MOTOR AND COGNITIVE IMPAIRMENT AFTER STROKE

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SUMMARY – Cognitive abilities have great impact on rehabilitation program in stroke patients. Therefore, fast and practical psychometric assessment as an indicator of individual rehabilitation program is of great importance. The aim of this study was to analyze and compare motor and cognitive impairment in stroke patients in acute, subacute and chronic phase of the disease, taking age, sex, education, stroke risk factors, lateralization and type of stroke in consideration. The study included 50 stroke patients, 33 male and 17 female. Ischemic stroke was diagnosed in 78% and hemorrhagic stroke in 22% of patients. Hypertension was the leading stroke risk factor in 82% of patients. Cognitive impairment in acute, subacute and chronic phase of the disease was noticed in 12% of stroke patients with ischemia in the left brain hemisphere, mMMSE average score 31 and SKT score 19, IQ under 90. Better motor recovery in acute and subacute phase of stroke was followed by better cognitive status. All cognitively impaired stroke patients had low level of education, some had accomplished elementary education and others had not, all much below the dementia risk age of 75 years. Exclusion of patients with severe stroke from the study led to overestimation of the results. Finally, a coherent algorithm for somatic and cognitive stroke assessment in stroke patients poses itself as an imperative as a guideline for plastic, individualized and appropriate rehabilitation.

Key words: *Stroke – diagnosis; Cognition; Motor skill disorders; Neurologic examination; Tomography, x-ray, computed*

Introduction

Stroke is an acute condition provoked by partial or total interruption of blood supply to the brain. Traditional pathological classification includes ischemic stroke and hemorrhagic stroke. Ischemic stroke is usually caused by stenosis or occlusion of blood vessel with a thrombus or embolus from myocardial infarction, heart valve failure, post-thrombotic endocarditis, exulcerated plaque, and after cardiac surgery. Hemorrhagic stroke includes intracerebral hemorrhage and subarachnoid hemorrhage. It is estimated that 4 million people a year will suffer a stroke. One-third dies, one-third has a severe stroke, and one-third has a minor stroke.

Beside physical impairment, stroke usually also leads to cognitive impairment, which involves attention, orientation, memory and thinking[1-6]. There are some indications suggesting that big hemispheric infarcts are found more often among demented patients than non demented ones[7-10]. However, there are too few data on the association of the size and localization of brain infarct with the severity of cognitive impairment[11].

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The risk of cognitive impairment in stroke patients increases with age and reaches peak after age 75[12]. Also, the concurrent presence of several risk factors increases the possibility of cognitive disorder in stroke, the most important being hypertension, diabetes, atrial fibrillation, and myocardial infarction[13-16]. The association of cognition impairment with the low level of education is clear in univariable samples, but not as clear in multivariable analyses.

The aim of the study was to follow the evolution of cognitive impairment in different clinical phases of stroke, the confirmation and recording of impairment, and the possibility of starting an early therapeutic and rehabilitation procedure[17,18].

Patients and Methods

The study included 50 patients, male and female, aged 30-70 years, recruited from Department of Neurology, Vinkovci Genaral Hospital, with positive diagnosis of stroke risk factors (hypertension, diabetes, hyperlipoproteinemia, heart disease, smoking, alcoholism, obesity, physical inactivity, stress, and heredity). Neurological status was assessed within 48 hours of admission, then after 7 days, at discharge (within 3-4 weeks), and finally at 3-6 months after stroke. Assessment was performed by using the European Stroke Scale (ESS) for evaluation of consciousness and motor status, with maximal score 100. In the same sequence of time, cognitive functions were analyzed (attention, short memory, orientation, registration, speech, reading, writing, and counting) by the modified Mini Mental State Examination (mMMSE), defining severe cognitive impairment with a score equal or less than 24, and moderate cognitive impairment with a score equal or less than 36; and SKT (a short cognitive performance test for assessing memory and attention), measuring successfulness, reacting time, and number of errors in the 0-27 score range. As part of the neurologic diagnostic procedures, all patients underwent brain computed tomography (CT scan) at admission and at discharge from the hospital, and again at the check-up after 3-6 months. Brain CT findings were classified according to the standard protocol as positive if the signs of ischemic or hemorrhagic stroke were present, measuring the dimensions in mm, in two diameters, minimum in two layers. Definite postmorbid IQ was defined by Wechsler Adult Intelligence Scale (WAIS). Patients with disturbance of consciousness, with agnosia, agraphia, alexia or aphasia were excluded. Data were statistically analyzed by parametric and nonparametric tests of difference and correlation (ANOVA, Student's t-test).

Results

The study included 50 stroke patients, 33 (66%) male and 17 (34%) female, age range 30-70 years, mean age 61. Education structure showed that most stroke patients had low level, partially or fully accomplished elementary education (n=32, 64%). Fourteen (28%) patients had secondary education, and four patients had university degree.

Stroke risk factors were present isolated or in combinations. Hypertension was found to be the most common stroke risk factor and it was present in 42 (82%) patients, followed by hyperlipoproteinemia (62%). Diabetes, smoking and alcoholism were found in similar proportions, while heart diseases, stress and physical inactivity were present in the lowest proportion (Table 1).

There were more ischemic stroke (n=39, 78%) than hemorrhagic stroke (22%) patients (Fig. 1).

Most strokes were situated in the left brain hemisphere (n=27, 54%). Bilateral lesions were present in a small part including some of lacunar strokes and subarachnoid hemorrhage (Fig. 2).

Table 1. Stroke risk factors in study patients

Risk factor	n	%
Hypertension	41	82.0
Hyperlipidemia	31	62.0
Diabetes	19	38.0
Heart disease	5	10.0
Smoking	20	40.0
Alcoholism	21	42.0
Obesity	12	24.0
Physical inactivity	5	10.0
Stress	5	10.0
Heredity	15	30.0

Analysis of the ESS results assessed at 48 hours from admission, then after 7 days, at discharge (3-4

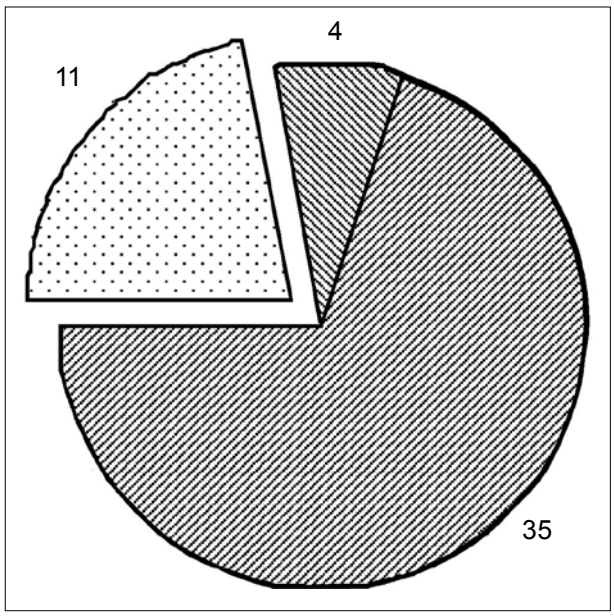

Fig. 1. Types of stroke.

weeks) and at follow up after 3-6 months showed an increase in the average score. At admission, the average score was 81.58, and in chronic phase of stroke, it increased to 91.80, suggesting motor recovery in stroke patients (Table 2).

The mMMSE results after 7 days showed the average value to have slightly increased from the starting score at 48 hours (36.06-37.96). At discharge and at follow up after 3-6 months, the average values of mMMSE were minimally different, showing a declining tendency (Table 3). SKT score decreased through all phases of stroke (acute, subacute and chronic) (Table 4).

IQ assessed by WAIS after 3-6 months was less than 90 in 11 patients and 90-110 in 39 patients. There were no patients with IQ higher than 110, although there were 8% of patients with university degree.

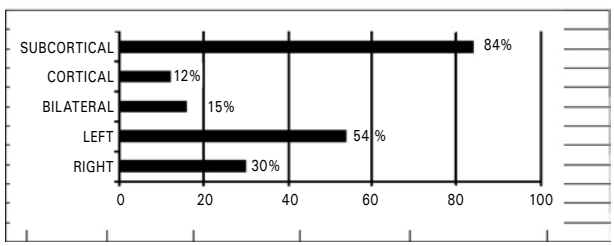

Fig. 2. Localization of stroke.

Table 2. European Stroke Scale (ESS) at 48 hours, 7 days, 3-4 weeks and 3-6 months after stroke

ESS	48 h	7days	3-4 weeks	3-6 months
Mean	81.58	85.84	88.46	91.80
Median	81.00	87.50	90.00	94.00
Standard deviation	12.3686	11.2347	10.8894	8.4225
First quarter	74.00	82.75	86.00	89.00
Fourth quarter	92.25	92.50	95.00	97.00

Table 3. Modified Mini Mental State Examination (mMMSE) at 48 hours, 7 days, 3-4 weeks and 3-6 months after stroke

mMMSE	48 h	7 days	3-4 weeks	3-6 months
Mean	36.06	37.96	39.46	39.02
Median	36.00	37.00	38.50	38.50
Standard deviation	6.1226	5.4209	5.1950	6.0961
First quarter	32.75	34.00	36.00	35.00
Fourth quarter	40.00	42.00	43.25	44.25

Table 4. SKT (a short cognitive performance test for assessing memory and attention) at 48 hours, 7 days, 3-4 weeks and 3-6 months after stroke

SKT	48 h	7 days	3-4 weeks	3-6 months
Mean	18.90	15.60	12.36	11.40
Median	19.00	17.00	13.00	10.50
Standard deviation	4.7305	4.7208	4.8519	5.6821
First quarter	17.00	13.00	9.75	7.75
Fourth quarter	21.50	19.00	15.00	16.00

Discussion

In our study, we tried to make parallel investigation of motor and cognitive impairment in stroke patients according to age, sex, education, stroke risk factors, localization and lateralization of the lesion.

Hypertension was the most common risk factor, and it was present in 42 (82%) patients. The second most common risk factor was hyperlipoproteinemia, present in 62% of patients. Even though there were patients with multiple stroke risk factors, there was no

certain association with the level of cognitive impairment because multiple risk factors were found among cognitively unimpaired patients too.

There were more ischemic stroke patients (n=39, 78%), than hemorrhagic stroke patients (n=11, 22%).

It was found that patients with better cognitive status in acute and subacute phase had better motor deficit recovery, which is consistent with the reports by Hajek *et al*., Schumann *et al*. and Heruti *et al*.[19-21]. Cognitively impaired stroke patients had a large ischemic lesion in the left brain hemisphere, which is consistent with the findings reported by Tatemichi *et al*., Pohsjavara *et al*. and Censori *et al*.[2,8,22].

The mMMSE and SKT scales applied from the acute to chronic stroke phase showed improvement of the patients' cognitive status. These results are consistent with those reported by Meier *et al*., showing that greatest recovery of cognitive function was found in the period from the onset to three months after stroke[23]. Cognitive impairment was detected in 12% of patients in the chronic phase of stroke, which is below the standards in the literature. Better results of cognitive functions in the chronic phase of stroke may have been influenced by the large proportion of lacunar ischemic strokes, which showed faster recovery, as also found in the literature[7,24-26].

An inverse relation of age and cognitive status has already been considered in the literature[2,8,12,13,27,28 .] In our study, the age was not a significant risk factor for cognitive impairment because our patients' age was under 75. The association of cognitive impairment with lower educational level is consistent with the results reported by Tatemichi et al.[2,8,26,29.]

Conclusion

Cognitive functions were assessed in 50 stroke patients, 33 men and 17 women, aged 30-70 years. Hypertension was the leading stroke risk factor. Ischemic stroke was found in a greater proportion of patients (78%) than hemorrhagic stroke (22%). In the acute and subacute phase of stroke, better motor recovery was followed by better cognitive status. Cognitive impairment in the acute, subacute and chronic phase of stroke was found in 12% of patients with lesions in the left brain hemisphere, with average mMMSE score 31 and average SKT score 19. All patients were poorly educated, having partially or fully completed elementary school. They were all younger than the risk age for dementia (75 years). The exclusion of patients with severe stroke from the study had an impact on overestimated results.

It is certain that by registration, specification and quantification of cognitive impairment in stroke patients we are creating new guidelines for a rehabilitation program which integrates motor and cognition rehabilitation procedures for a more successful recovery of stroke patients.

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Sažetak

MOTORIČKI I KOGNITIVNI DEFICIT NAKON MOŽDANOG UDARA

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Kako kognitivne sposobnosti u velikoj mjeri utječu na rehabilitacijski program bolesnika s moždanim udarom (MU), veliko je značenje brze i praktične psihometrijske prosudbe kao indikatora individualnog rehabilitacijskog programa. Cilj istraživanja je bio analizirati i usporediti motorički i kognitivni deficit u bolesnika s MU u akutnoj, subakutnoj i kroničnoj fazi bolesti, uvažavajući pritom dob, spol, obrazovanje, čimbenike rizika za MU, lateralizaciju i vrstu MU. Istraživanje je obuhvatilo 50 bolesnika s MU, 33 muškarca i 17 žena. Nađeno je 78% bolesnika s ishemijskim MU i 22% s hemoragijskim MU. Hipertenzija se pokazala vodećim čimbenikom rizika za MU (82%). Kognitivni deficit u akutnoj, subakutnoj i kroničnoj fazi zabilježen je u 12% bolesnika s ishemijskim MU u lijevoj moždanoj hemisferi, s prosječnim zbirom na ljestvici mMMSE 31 i na ljestvici SKT 19, IQ ispod 90. Nakon boljeg motoričkog oporavka u akutnoj i subakutnoj fazi MU uslijedilo je poboljšanje kognitivnog statusa. Svi bolesnici s kognitivnim oštećenjem bili su niske naobrazbe sa završenim i nezavršenim osnovnim obrazovanjem, znatno mlađi od rizične dobi za mogući razvoj demencije (75 godina). Isključenje iz istraživanja najtežih bolesnika s MU svakako je utjecalo na precijenjenost rezultata. U konačnici nameće se neophodnost koherentnog algoritma somatske i kognitivne procjene statusa bolesnika s MU, koja bi plastično oblikovala kvalitetnu rehabilitaciju.

Ključne riječi: *Moždani udar – dijagnostika; Kognicija; Motorički poremećaji; Neurološki pregled; Tomografija, kompjutorizirana*