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Factors Influencing Mini-mental State (MMSE) Score in Stroke Patients

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Aim: To evaluate the usefulness of MMSE score in vascular dementia and the influence of different factors on the MMSE score. **Subject and methods:** We studied 78 stroke patients followed up at the neurology unit, Specialistic Polyclinic 2, Tirana. A neurological visit is done and the MMSE score is calculated for each of them. We noted the stroke form (ischemic, hemorrhagic), patient's age, education, time from stroke onset, accompanying neurological disorders (parkinsonism, epilepsy), risk factors (arterial hypertension, cardiac diseases, diabetes mellitus, smoking, carotid stenosis). The imaging (CT and/or MRI) of the brain is requested. Independent Samples Test, t-test for Equality of Means, 2 – tailed, is applied for the statistical evaluation. **Results:** The mean age of the patients in the study is 70.31 years old. There are 37 females (47.43%) and 41 males (52.56%). 12 (15.38%) patients had hemorrhagic and 66 (84.61%) ischemic stroke. The mean time from stroke onset is 4.55 years. 15 (19.2%) patients have parkinsonism, 1 other extra pyramidal disorder, 3 (3.8%) secondary generalized epilepsy. The mean MMSE score for all patients is 23.48. The multi ischemic cerebral lesions were present in the imaging of 12 (15.38%) patients. The generalized cortical atrophy is found in 25 (32%) patients and the temporal atrophy in 14 (17.94%) patients. We analyzed the data of 37 patients [16 (43.24%) females and 21 (56.75%) males], with MMSE score ≤23. The mean age is 75.39 years old. 6 (16.21%) patients are diagnosed with hemorrhagic stroke. 3(8.1%) patients have secondary generalized epilepsy, 9 (24.32%) are suffering of parkinsonism and the mean time from stroke onset is 4.31 years. The imaging study revealed multi ischemic cerebral lesions in 9 (24.3%) patients. We found accompanying temporal atrophy in 10 (27%) patients, frontal atrophy in 2 (5.4%) patients, and generalized cortical atrophy in 17 (45.9%) patients. **Conclusion:** Dementia after stroke is frequent. The MMSE is still a useful scale to evaluate the VaD and is related to age, gender, education, stroke age, cardiovascular risk factors, stroke type and localization, other neurological disorders as epilepsy and parkinsonism.

Key words: stroke, Mini-Mental State (MMSE), neurological disorders, vascular dementia (VaD).

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1. INTRODUCTION

Vascular dementia (VaD) is the second most common form of dementia. (1) The history of vascular dementia began in 1672 with dementia post apoplexy cases described by Thomas Willis. The term of multi-infarct dementia was used from Hachinski in 1974 (2) and in 1995 Bowler and Hachinski introduced the term of vascular cognitive impairment (3).

VaD can be regarded as a group of disorders consisting of cognitive impairment with significant impact on functioning, due to cerebral ischemia or hemorrhage *(4).* Approximately 10% of patients with first-ever stroke develop new dementia and at least 30% have dementia after recurrent stroke *(5).* The causes and characteristics of cognitive decline after stroke are poorly defined, because most studies have relied on the diagnosis of dementia after stroke, without measurement of pre-stroke cognitive function. Different measures scales for cognitive declined are proposed, including Mini-Mental State Examination (MMSE), that remain a widely used test *(6).*

We tried to find the correlation between the lower scores of MMSE and the following risk factors linked to the development of dementia after a stroke: age, low education level, diabetes mellitus, cardiac diseases, epileptic seizures, global and temporal lobe atrophy, stroke form, location of stroke.

2. SUBJECT AND METHODS

We partly retrospectively studied 78 stroke patients followed up at the neurology unit, Specialistic Polyclinic 2, Tirana. A neurological visit including the MMSE was performed to all of them. We called vascular dementia all the cases who reported a progressive cognitive decline and had less than 24 points in MMSE after an stroke event. We noted the stroke form (ischemic, hemorrhagic), patient's age, education, time from stroke onset, accompanying neurological disorders (parkinsonism, epilepsy), risk factors (arterial hypertension, cardiac diseases, diabetes mellitus, smoking, carotid stenosis). The imaging (CT and/or MRI) of the brain is requested.

Independent Samples Test, t-test for Equality of Means, 2 – tailed, is applied for the statistical evaluation.

	Number %	Mean Age	Gender	MMSE mean	Stroke ageyears	Education	High BP	DM	Lipid disorders	CVD	Carotid Stenosis	Smoking	Epilepsy	Parkinsonism	Ischemic Stroke	Hemorrhagic Stroke
MMSE ≤ 23	37 47.43%	75.1 (SD 7.38)	F 16 43.24% M 21 56.75%	21.48	5.86 (SD 2.2)	27 L 72.97% 10 H 27.02%	37 100%	30 81.08%	29 78.37%	31 83.78%	28 75.67%	28 75.67%	3 8.1%	9 24.32%	31 83.78%	6 16.21%
MMSE ≥ 24	41 52.56%	65.98 (SD 10.5)	F 21 51.21% M 20 48.78%	25.29	4.78 (SD 2.0)	15 L 36.58% 22 H 53.65% 4 G 9.75%	28 68.29%	10 24.39%	16 39%	16 39%	20 54.05%	12 29.26%	0 0%	6 14.63%	35 85.36%	6 14.63%
Mean difference	_	-9.132*	-.083	_	1.084**	_	-.317*	-.567*	-.418*	-.448*	-.293*	-.464*	_	_	_	_
Total	78	70.31	F 37 47.43% M 41 52.56%	23.48	5.29	42 L 53.84% 32 H 41.02% 4 G 5.12%	65 83.3%	40 51.28%	45 57.69%	47 60.25%	48 61.53%	40 51.28%	3 3.8%	15 19.2 %	66 84.61%	12 15.38%

Table 1. Factors influencing MMSEGender: F = female, M = mal Education: L = low, H = high school, G = graduate BP Blood Pressure. DM Diabetes Mellitus (*) indicate coefficients with p<0, 01; (**) indicate coefficients with p-value < 0, 05; (no asterisk) indicate no significant difference

3. RESULTS

The main results are included to the Table 1. The mean age of the patients in the study is 70.31 years old. There are 37 females (47.43%) and 41 males (52.56%). 12 (15.38%) patients had hemorrhagic and 66 (84.61%) ischemic stroke. The mean time from stroke onset is 4.55 years. 15 (19.2%) patients have parkinsonism, 1 other extra pyramidal disorder, 3 (3.8%) secondary generalized epilepsy. The mean MMSE score for all patients is 23.48. The multi ischemic cerebral lesions were present in the imaging of 12 (15.38%) patients. The generalized cortical atrophy is found in 25 (32%) patients and the temporal atrophy in 14 (17.94%) patients.

We analyzed the data of 37 patients [16 (43.24%) females and 21 (56.75%) males], with MMSE score ≤23. The mean age is 75.39 years old. 6 (16.21%) patients are diagnosed with hemorrhagic stroke. 3(8.1%) patients have secondary generalized epilepsy, 9 (24.32%) are suffering of parkinsonism, 1 has other extrapiramidal disorder and the mean time from stroke onset is 4.31 years. The imaging study revealed multi ischemic cerebral lesions in 9 (24.3%) patients. We found accompanying temporal atrophy in 10 (27%) patients, frontal atrophy in 2 (5.4%) patients, and generalized cortical atrophy in 17 (45.9%) patients.

4. DISCUSSION

This study presented a series of patients with stroke who had been treated at a secondary level referent health institution located in an urban region. The patients were retrospectively/prospectively registered including hemorrhagic or recurrent stroke.

Cognitive impairment, acutely or sub acutely, after an acute neurologic event with a stepwise progression is a typical history suggestive of vascular dementia. However, this classic history is usually observed with multi-infarct dementia and may not be observed with lacunar state.

A commonly used cognitive screening tool is the Folstein Mini-Mental State Examination (MMSE) *(7).* It consists of 11 subscales (maximum score in parentheses) that are summarized into a total score (30): orientation to time (5), orientation to place (5), immediate word recall (3), attention (5), delayed word recall (3), naming (2), repetition (1), following commands (3), reading (1), writing (1), and design copy (1). Attention was assessed with 2 tasks, serial sevens and spelling a word backward and the higher of the 2 scores was recorded. *(7).*

The MMSE is still the world's most frequently used screening test for cognitive impairment, even though there are brief tests tapping a broader range of cognitive functions and showing a higher sensitivity and specificity. One of the reasons might be that there is no other test that so many practitioners are familiar with. This not only makes it a useful cognitive assessment tool, but its results are easily reported among colleagues and across clinical settings *(8).*

Some studies have examined the utility of MMSE tasks to aid in differentiating disorders that have different cognitive profiles. Jefferson et al. (2002) compared vascular dementia (VaD), AD and PD with dementia (PDD) matched on MMSE score. There are studies using MMSE to evidence of a preclinical period with cognitive deficits in VaD *(9).*

The MMSE exists in many modified versions and test batteries, for example the Addenbrooke's Cognitive Examination (ACE), the Modified Mini-Mental State (3MS) (10), the Cognitive Abilities Screening instrument (CASI) (10), the CERAD battery and the Severe Mini-Mental State Examination (SMMSE). There are also special versions for hearing- and vision-impaired individuals, but further studies are needed to warrant their validity *(8).*

As in previous studies (10, 11), we have shown that there is a correlation between the age of the patients and vascular dementia. Our data on the mean age of demented patients (75.1±7.3 years) are similar with the data given by the Hong Kong (75±8.5 years*) (10)*, and Canadian study (78.1±6.04 years) *(12).*

The high level of previous education was highlighted as a protective factor for VaD in some other studies. *(10).*

The cardiovascular risk factors and diabetes mellitus were more evident in the demented patients and the other risk factors as smoking, arterial hypertension, carotid stenosis had higher percentage values in patients with MMSE ≤23. There are studies demonstrating limiting influence of traditional cardiovascular risk factors in developing dementia post stroke. *(13).* there is also substantial evidence that stroke risk factors such as hypertension, diabetes; lipid disorders, etc. are independently associated with an increased risk of Alzheimer's disease and vascular cognitive impairment *(14)*.The Framingham study concludes that although none of the individual factors increases the risk

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of developing dementia significantly, their combination may increase the risk of developing dementia by increasing the risk of having a stroke (11). Control of blood pressure may thus not only contribute to the prevention of stroke *(14),* but also to slowing down the progression of cognitive impairment in hypertensive individuals *(15).*

The association with epilepsy is evident in our study, and a weaker relation with parkinsonism is present too. According to a French study *(16*), patients with stroke who have epileptic seizures may be at increased risk of dementia.

There is not a significant difference between the stroke types (ischemic or hemorrhagic), according to our data. The location of ischemic or hemorrhagic stroke and /or multi infarct lesions was more important in developing dementia. The hippocampal neuronal atrophy is an important substrate for dementia in both cerebrovascular and neurodegenerative disease according to a recent study (17*).*

In the neurodegenerative dementias, the topography of the atrophy provides information about the specific type: atrophy of the medial temporal lobe is predominant in Alzheimer disease, while atrophy of the frontal and anterior temporal lobes is seen in frontotemporal dementia, with less medial temporal atrophy than in Alzheimer disease for frontotemporal dementia; vascular dementia is marked by infarction, lacuna, and signal abnormalities in the white matter and sometimes microbleeding *(18).*

In the Stroke Data Bank *(18),* the risk for vascular dementia increased with the number and size of ischemic lesions.

5. CONCLUSION

Dementia after stroke is frequent. The MMSE is still a useful scale to evaluate the VaD. The cognitive decline is correlated with age, gender, education, stroke age, cardiovascular risk factors, stroke type and localization, other neurological disorders as epilepsy and parkinsonism.

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