

Data analyses were performed using SPSS version 22.0 (Statistical Package for Social Sciences, IBM Inc., Chicago, IL, USA). The descriptive statistics of the data were calculated. Shapiro-Wilk test was applied for testing the normality of distribution. Chi-Squared test was used for analyzing categorical variables. For the normally distributed data, independent-samples t-test was applied to compare the 2 groups. For the non-normally distributed data, Mann-Whitney-U test was applied to compare the 2 groups. Spearman's correlation test was also used for the data that did not show normal distribution. A p-value of smaller than 0.05 was considered to be statistically significant.

RESULTS

The mean ages of the RRMS patients and the control group that were included in the study were respectively 37.21±5.61 and 35.6±10.09 (p=0.459). 17 (60.7%) of the RRMS patients were female, 11 (39.3%) were male, while 16 (63.3%) of the control group were female, and 14 (46.7%) were male (p=0.571). The mean education level of the RRMS patients was 8.11±2.38 years, while that of the control group was 9.33±3.11 years, and this difference was not significant (p=0.099). The mean EDSS score of the RRMS patients was 2.63±1.71.

The total MoCA scores of the RRMS patients were significantly lower in comparison to the control group (p=0.006). Table 1 shows the sub-dimension and total MoCA scores of the RRMS and control groups. While 2 (6.7%) cognitive disorder was found in the control group, 8 (28.6%) of the RRMS patients had cognitive disorders based on the results of the MoCA test. There was a negative, medium-level significant relationship between the MoCA total scores and the EDSS scores (r: -0.583; p<0.001).

Table 1. MoCA sub-component and total scores of the RRMS and control groups. [Median (minimum, maximum)]

	RRMS (n=28)	Control Group (n=30)	P
Executive Functions	4 (min:3, max:5)	5 (min:3, max:5)	P = 0.015 U = 277
Naming	2 (min:1, max:3)	2 (min:2, max:3)	P = 0.764 U = 403
Attention	4 (min:1, max:6)	5 (min:3, max:6)	P = 0.034 U = 289.5
Language	2 (min:1, max:3)	3 (min:1, max:3)	P = 0.005 U = 256.5
Abstract Thinking	2 (min:0, max:2)	2 (min:0, max:2)	P = 0.067 U = 332
Delayed Recall	4 (min:1, max:5)	5 (min:2, max:5)	P = 0.024 U = 282.5
Orientation	6 (min:4, max:6)	6 (min:5, max:6)	P = 0.135 U = 345
MoCA Total Score	24 (min:15, max:30)	27 (min:19, max:30)	P = 0.006 U = 243

RRMS: Relapsing-remitting multiple sclerosis, MoCA: Montreal Cognitive Assessment,
U: Mann–Whitney-U, Significant findings (p < 0.05) were shown in bold.

DISCUSSION

In this study, the RRMS patients had significantly lower scores in comparison to the control group in terms of

the executive function, attention, language and delayed recall MoCA dimensions. It was reported that cognitive dysfunction in MS is area-specific rather than a global dysfunction (3). It was shown that cognitive impairment may be seen in MS patients even at the early stages of the disease (10). While cognitive impairment in MS patient varies from patient to patient, it was stated that it could occur even at the onset of the disease (3). While researchers reported that, in MS patients, especially memory, learning, information processing rate, attention and executive functions are affected, they stated that language disorders are usually not encountered (3,11). The prevalent involvement of white matter in MS patients and relatively nonexistent involvement of gray matter were proposed as the reason for this (3,12). In contrast, a study which assessed language functions in MS patients by using MoCA found an impact on language (13). With the developments in MRI techniques, it was demonstrated that cortical gray matter involvement is seen in MS starting with the early stages of the disease (12,14,15). Considering this information in the literature and the results of our study together, it may be stated that the MoCA test is an effective test for assessment of cortical involvement in MS patients.

Memory, attention, executive functions and information processing rate, which are the most frequently influenced areas in MS, may be assessed with MoCA. It was reported that impact on the areas of memory, information processing rate, executive functions, attention and concentration may be seen in MS patients even at the early stages of the disease (4). The finding of the study that the test performance of the MS patients was worse than the control group shows that the MoCA Test, which may be applied fast, may be used to monitor the cognitive functions of MS patients.

In this study, a negative, medium-level significant relationship was found between the total MoCA scores and the EDSS scores. The results of studies in the literature on the relationship between EDSS scores and cognitive impairment are variable. A previous study found a strong and significant relationship between EDSS and cognitive dysfunction (16). Nevertheless, two other studies could not find a significant relationship between EDSS scores and cognitive dysfunction (13,17). It is worth noting that the numbers of patients in these two studies that could not find a relationship between EDSS and cognitive functions were low. This information in the literature and the result of this study show that there is a need for broad-scoped studies to be carried out in this field.

The limitations of this study may be listed to include the low number of patients, inclusion of MS patients with only the RRMS form and that conditions that cause cognitive dysfunctions such as sleep disorders and present but non-diagnosed depression were not accounted for. In addition, the MoCA test was not supported by other neuropsychiatric tests in this study, and this topic may be seen as a limitation of the study. Lastly, patients who were using MS drugs were not excluded. This situation can be seen as a limitation of the study because some of MS drugs may affect cognitive functions.

CONCLUSION

It was reported that cognitive dysfunction in MS patients affects emotional, social, sexual and work-related activities, and it may affect quality of life even in MS patients with mild disability (18,19). Considering this information and the results of this study together, it may be concluded that the cognitive functions of MS patients should be assessed at each examination, and this assessment may be made with the MoCA test which is practical.

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