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Mini mental state exam versus Montreal cognitive assessment in patients with age-related macular degeneration

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Abstract. – OBJECTIVE: To compare the ability of the MMSE and MoCA to identify cognitive dysfunction in patients with age-related macular degeneration (AMD).

PATIENTS AND METHODS: The study included 81 (29 female, 52 male) AMD patients who were recruited from the Ophthalmology Department of Kırıkkale University during 2012. Participants were screened for cognitive impairment using the MMSE and MoCA. The scores were recorded for all participants. The primary outcome measure was the proportion of patients with a score less than 21 on either test.

RESULTS: The percentage of subjects who scored below a cut off of 21/30 was higher on the MoCA (48.1%) than on the MMSE (18.5%) ($p = 0.05$). The range and standard deviation of scores was larger with the MoCA (7-30, 5.34) than with the MMSE (19-30, 3.26). There was a more pronounced ceiling effect of the MMSE than of the MoCA. The mean MMSE scores of dry-and wet-type AMD patients was significantly higher than the MoCA scores of the same patients ($p = 0.000$ and $p = 0.000$).

CONCLUSIONS: The MoCA seems to be more sensitive than the MMSE to early cognitive impairment in AMD patients.

Key Words:
Age-related macular degeneration, Cognitive impairment, MMSE, MoCA.

Introduction

Age-related macular degeneration (AMD) is the leading cause of severe vision loss among the elderly. Most patients with AMD have the dry type of the disease and will not lose central vision. However, the dry type of AMD can lead to the wet type. Although only about 10% of people with macular degeneration develop the wet type, they make up the majority of those who experience serious vision loss from the disease.

Age-related macular degeneration and cognitive impairment are both chronic neurodegenerative disorders affecting an increasing number of persons as they age. There are a limited number of studies that have directly examined the association between early AMD and cognitive function in the general population[1-6]. The Atherosclerosis Risk in Communities study previously reported an association between cognitive impairment and early AMD[3]. Wong et al[6] reported that a low score on a test of cognitive function increased the risk of AMD by almost 40%[3]. In a recent study, patients with AMD, especially those with the dry-type, were shown to be at greater risk for cognitive impairment.

The mini-mental state examination (MMSE) is the most widely used short cognitive screening test because it is quick and easy to administer in a clinical setting. However, the MMSE gives 24/30 points for memory, language and orientation and only 1/30 for visuoconstructive function and is insensitive to mild cognitive impairment[7-9]. The Montreal Cognitive Assessment (MoCA) is a brief instrument that allocates 14/30 points for visuospatial, attentional and executive function and was developed to identify patients with mild cognitive impairment[10-15]. Compared to the MMSE, the MoCA has a sensitivity of 90% compared to 18% in detecting mild cognitive impairment. In addition, the MoCA uses more numerous and demanding tasks to assess executive function, higher level language abilities, memory, and complex visuospatial processing.

Up to now, few studies have examined cognitive functions using the MMSE in AMD patients. However, to our knowledge, no study has examined cognition on the MoCA in AMD patients. The aim of the current study was to compare the ability of the MMSE and MoCA to identify cognitive dysfunction in patients with age-related macular degeneration.

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Patients and Methods

The study included 81 AMD patients who were recruited from the Ophthalmology Department of Kırıkkale University during 2012. Kırıkkale University Ethics Committee approved the study protocol and informed consents were obtained from all participants. The study was done in adherence to the tenets of the Declaration of Helsinki.

The inclusion criteria were (1) age 60 years or older, (2) bilateral AMD, and (3) best corrected visual acuity no worse than 2/10. The exclusion criteria were (1) the presence of glaucoma, diabetic retinopathy, or cataract surgery within 6 months; (2) dementia, and (3) the presence of life-threatening illness.

Participants were screened for cognitive impairment using the MMSE and MoCA by the same investigator. There was a ten minute break between assessments. The scores were recorded for all 81 participants. The primary outcome measure was the proportion of patients with a score less than 21 on either test. A score of less than 21 on the MMSE has been used as a cut off providing evidence for cognitive impairment[16]. A cut off of 21 in the MoCA was chosen to optimize sensitivity and specificity in the study for assessing mild cognitive impairment.

The statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) program (SPSS Inc. Chicago, IL, USA). Proportions were compared using chi-square tests. Continuous data are expressed as means and standard deviation. p values less than 0.05 were considered as statistically significant.

Results

Eighty-one (29 female, 52 male) subjects with AMD participated in the study. The mean age of the patients was measured as 70.52 ± 9.66 years, and the mean disease duration was 6.5 ± 1.3 years. Sixty seven subjects (82.8%) completed elementary school, 9 subjects (11.1%) completed high school, and 5 subjects (6.2%) had a university degree.

There were 66 AMD patients (81.5%) with a score of greater than 21 on MMSE test. Forty-two patients (51.9%) had a score of greater than 21 on MoCA test. More subjects (39 patients) had a score of less than 21 on the MoCA (39%) than on the MMSE (18.5%) (p = 0.05). No subject with a score greater than 21 on the MoCA scored less than 21 on the MMSE while 61.5% (24 patients) of those who scored greater than 21 on the MMSE had a score less than 21 on the MoCA (p = 0.0004) (Table I).

Table I. Number of subjects with scores above and below the 21-point cutoff on each test.

	MMSE ≥ 21	MMSE < 21	Total
MoCA ≥ 21	42 (63.06%)	0 (0.0%)	42 (51.9%)
MoCA < 21	24 (36.4%)	15 (100%)	39 (48.1%)
Total	66 (81.5%)	15 (18.5%)	81 (100%)

The range and standard deviation of scores was larger with the MoCA (7-30, 5.34) than with the MMSE (19-30, 3.26). There was a more pronounced ceiling effect of the MMSE (7 subjects had a score of 30) than of the MoCA (1 subject had a score of 30) (Figure 1). When MMSE and MoCA scores on items assessing the same cognitive domain or function were compared, items assessing attention, visuospatial function, executive function, naming, and repetition contributed to the lower MoCA scores.

There were 38 (46.9%) participants with dry-type AMD and 43 (53.09%) participants with wet-type AMD in the study. While the mean MMSE score of patients with dry-type and wet-type AMD was 23.95 ± 4.20 and 24.60 ± 3.26, consecutively, the mean MoCA scores in dry-type and wet-type AMD patients was found to be 19.08 ± 4.83 and 19.77 ± 5.34, consecutively. The mean MMSE scores of dry-and wet-type AMD patients was significantly higher than the MoCA scores of the same patients (p = 0.000 and p = 0.000).

Discussion

Previous studies have suggested that there may be an association between early and/or late AMD and cognitive impairment. Some authors[1-6] have proposed that, in older population, cognitive impairment may share common age-related pathogenesis and risk factors with early AMD. Depression is also common and unrecognised in AMD patients and can have impacts on cognitive functions.

As known, the most widely used screening tool for mild cognitive impairment is the MMSE, which is often criticized for its poor screening sensitivity. To eliminate this problem, MoCA was developed, especially for screening mild cognitive

impairment. Likewise MMSE, the MoCA consists of maximum 30 points but the number of its examined modules is higher than in MMSE. Prior studies have all used MMSE to test cognitive functions in AMD patients[1-6]. To our knowledge, this is the first investigation of the MoCA's ability to assess cognitive functions in AMD patients in comparison to MMSE.

In this study, we examined performance on the MMSE and MoCA in a sample of AMD patients to see which brief cognitive instrument was better able to detect cognitive decline. We demonstrated that the MoCA, compared to the MMSE, is less prone to ceiling effects in AMD and classifies more patients as having mild cognitive impairment, as defined by a score less than 21. Additionally, AMD patients did more mistakes on the MoCA test than on the MMSE test in domains such as attention, executive function, and visuospatial processing. These findings suggest that the MoCA may be more sensitive than the MMSE to early cognitive impairment in AMD patients.

The results of the present study highlight two important points. Firstly, MoCA is comparable to MMSE in assessing cognitive impairment. In all cases of cognitive impairment on MMSE, MoCA was also abnormal. In addition, MoCA test detected additional cases of mild cognitive impairment, when the MMSE was normal. Secondly, this study also reinforces the value of screening for AMD patients for cognitive impairment during the disease process.

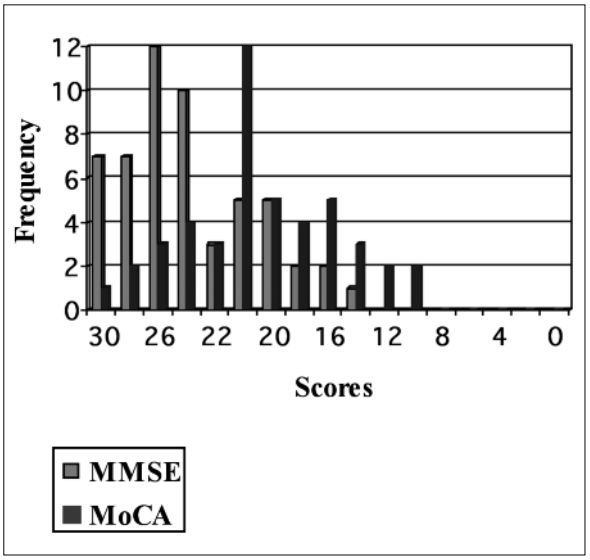

Figure 1. Frequency of scores on the mini mental state exam and the Montreal cognitive assessment.

Conclusions

We found that the MoCA provides considerably more insight into the cognitive status of patients with AMD than other simple screening tools such as the MMSE. This may have important implications for clinical trials, if the MoCA is to be used as the primary cognitive outcome measure. Future researches may focus on validating the MoCA as a screening instrument for AMD patients.

Conflict of Interest

The Authors declare that there are no conflicts of interest.

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