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Tachycardia as a Negative Prognostic Factor for Stroke Outcome

Amina Nakicevic[1], Salem Alajbegovic[2], Lejla Alajbegovic[3]

[1]Neurology Clinic, Clinical Center of Sarajevo University, Sarajevo, Bosnia and Herzegovina

[2]Cantonal Hospital Zenica, Zenica, Bosnia and Herzegovina

[3]Representative of Berlin Chemi Bosnia and Herzegovina

Corresponding author:
Professor Salem Alajbegović, MD, PhD. Cantonal Hospital Zenica,Crkvice 67, 72000 Zenica, Bosnia and Herzegovina Phone: +387 32 406-484. ORCID ID: 0000-0002-7379-2489, E-mail: dr-alajbegovic@kbze.ba

ABSTRACT

Introduction: The outcome of stroke, especially lethal one is significant, as in the hemorrhagic as well as in ischemic stroke. **Goal** was to show the impact on the stroke outcome of tachycardia correlated with lesion localization. **Material and methods:** Material for our work was patients who were treated due to the stroke at the Neurology Clinic Sarajevo in the period from 31 March 2015 until 01 January 2016. A total of 544 stoke patients were treated in the reporting period, 221 (44.6%) died. There were 70.9% patients with ischemic and 29.1% with hemorrhagic stroke. Each patient underwent ECG, which registered tachycardia during admission and on third day of hospitalization. **Results:** In relation to the presence of tachycardia on admission there were statistically significant differences in the group of patients with hemorrhage and ischemia in relation to presence of tachycardia ($p < 0.01$). In the group of patients with hemorrhage coma was more present (78.9%), while tachycardia was statistically more often in those with loss of consciousness than in the group with coma. Group of patients with ischemia has 52.75% of the patients with tachycardia without statistical correlation between the presence and absence of disorders of consciousness. Midline lesions were statistically more often associated with paroxysmal tachycardia in relation to the lateral lesions ($p < 0.01$). Statistical analysis shows that there are statistically significant differences between observed groups $x2=35.576$, $p=0.0001$. Lethal outcome of hemorrhagic stroke was 55.45%, 32.6% for ischemia. A significant statistical significance of ischemic and hemorrhagic stroke compared to the lethal outcome correlated with the registered tachycardia and medial lesion localization. **Conclusion:** Tachycardia on admission in patients with stroke is a relevant negative predictor for stroke outcome. Medial localization of changes significantly affects the occurrence of tachycardia and lethal outcome of stroke which is statistically significantly more associated with hemorrhagic stroke.

Keywords: stroke, outcome, prognostic factors, tachycardia.

1. INTRODUCTION

A stroke is a condition of acute cerebral circulation disorder with transient or permanent neurological dysfunction. Stroke is a clinically defined syndrome with the rapid development of signs and symptoms of "focal loss of brain function that last longer than 24 hours, for which there is no other obvious cause other than vascular origin of the disorder" (1). Epidemiological data from Western countries show a decrease in mortality and morbidity from stroke as a result of preventive actions (2). However, stroke is a serious health and socioeconomic problem, both worldwide and in our country. It is still the third cause of death and the leading cause of disability (3, 4). The most important risk factor is age (5). Other important risk factors involve hypertension, hyperlipidemia, diabetes, elevated hematocrit, and antiphospholipid antibodies. Cardiac disease belongs to a group of conditionally variable factors and they can be a source of emboli (emboligenic cardiopathy) or in various forms of ischemic cardiomyopathy (6).

Among all cases of stroke 85% are ischemic insults, while bleeding (hemorrhage) is the cause for the remaining 15% of cases. The mortality rate is higher, and the clinical picture is more severe in case of hemorrhagic form. But the prognosis for survivors regarding the reparation of bleeding and recovery of patients is better because the bleeding is completely absorbed, while in the ischemic form remains the permanent scar at the location of stroke. Arterial lesions which are responsible for ischemic stroke are the result of blood vessel occlusion associated with thrombotic process due to primarily atheromatous changes,

occlusion of blood vessel with embolus originated from the heart or arterial wall or by changes in the blood vessel wall (vasculitis, arterial dissection ...) (7).

Although there are other causes, these three are the cause in more than 90% of patients with ischemic CVI: atherosclerosis 60-70%, embolism of cardiac origin 10-20%, along with perforating arteries, which is responsible for lacunar infarctions 10-20%. Cardiac diseases - all those diseases that lead to problems in blood flow or in which are formed thrombus in cardiac cavities, e.g.: absolute arrhythmia with thrombi in the antechamber, atrial fibrillation, mitral stenosis, heart valve abnormalities, decompensated heart, etc., can be a source of emboli.

Stroke as an acute or subacute occurred neurological deficit due to local disorders in arterial circulation is followed by either quantitative or qualitative disorders of consciences. Stroke caused by thrombosis, embolism or hemorrhage, cause impairment at various degrees to consciousness (8). Loss of consciousness begins abruptly in case of hemorrhage or a little slower in case of thrombosis. Beside disorders of consciousness, there are focal neurological signs and signs of cardiovascular hypertension, rhythm disorder, which introduced patient in a condition that threatens its life.

The course of the disease and prognosis are associated with a number of factors that interact with each other, and which lead to consciousness disorders, which affect and exacerbate existing neurological deficit, lead to complications in the form of urinary tract infections, hypostatic pneumonia, sepsis, pulmonary embolism, deep vein thrombosis and convulsions, cardiac decompensation and myocardial infarction. Prognosis of stroke recovery is better for patients with a hemorrhagic stroke because there is lower level of damage to brain tissue than in case of ischemic stroke. Depending on the age of the person who has a stroke, its former general health state or previous diseases dependent the course and prognosis of the disease (7).

Tachycardia represent an increase in heart rate above the physiological limit. In humans, physiological limit depends on the age and in adults it is more than 100 beats per minute. The increase in heart rate can be a part of physiological phenomena in the human body. Examples of this are tachycardia as a result of increased metabolic needs, a result of a drop in blood pressure (reflex tachycardia) or tachycardia as a result of stimulation of the heart directly to the nerves and hormones of the sympathetic nervous system. Tachycardia may be due to pathological processes of the heart or pathological processes that do not primarily affect the heart (9).

The goal is to determine the predictive value of tachycardia for stroke outcome with a particular emphasis on the type of cerebrovascular stroke and localization of lesions.

2. MATERIAL AND METHODS

Testing was conducted prospectively at the Neurology Clinic from March 31, 2015 until January 1, 2016. The sample consisted of 240 patients with different types and subtypes of cardiovascular stroke. There were 60 ischemic strokes with impaired consciousness of coma type, and 60 without disorder of consciousness of coma type. Hemorrhage strokes was registered in 60 cases with impaired consciousness of coma type, and 60 without the disorder of consciousness of coma type.

Inclusion criteria: CT findings of the cranium of a patient with acute stroke taken just before admission to the clinic or in the first hours after admission, the time spent at the clinic of at least 6 hours, the existence of data about previous illnesses, absence of stroke in patients with expansive process on brain.

Exclusion criteria: lack of CT cranium findings, disorder of consciousness as consequence of cognitive processes (dementia), consciousness disorders occurred due the toxic action of the drugs, alcohol or drug use, impaired consciousness occurred due to convulsive seizure or epileptic seizure (postictal states), psychosis, impaired consciousness occurred due to metabolic disorders (metabolic encephalopathy), disorder of consciousness occurring after cardiac arrest and, short stay at the clinic for less than 6 hours, stroke as the result of expansive process (bleeding in the tumor).

For this study is used questionnaire for both groups, which contained a modified scale for disorders of consciousness in cerebrovascular stroke (NIHSS - scale and Rankin scale). Patients were divided into two groups: those who had ischemic stroke and those who had a hemorrhagic stroke. The groups were further divided into subgroups: with and without the disorder of consciousness during the first seven days after the stroke. We compared gender, age, variable and fixed risk factors, disorder of consciousness of coma type and the localization of stroke.

3. RESULTS

Statistical analysis by chi-square test shows that there are no statistically significant differences in the gender representation according to the observed groups ($x2=6.563$; $p=0.087$; $p>0.05$).

Statistical analysis by one-way analysis of variance showed that there were no statistically significant differ-

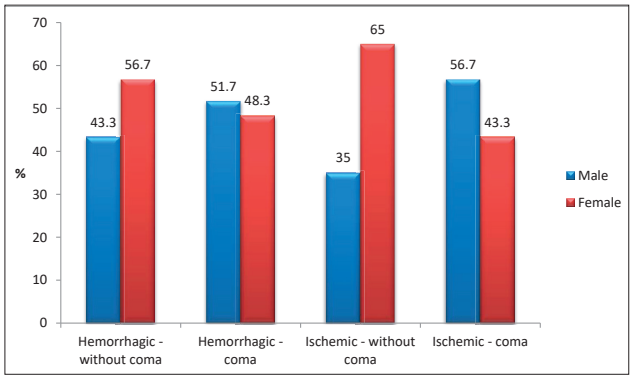

Figure 1. Gender distribution according to types and subtypes of stroke

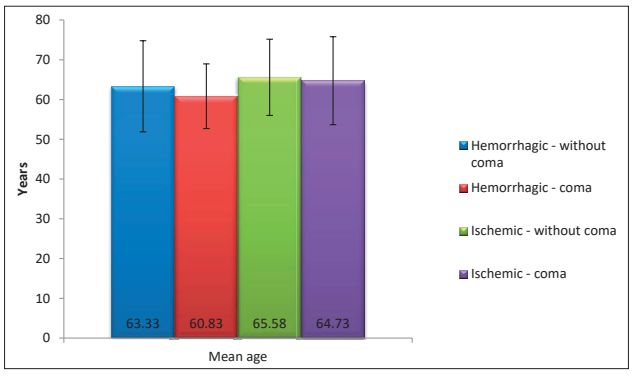

Figure 2. Mean age according to types and subtypes of stroke

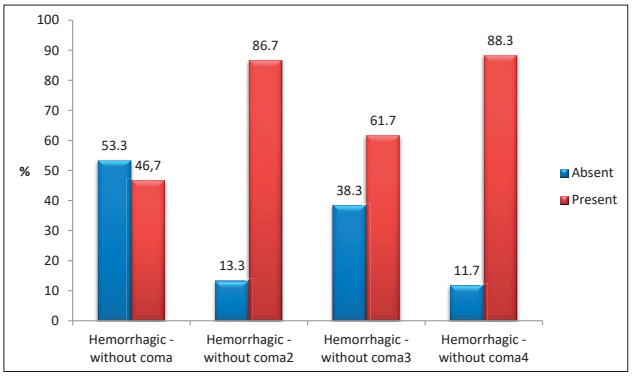

Figure 3. Tachycardia at admission according to types and subtypes of stroke (x2=35.576; p=0.0001)

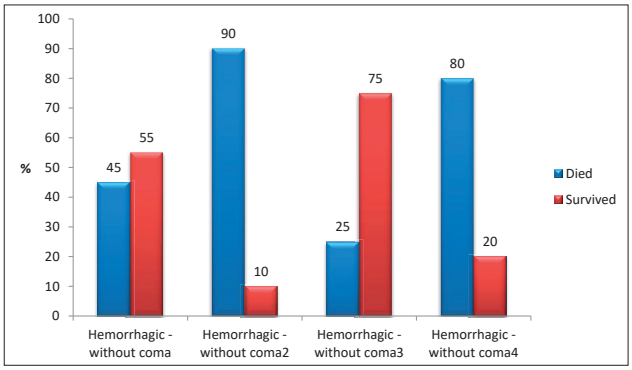

Figure 4. Lesion side according to types and subtypes of stroke (x2=72.467; p=0.0001)

ences between groups in relation to the mean age (F=2.514; p=0.059; p>0.05).

4. DISCUSSION

Statistical analysis by one-way analysis of variance showed that there were no statistically significant differences between groups in relation to the average age (p>0.05). Statistical analysis shows that there are significant differences between the observed group in relation to the presence of tachycardia on admission at the level of p<0.01. There are statistically significant differences between groups in relation to the localization of lesions (p<0.05). Analysis shows that there are statistically significant differences between groups in relation to the volume of lesions on admission (p<0.01).

There are statistically significant differences observed between groups in relation to lesions localization (p<0.05). In relation to the presence of tachycardia on admission there were statistically significant differences in the group of patients with hemorrhage compared to ischemia in relation to the presence of tachycardia (p<0.01). In the group of patients with hemorrhage disorders of consciousness of coma type was more present (78.9%). The group of patients with ischemia had 52.75% of patients with tachycardia without statistical association between the presence and absence of disorder of consciousness.

Medial lesions are more commonly associated with paroxysmal tachycardia compared to the lateral lesions (p<0.01). Statistical analysis shows that there are significant differences between the observed groups x2=35.576, p=0.0001 in relation to the outcome of stroke. A lethal outcome of hemorrhagic stroke was present in 55.45% of cases and 32.6% in case of ischemic. Significant statistical significance of ischemic and hemorrhagic stroke compared with a fatal outcome is in correlation with registered tachycardia on admission and medial localization of changes.

Oxford Community Stroke Project registered 675 patients with a first stroke, of which 53% female and 47% male (mean age 72.2 years) (10). In our material, the average age was from 60.83 to 65.8 years as the comparative results of the above studies for the entire sample. We analyze the sample in relation to age by groups and according to a statistical analysis by one-way analysis of variance it is shown

			Group				Total
			Hemorrhagic - without coma	Hemorrhagic - without coma	Hemorrhagic - without coma	Hemorrhagic - without coma	
Lesion localization	Cerebellum	N	3	3	2	3	11
		%	5.0	5.0	3.3	5.0	4.6
	Frontal	N	2	0	0	0	2
		%	3.3	.0	.0	.0	.8
	Frontoparietal	N	10	11	5	4	30
		%	16.7	18.3	8.3	6.7	12.5
	Brainstem	N	0	2	0	0	2
		%	.0	3.3	.0	.0	.8
	Occipital	N	2	0	1	1	4
		%	3.3	.0	1.7	1.7	1.7
	Occipitoparietal	N	0	0	1	1	2
		%	.0	.0	1.7	1.7	.8
	Parietal	N	17	9	14	9	49
		%	28.3	15.0	23.3	15.0	20.4
	Parietooccipital	N	17	17	21	24	79
		%	28.3	28.3	35.0	40.0	32.9
	Pons mesencephalon	N	0	0	1	0	1
		%	.0	.0	1.7	.0	.4
	Temporo parieto occipital	N	0	5	5	12	22
		%	.0	8.3	8.3	20.0	9.2
	Temporo parietal	N	9	13	10	6	38
		%	15.0	21.7	16.7	10.0	15.8
Total		N	60	60	60	60	240
		%	25.0	25.0	25.0	25.0	100.0

Table 1. Lesion localization according to types and subtypes of stroke. x2=45.686; p=0.033

			Group				Total
			Hemorrhagic - without coma	Hemorrhagic - without coma	Hemorrhagic - without coma	Hemorrhagic - without coma	
Lesion side	Centrally	N	0	2	1	0	3
		%	.0	3.3	1.7	.0	1.3
	Lateral	N	31	24	32	17	104
		%	51.7	40.0	53.3	28.3	43.3
	Medial	N	29	34	27	43	133
		%	48.3	56.7	45.0	71.7	55.4
Total		N	60	60	60	60	240
		%	25.0	25.0	25.0	25.0	100.0

Table 2. Lesion side according to types and subtypes of stroke. x2=13.876; p=0.031

that there are no statistically significant differences observed between groups in relation to the average age (p>0.05). Our results in average age in our sample are comparable to results of Alajbegović et al. (11, 12). Our results showed that there was no statistically significant difference between groups, depending on gender and age which can be considered comparative to the results of the above mentioned studies (10, 11, 12).

Regardless of significant decrease in morbidity and mortality rates from cerebrovascular disease and stroke according to the results of the Framingham Heart Study (13), AHA expect that the absolute measures of morbidity and mortality in the next thirty years will be higher because of the prolonged life expectancy of the population. American Heart Association in 1996 identified "profile of apoplectic personality" that make up the year with atherosclerosis, systolic blood pressure>160 mmHg and diastolic blood pressure>95 mmHg, history of cardiovascular disease, hypercholesterolemia, smoking, alcohol consumption and glucose tolerance. History of cardiovascular diseases is extremely important. This includes: coronary heart disease, congestive heart disease, hypertrophy of the left heart, mitral stenosis, infective endocarditis, and cardiac disease with ECG changes in terms of cardiac congenital or acquired heart changes, hypertrophy of the left heart, rhythm disorders with a various feature (14). A number of heart diseases increases the risk of cerebrovascular accident (15). Atrial fibrillation is the most powerful and the most common cardiac precursor of stroke (16).

The Framingham study using multivariate analysis of risk factors and stroke demonstrated that coronary heart disease doubles the risk for cerebrovascular accident, hypertrophy of the left heart triples the risk of cerebrovascular accident, and heart failure quadruples the risk of cerebrovascular accident (8).

Statistical analysis on our sample shows that there are statistically significant differences observed between groups in relation to the presence of tachycardia on admission (p<0.01). Presence of tachycardia at the admission is a negative factor for the outcome of stroke, just like other types of disorders of the heart rhythm arrhythmia has high level of significance (p<0.01). Statistically significantly more frequent arrhythmia was recorded in a group with coma, both ischemic stroke and hemorrhagic one. This result contrasting the results of Naoki Nago from 2011 about association of heart disease with higher mortality in patients with heart disease (17).

Our results are comparable also to the statement by Andersen who found significant proportion of heart disease, smoking and diabetes as risk factors for the occurrence ischemic stroke and a higher rate of fatalities in case of these illnesses. Our analysis shows that there are statistically significant differences observed between groups in relation to cardiomyopathy (p<0.01) as statements in comparative literature (11, 12, 18). The statistical analysis shows that there are statistically significant differences observed between groups in relation to the treatment outcome (p<0.01).

5. CONCLUSION

Tachycardia at admission in the patients with the different types of stroke is relevant negative predictor of the stroke outcome. Medial localization of intracranial changes has significant impact on the occurrence of tachycardia and lethal stroke outcome. Disorder of consciousness of coma type is a significant negative predictor of the stroke outcome. Lethality in case of hemorrhagic stroke is statically significantly more often than in case of ischemic stroke.

- Authors contribution: Author's contributions: Amina Nakicevic and Salem Alajbegovic performed the examination the patients, collected the data, analyzed them and wrote the text. Lejla Alajbegovic performed statistical analysis, assisted in writing the text including final editing and critical revision of the scientific content. All authors have read the text and approved the final manuscript.
- Conflict of interest: none declared.

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