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Research Article

Mini Mental Status Examination vs. Montreal Cognitive Assessment For Early Diagnosis Of Vascular Dementia.

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Abstract

Background: The Mini Mental Status Examination (MMSE) and Montreal Cognitive Assessment (MoCA) are the most commonly used scales to detect mild cognitive impairment in population-based epidemiologic studies. The aim of this study was to define which test is more reliable for early diagnosis of vascular dementia – MoCA or MMSE.

Material and methodes: This prospective study included 274 patients with acute stroke, both sexes and all age groups. Patients were divided into groups: demented (DP) and non-demented (NDP). Each patient was underwent to a clinical examination and scoring with appropriate scales (MMSE and MoCA). Patients were tested on two times after discharge.

Results: Out of the total number of patients, 171 (62.5%) of them were male, and 103 (37.5%) were female (p=0.339). First testing with the MMSE showed that 143 (52%) had mild or moderate dementia. Sixth months after stroke, the number of demented patients increased to 165 (60%). First testing with the MoCA scale showed that 183 (66%) had some degree of dementia, and after the sixth month 191 (69%). The MoCA recorded a greater number of patients with dementia in both, the first and second testing. MoCA is more sensitive than MMSE for detecting patient with vascular dementia 3 and 6 months after stroke (p=0.0004; p=0.01).

Conclusion: The MoCA is more sensitive scale than the MMSE for detecting early stages of vascular dementia. It should be used in daily practice more often than the MMSE in order to make a timely diagnosis of the early stage of dementia.

Keywords : vascular dementia, MMSE, MoCA

INTRODUCTION

Heterogeneous clinical manifestations of cerebrovascular disease (CVD) arise depending on the location of the brain region affected. Beside major physical disabilities caused by vascular lesions in the cerebrum, cognitive functions are frequently affected [1]. Usually sublime at onset they have been often ignored. In literature, CVD was initially addressed as atherosclerotic dementia and was strictly distinguished from senile dementia [2]. Later the terms multi-infarct and post-stroke dementia were introduced; the former describing cognitive impairment after mild recurrent strokes, and the latter after a major symptomatic stroke [2]. The term vascular dementia (VaD) was introduced only two decades ago defining the cognitive decline caused by any type of CVD with clinical manifestation of dementia. VaD may be caused by multiple strokes, but also by single strategic stroke, multiple lacunes, and hypoperfusive lesions such as border zone infarcts and ischemic periventricular leukoencephalopathy [2].

In the developed world, 5–10 percent of people older than 65 years have dementia. One fifth of dementia aetiologies are due to vascular brain lesions (vascular dementia). A milder form is called vascular cognitive impairment (VCI). The main clinical criteria for VaD are: cognitive decline verified by standardized cognitive test/scale, evidence of the associated vascular brain lesion, and excluded reversible causes of cognitive decline [3].

In the United Kingdom and Sweden, prevalence of cognitive impairment, three months after stroke, ranges from 24 to 39%, while cognitive impairment was present in 96% of patients after stroke onset using battery of neuropsychological test and 39% of patients using the MMSE [4, 5]. In the Dutch study,

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cognitive functions were examined in 176 subjects with the first stroke after 6 months and the prevalence of cognitive impairment was over 70% [6]. The frequency of cognitive impairment in patients after stroke in one our study is 69% and it is within the framework of the above studies [7]. All these studies suggest that cognitive syndromes are common after stroke.

In the past, testing for Alzheimer's disease and other cognitive issues often meant turning to the Mini Mental Status Examination (MMSE) before any further testing was undertaken. Created by renowned psychiatrist Marshal Folstein, and introduced in 1975, the MMSE tests cognitive function by examining orientation, word recall, language abilities, attention and calculation, and visuospatial ability [8]. Today, the Montreal Cognitive Assessment (MoCA), a newer test created in 1996, is also available. Assessing many of the same areas as the MMSE, the MoCA is a little more in depth and includes tasks such as a clock-drawing test and a trail test (connecting the dots) [9, 10]. MMSE and MoCA are the most commonly used scales to detect mild cognitive impairment in population-based studies [11].

The aim of this study was to define which test is more reliable for early diagnosis of vascular dementia – MoCA or MMSE.

MATERIAL AND METHODS

This prospective study included 274 patients with acute stroke (ischemic and hemorrhagic), both sexes and all age groups, who were hospitalised at the Department of Neurology Tuzla, Bosnia and Herzegovina in one year period. Including criteria was acute stroke without previous cognitive decline. Excluding criteria were subarachnoid haemorrhage, recurrent stroke or mortality in the first 3 months after the patient was included in the study, existence of cognitive impairment before the beginning of the study (based on medical records), or patient did not come to testing.

Patients were divided into two groups: demented (DP) and non-demented (NDP). The diagnosis of vascular dementia (VaD) was based on diagnostic criteria by the National Institute of Neurological Disorders and Stroke Canadian Stroke Network Working Group (NINDS-AIREN) [12], Diagnostic and Statistical Manual of Mental Disorder IV (DSM-IV) [13] and International Classification of Diseases 10 (ICD-10) [14], clinical exam and neuropsychological testing.

For every patients, who fulfilled for entering the study, demographic data, vascular risk factors, localization of stroke, side and number of lesions in the brain were analysed. To confirm and localize the stroke, to computed tomography (CT) of brain was made for every patient, in some cases even the magnetic resonance imaging (MRI) of the brain.

Every patient was subjected to a clinical examination and scoring with appropriate scales. Patients were tested on two times after discharge; first testing after three months, and second six months after the stroke. For the evaluation of cognitive functions, the following measure scales were used: Mini Mental Status Examination MMSE [8], Montreal Cognitive Assessment (MoCA) [9, 10], and Dementia Rating Scale (DRS) [15,16]. IBM SPSS Statistics v.21 was used for statistical data processing. In the analysis of the obtained results, average value and standard deviation were used with a confidence interval of 95%. The $\chi 2$ test was used to compare certain variables, and Student's t-test for independent variables. The differences were considered significant if $p < 0.05$.

RESULTS

In one-year period at the Department of Neurology, University Clinical Centre Tuzla were hospitalized 946 patients with acute stroke, both sexes and all age groups. Out of them, 534 patients met the inclusion criteria, of which 274 were analysed and 260 patients excluded from the study.

Out of the total number of patients (274), 171 (62.5%) of them were male, and 103 (37.5%) were female ($p = 0.339$). Women were older than men (66.25 ± 1.95 vs. 65.06 ± 1.49 years). VaD was verified in 190 (69%) patients. More men than women had dementia (111 or 58% vs. 79 or 42%, $p = 0.035$).

Table 1 shows that of the total number of patients tested with the MMSE after the third month, had mild or moderate dementia. On the second test, sixth month after the stroke, the number of demented patients increased (**table 1**).

Table 1. Distribution of vascular dementia according to MMSE three and six monts after stroke.

MMSE three and six months after stroke	NDP		DP		Total	
	three N (%)	six N (%)	three N (%)	six N (%)	three N (%)	six N (%)
Normal (MMSE 25-30)	132(100)	109 (100)	0 (0.0)	0 (0.0)	132 (48.2)	109 (39.8)
Mild dementia (MMSE 21-24)	0 (0.0)	0 (0.0)	79 (55.6)	81 (49.1)	79 (28.8)	81 (29.6)
Moderate dementia (MMSE 11-20)	0 (0.0)	0 (0.0)	63 (44.4)	84 (50.9)	63 (23.0)	84 (30.7)

MMSE – Mini Mental Status Examination; NDP – non-demented patients; DP – demented patients; MMSE three months X2 = 258.418, p < 0.000; MMSE six months X2 = 269.85, p < 0.000;

First testing with the MoCA scale, three months after the stroke, showed that 66% had some degree of dementia (mild, moderate or severe), and after the sixth month, that number were slightly higher. The MMSE and MoCA results differ in the sense. The MoCA scale recorded a greater number of patients with dementia in both, the first and second testing while there were no patients with a severe form of dementia in the first MMSE testing (**table 2**). MoCA is more sensitive than MMSE for detecting patient with vascular dementia 3 and 6 months after stroke (143 vs. 183 $p < 0.0004$; 165 vs. 191 $p = 0.01$).

Table 2. Distribution of vascular dementia according to MoCA three and six months after stroke.

MoCA three and six months after stroke	NDP		DP		Total	
	three N (%)	six N (%)	three N (%)	six N (%)	three N (%)	six N (%)
Normal (MoCA 25-30)	91(100)	83 (100)	0 (0.0)	0 (0.0)	91 (33.2)	83 (30.3)
Mild dementia (MoCA 21-24)	0 (0.0)	0 (0.0)	69 (37.3)	63 (33.0)	69 (25.2)	63 (23.0)
Moderate dementia (MoCA 11-20)	0 (0.0)	0 (0.0)	106 (57.4)	119 (62.3)	106 (38.7)	119 (43.4)
Severe dementia (MoCA 0-10)	0 (0.0)	0 (0.0)	8 (4.3)	9 (4.7)	8 (2.9)	9 (3.3)

MoCA – Montreal Cognitive Assessment; NDP – non-demented patients; DP – demented patients; MoCA thre months X2 = 265.081, $p < 0.000$; MoCA six months X2 =274.00; $p < 0.000$;

DISCUSION

Dementia is a leading cause of disability in people older than 65 years worldwide including China, which induces huge challenges for policy makers, healthcare professionals, and family members [1]. In addressing cognitive screening tools, the MMSE and MoCA are the most commonly used methods in cognitive impairment detection in both clinical and research fields. It was widely identified that MoCA was superior to MMSE in the detection of mild cognitive impairment (MCI) as the MMSE had lower sensitivity among multiple study settings[17].

In our study, by testing with the MMSE after the third month, half of the subjects had mild or moderate dementia, and after the sixth month, the number of demented patients increased to 60%. By testing the MoCA scale after the third month, 66% of the analyzed patients had some degree of dementia (mild, moderate or severe), and after the sixth month, 69% of them were demented. The results of the MMSE and MoCA differ in the sense that the MoCA scale recorded a larger number of subjects with dementia in both the first and second testing, while there were no subjects with a severe form of dementia in the first MMSE testing. Also, we used DRS, and the results of the MoCA and DRS during first and second testing were almost the same (67% vs. 68%; 69% vs. 69%). We are of the opinion, that the results of the MMSE and MoCA differ due to the higher sensitivity of the MoCA, although both tests are performed in pairs “examiner and subject”. Also, the MoCA contains the “clock drawing test”, which is one of the tests used separately as a screening for cognitive impairment and dementia and as a measure of spatial dysfunction and neglect[18].

In this study, we also used the DRS, which is more sensitive and detailed than the MMSE and MoCA, it takes longer to do that test and is not for everyday use. The results of DRS and MoCA are very similar, and this scale is more sensitive for detecting demented patients, so this is another indication that the MoCA scale is more reliable for detecting early stage of dementia. The MoCA is superior to the MMSE in the detection of patients with cognitive impairment at higher risk for incident dementia at a memory clinic setting [19]. Also, Ciesielska et al. in their study shown that MoCA test better meets the criteria for screening tests for the detection of MCI among patients over 60 years of age than MMSE [20].

The results study of Trzepacz et al. showed that MoCA and MMSE were more similar for dementia cases, but MoCA distributes MCI cases across a broader score range with less ceiling effect [21]. Jia et al. in their study point out that MoCA had less ceiling effect for MCI and better detection of cognitive heterogenity of the sample. The findings of this study showed that MMSE and MoCA had good correlation and moderate agreement for detecting MCI in Chinese population aged 55 years and above [11].

The MoCA demonstrated more differences in cognitive profile between TIA, stroke and memory research subjects without major cognitive impairment than the MMSE. The MoCA showed between-group differences even in those with normal MMSE and would thus appear to be a useful brief tool to assess cognition in those with MCI, particularly where the ceiling effect of the MMSE is problematic [22]. Its validity has been established to detect mild cognitive impairment in patients with Alzheimer’s disease and other pathologies in cognitively impaired subjects who scored in the normal range on the MMSE [10].

Using different instruments, it was confirmed that the previously used test (MMSE) can be a test for a quick assessment of the existence of cognitive impairments, and that there are much more sensitive tests such as MoCA and DRS for more accurate diagnosis of the early stages of dementia. These two tests, MoCA and DRS, were not used in everyday practice in our region before this research.
With this study, we did not get any new results that are different from other researchers, but this study is important for our Clinic because after that we introduced into daily practice the use of a "new scale" – MoCA, for patients with suspected dementia. Unfortunately, in our country, we do not have a registry for people with dementia, nor do we know the exact the prevalence and the incidence of the disease. That is one of the limitations of our study. We hope to have this data in the near future. Another limitation of the study is that the data refer only to our Department (one region of Bosnia and Herzegovina).

CONCLUSION

The MoCA is a more sensitive scale than the MMSE for detecting early stages of vascular dementia. It should be used in daily practice more often than the MMSE in order to make a timely diagnosis of the early stage of dementia and start an adequate therapeutic approach.

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