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SCREENING FOR POSTSTROKE COGNITIVE IMPAIRMENT VIA MINI MENTAL STATE EXAMINATION AND MONTREAL COGNITIVE ASSESSMENT SCALE.

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SUMMARY:

Objective: The aim of our study is to examine cognitive performance after mild stroke via Mini Mental State Examination (MMSE) and Montreal cognitive assessment scale (MoCA) and to compare the results.

Material and methods: We examined 54 patients with mild stroke (aged 52 to 72 (mean 63.17, SD 5.96); 34 males and 20 females) and 54 controls, adjusted by age, sex and education level. All subjects were tested via MMSE (Bulgarian version) and MoCa (Bulgarian version). Data was collected in the single step model at the 90th day after stroke incident for patients and at the day of obtaining informed consent for controls.

Results: Patients have poorer performance on both MMSE and MoCa than controls. MoCa has comparatively good discriminative validity and sensitivity.

Conclusions: Although MMSE is one of the classical screening tools for cognitive impairment widely used in Bulgaria, other screening tools should not be ignored. On the basis of our results, MoCa is also a good screening instrument, especially for poststroke cognitive impairment.

Key words: Mini Mental State Examination, Monreal cognitive assessment scale, ischemic stroke, cognition.

INTRODUCTION

Stroke is one of the leading causes for death and disability all over the world. However, because of the specific vascular risk profile of our population, Bulgaria is one of the countries with higher morbidity rate[1] with increasing number of cases in active population group, where cognitive impairment leads to severe socioeconomic problems as temporary or permanent disabilities, work retirement and working problems even in cases with full motor recovery.

The active screening for cognitive impairments in these cases is crucial for problem – solving long-term strategy.

Based on simple and easy applicable questions, MMSE is one of the widely used screening tools for cognitive impairment[2]. It could be made in all cases with mild or moderate stroke, except in cases with aphasia, loss of consciousness or severe psychiatric symptoms. However it is not the only test, developed as a screening instrument. One of the most recently designed screening instruments is MoCA. It assesses eight different cognitive domains and is also easy applicable in practice[3].

MATERIAL AND METHODS

The aim of our study was to examine cognitive performance after mild stroke via MoCA and MMSE and to compare the results.

We examined 54 patients with mild stroke (aged 52 to 72 (mean 63.17, SD 5.96); 34 males and 20 females) and 54 controls, adjusted by age, sex and education level. To participate in the study, the patients should be with first stroke with severity below 10 points on National Institute of Stroke Scale, with no evidence of aphasia, apraxia and agnosia. Study exclusion criteria included family or medical history for dementia, other psychiatric (including alcohol or drugs abuse and depression via DSM 4 TR Criteria) and neurological diseases (including previous strokes or TIA).

All individuals were examined in The Department of Neurology and Neurosurgery, Medical University, Pleven, after obtaining the informed consent.

Data was collected in the single step model at the 90th day after the stroke incident for patients and at the day of obtaining informed consent for controls.

All subjects were tested via MMSE (Bulgarian version) and MoCa (Bulgarian version). Scores of 24 or less on the MMSE and of 25 of MoCA were indicative for cognitive impairment.

Statgraphics Plus 5.0. was used. Descriptive statistics were used to summarize the demographic data.

The purpose of this analysis was to compare MoCA with MMSE, so we used the term “true positive” for the results that concurred to positive results on MMSE, and “false positive” for the positive results on MoCa that not correspond to positive results on MMSE. The term “false positive” was due to positive result in MoCa that not correspond to positive result on MMSE, and with “true negative” we indicated the negative result on MoCa that correspond to negative result on MMSE.

MoCa positive predictive value was calculated as (number of true positive MoCa results)/(all positive MoCa results). For calculation of negative predictive value we used the following formula: (number of true negative MoCa results)/(all negative MoCa results). Compared to MMSE, the sensitivity of MoCA was calculated via the following formula (true positives)/(true positives +false negatives). The specificity of the test was measured by (true negatives)/(true negatives + false positives). The false positive rate was evaluated by the formula (false positives)/(false positives + true negatives) and the false negative rate via (false negatives)/(true positives + false negatives). The likelihood ratio positive was measured as (sensitivity)/(1-specificity) and negative as (1-sensitivity)/(specificity).

We measured also discriminative validities for both tests according to the formula: 2 (negative results of control group - negative results of stroke group)/all examined individuals

We used also ANOVA, two sample comparisons and regression analysis. All obtained results were interpreted at 95% Confidential level.

RESULTS

Demographic characteristics of the two groups are listed on Table 1.

Table 1. Demographics

		Patients	Controls
Age	Mean	63.54	63.72
	SD	6.06	5.95
Sex distribution	Ratio males:females	34:20	34:20
Education level	Ratio below8/ above 8 years of formal education	12:42	12:42

The means of the examined values are given on Table 2

Table 2. Results on MMSE and MoCA

		Patients	Controls
		N=54	N=54
MMSE	Min-Max Result(points)	20-30	24-30
	Mean (points)	25.83	27.89
	SD	2.30	1.40
MoCA	Min – Max Result(points)	19-30	23-30
	Mean (points)	24.06	27.52
	SD	2.58	1.61

Legend: MMSE – Mini Mental State Examination. MoCA – Montreal Cognitive Asessment scale. Min – minimal result, Max – maximum result, SD – standard deviation, N – number.

Patients have poorer performance on both MMSE (ANOVA F=2.7, p=0.0004) and MoCa (ANOVA F=2.56, p=0.0008) than controls.

Cognitive impairment, using MMSE (points below 26), is found in 24.07% (13) of stroke survivors and only in 3.7% (2) of controls. Using MoCa, we obtain cognitive impairment (MoCA points below 26) in 64.81% (35) of stroke survivors and in 9.26% (5) of control subjects.

MoCA positive predictive value, obtained on the basis of formulas mentioned above, is (23/45)*100% = 51.11% and negative predictive value is (18/19)*100%=94.74%. The sensitivity of MoCA is ((23) / (23+1))*100%=95.83% and it's specificity is ((18) / (18+12))*100%=60%. The false positive rate is ((12) / (12 +18))*100%=40% and the false negative rate is ((1) / (23+1))*100%=4.17%. The likelihood positive ratio is (0.9583) / (1-0.6) = 2.3958 and negative likelihood ratio is (1-0.9583) / (0.6) = 0.0695.

The discriminate validity of MMSE is ((28(52-41)) / 108)=20.37 and of MoCa is ((2*(49-19)) / 108)=55.56.

Declination of all examined scales and groups by age was found (see table 3).

Table 3. The impact of age on examined cognitive scales

	Patients		Controls	
	MMSE	MoCa	MMSE	MoCa
F=	15.50	7.81	9.33	22.31
P=	0.0002	0.0072	0.0035	0.0001
Correlation coefficient =	-0.48	-0.36	-0.39	-0.55

Legend: MMSE – Mini Mental State examination. MoCa –Montreal Cognitive Assessment scale. F, p, correlation coefficient are due to ANOVA statistics

DISCUSSION.

Stroke survivors have poorer performance than controls at both scales. Cognitive impairment measured with MMSE is found in 24%, which is very similar to the results of other authors. Although MMSE is though as "gold standard" for screening for cognitive impairment[4,5], we find small discriminative validity of the test.

Aging influences MMSE test performance in both control and patient group, but the correlation coefficient is higher in the last one. We suggest that it is due to stronger premorbid cognitive declination in stroke survivors, compared to control subjects, probably to the long-term action of vascular risk factors, which are known as independently associated with poor cognitive performance[6,7,8].

Using MoCa, cognitive impairment is obtained from 65% of stroke survivors, which is higher than we have expected. The test has good discriminative validity of 56% and compared to MMSE is with good sensitivity, however it has lower specificity (60%) and lower positive predictive value. Age also influences MoCa test results but unexpectedly the correlation coefficient is higher in control group and lower in patient group, compared with MMSE.

CONCLUSIONS

Although MMSE is one of the classical screening tools for cognitive impairment widely used in Bulgaria, other screening tools should also be used. On the basis of our results, MoCa is also a good screening instrument, especially for cognitive impairment via stroke survivors with comparatively good discriminative validity and sensitivity.

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