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Prevalence and Predictors of Depression after Stroke - Results from a Prospective Study

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Abstract

BACKGROUND: A depression following a stroke (Post Stoke Depression-PSD) is the most common complication of a stroke that has a negative effect on the result after the stroke. A better definition of the risk factors of the disease will provide for better prediction and treatment.

AIM: To research identification of the risk factors for PSD, typical for the Macedonian population, which will help in early prediction, timely diagnosis and treatment of the disease?

MATERIAL AND METHODS: We carried out a prospective study in order to determine the prevalence and the risk factors of PSD in 100 patients treated at the hospital in Tetovo. The severity, localisation and the functional outcome of the stroke have been examined as potential risk factors for discharge and after 5 months. The symptoms of depression were quantified using the Hamilton Depression Rating Scale (HAM-d).

RESULTS: On discharge, 81% of the patients were diagnosed with PSD, and 67% had PSD after 5 months. A statistically significant codependence of $p < 0.05$ was registered between PSD and the level of functional dependence for activities of daily living (ADL); PSD and the severity of the stroke; and PSD and the level of disability on both examinations. In most patients with PSD, an ischemic stroke in the right middle cerebral artery has been diagnosed; the percentage difference between the other localisations is statistically significant ($p = 0.0436$; $p = 0.0002$).

CONCLUSION: There is an increased risk of PSD for immobile patients, those incapable of activities of daily living (ADL), with ischemic stroke in the right middle cerebral artery. A PSD screening and additional studies for better prediction are required.

Introduction

PSD is the most common affective disorder that occurs after an acute, focal cerebrovascular insult in the context of a clinically obvious stroke. The epidemiological studies report a widely variable prevalence of PSD that ranges between 10-64% of the patients that suffered a stroke [1] [2] [3] [4] [5] [6]. Some studies indicate highest PSD prevalence in the first 3-6 months following the stroke with a gradual decline after the first year since the stroke has occurred. This is an early, reactive stage of PSD. The depression that occurs later, after the 6th month following the stroke is considered a late stage of PSD.

The early prediction and diagnosis of PSD are important because the disease has a negative impact on survival, the success of the treatment and the medical rehabilitation, functional outcome, re-socialisation and the quality of life thus increasing the medical expenses [7] [8].

The pathophysiology of the disease remains to be explained. The predictors are not precisely defined. There is a set of studies that mostly indicate to the significant association between the extensive cerebral lesion in the frontal lobes and the occurrence of PSD without a clear predominance of the left or the right hemisphere [9] [10]. A higher level of functional disability for activities of daily living (ADL) after stroke is considered to be a risk factor most consistently associated to PSD [1] [2] [3] [4].

As a result to all of this, there was a need to research identification of the risk factors for PSD, typical for the Macedonian population, which will help

in early prediction, timely diagnosis and treatment of the disease.

Material and Methods

We carried out a prospective, longitudinal, epidemiological study in order to identify the prevalence and the risk factors for PSD on discharge from the hospital and after 5 months following the stroke. The study was carried out at the Department of Neurology at the Clinical Hospital in Tetovo, Macedonia. The study included all the patients, which fulfilled the inclusion criteria, clinically treated at the department due to an acute stroke, clinically verified and confirmed by computed tomography of the brain in the period from 1st September 2016 to 28th February 2017. Inclusion criteria: normal Mini-Mental Score according to the patient's education, maintained verbal communication ability, maintained sensorium, age ≤ 75. The study did not include patients with another comorbidity that seriously disturbed the general somatic condition and patients that were previously diagnosed with a psychiatric disorder. All the patients gave informed consent previously approved by the Ethical committee.

First, a quantification of the depression symptoms using the Hamilton Depression Rating Scale (HAM-d) was done on all the patients, which divided them into two groups, with and without PSD. For the group with PSD, there was an analysis of stroke severity, level of functional dependence for activities of daily living (ADL) and level of disability as a result of the stroke. A new examination of all the parameters was done 5 months after the stroke. Demographic data, vascular risk factors, data about the comorbidity and the localisation of the stroke was collected from the hospital's documentation and interviews of the patients and their relatives. The study included 100 patients, 97 of them were monitored for 5 months, and three deaths were recorded.

The Hamilton Depression Rating Scale (HAM-D) for quantification of depression symptoms, a form that is consisted of 21 questions. An official Macedonian translation from the Psychiatric Clinic in Skopje was used in the research. The scale score enables ranking the subject in one of the following groups: - 0-7 normal; - 7-13 mild depression; - 14-18 moderate depression; - 19-22 severe depression; - > 23 very severe depression.

National Institutes of Health Stroke Scale (NIHSS). The score range is from 0-42. A score from 24-42 indicates a severe stroke with catastrophic consequences and a patient in a coma. Such patients were not included in the study.

The level of functional dependence for activities of daily living according to the Barthel Index (BI), a questionnaire that provides an assessment of the functional ability for performing 10 basic activities of daily living. The index has a score from 0-100.

Stroke outcome according to the modified Rankin Scale (mRS) measuring the disability after stroke. The score range is from 0-6 where 2 is a slight disability, and 6 is a dead patient.

The statistical analysis was done with statistical software: STATISTICA 7.1; SPSS 17.0, using the following statistical methods: difference test, average and standard deviation, Mann-Whitney U test, Analysis of Variance-ANOVA, multiple regression analysis, Person correlation coefficient (r) and $\chi 2$ test, Shapiro-Wilk test. A statistical significance level of 0.05 (p) was defined as a confidence interval (95% CI).

Results

On the first examination, PSD was diagnosed in 81.0% of the patients, while on the second examination 65.0% of the patients had PSD, the percentage difference is statistically significant for $p < 0.05$ ($p = 0.0108$ Difference test) (Table 1). According to the Index of dynamics PSD in patients shows a decreasing rate of 19.8%.

Table 1: Patients with PSD

Psd	First		Second	
	N°	%	N°	%
Without	19	19.1	32	32.0
With	81	81.0	65	65.0
Exitus	0		3	3.0

According to the HAM-D score the majority of patients, 55%, had mild, early stage of PSD, with remission after 5 months in 12% of the patients (Table 2).

Table 2: Hamilton Depression Rating Scale-HAM-D

Finding / control	First		Second	
	N°	%	N°	%
0-7 normal	19	19.0	32	32.0
8-13 (mild depressive reaction)	55	55.0	43	43.0
14-18 (moderate depression)	14	14.0	16	16.0
19-22 (severe depression)	11	11.0	5	5.0
>23 (very severe depression)	1	1.0	1	1.0
Exitus	0		3	3.0
Total	100	100.0	100	100.0

According to the severity of the stroke (NIHSS score), more than a half of the patients with PSD presented a neurological deficit of moderate stroke on the first examination which improved in 5 months in 31% of the patients. A statistically significant dependence, $p < 0.05$, between PSD and the severity of the stroke was registered on both examinations (Pearson Chi-square: 9.75034, $p = 0.0017932$;

Pearson Chi-square: 10.9168, df = 2, p = 0.004260) (Table 3).

Table 3: Presence and absence of PSD about the severity of the stroke (NIHSS score)

Control/NIHSS/PSD	First		Second	
	Without	With PSD	Without	With PSD
0 without			9	5
0-4 small	16	36	22	46
5-15 moderate	3	45	1	14
Total	19	81	32	65

A statistically significant dependency of p < 0.05, between PSD and the degree of disability, was registered on both examinations (Pearson Chi-square: 9.79890, p = 0.043955; Pearson Chi-square: 26.4533, p = 0.000073) (Table 4). According to the modified Rankin Scale, mostly a moderately severe disability-38.3% and a moderate disability were registered in patients with PSD on the first examination. On the second examination, a moderate disability was registered in 41.5% of the patients with PSD.

Table 4: Presence and absence of PSD about the modified Rankin Scale

Control/Mrs/PSD	**First**		**Second**	
	Without	With PSD	Without	With PSD
0/no symptoms at all			6	3
1/ no significant incompetence	4	5	8	7
2/easy incompetence	6	13	16	16
3/moderate incompetence	7	30	2	27
4/ moderate severe incompetence	2	31	0	11
5/ severe incompetence	0	2	0	0
Total	19	81	32	65

A statistically significant dependence of p < 0.05 was recorded between PSD and the Barthel Index on both examinations (Pearson Chi-square: 14.1552, p = 0.006816; Pearson Chi-square: 18.7295, p = 0.000888) (Table 5). According to the Barthel Index, a moderate dependence for performing activities of daily living was recorded in patients with PSD (39.5% and 41.5%) on both examinations.

Table 5: Presence and absence of PSD according to the Barthel Index

Control/Barthel index S/PSD	**First**		**Second**	
	Without	With PSD	Without	With PSD
0-20 total dependacy	1	16	0	6
21-60 severe dependency	2	27	0	18
61-90 moderate dependency	11	32	15	27
91-99 easy dependency	0	2	3	3
100 independence	5	4	14	11
Total	19	81	32	65

A strong, negative, statistically significant correlation was recorded between the change of the value of the HAM-D score and the value of the BI in 5 months (Table and Chart 6). Namely, the improvement of the PSD during the 5-month period correlates with the increase of the degree of functional ability for ADL of the patients.

Table 6: The correlation between the change of the value of the HAM-D score and the value of BI during 5 months

Scales	Bi
Ham-d	-0.6969 P = 0.000

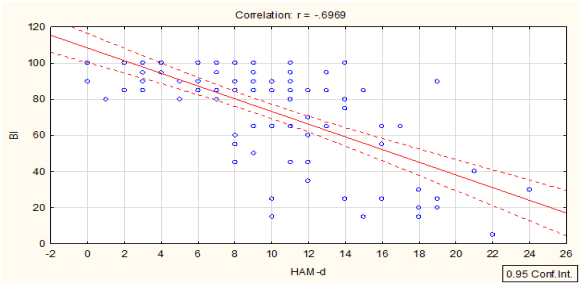

Figure 1: Presentation of the correlation between the change of the value of the HAM-D score and the value of the BI during 5 months

In the majority of patients with PSD, an ischemic stroke in the right middle cerebral artery was confirmed in 39.5% of the patients on the first examination and in 47.7% on the second examination. The percentage difference in relation to the other localizations is statistically significant for p < 0.05 on the first and second examination (p = 0.0436; p = 0.0002) (Table 7).

Table 7: Patients with PSD and localisation of stroke

First examination

Localization	PSD		Without	
	N°	%	N°	%
IS left MCA	20	24.7	3	15.8
IS left PCA	7	8.6	4	21.1
IS right ACA	1	1.2	9	47.4
IS right MCA	32	39.5	2	10.5
IS right PCA	7	8.6		
IS left MCA +bleeding	4	4.9	1	5.3
IS right MCA +bleeding	4	4.9		
IS left ACA+ IS left PCA	1	1.2		
IS left MCA+ IS left PCA	1	1.2		
IS left PCA+ IS right PCA	1	1.2		
IS right PCA+ IS left MCA	2	2.5		
IS right MCA+ IS right PCA	1	1.2		
Total	81	100.0	19	100.0

IS-ischemic stroke; MCA-middle cerebral artery; ACA-anterior cerebral artery; PCA-posterior cerebral artery

Second examination

Localization	PSD		Without	
	N°	%	N°	%
IS left MCA	13	20,0	8	25,0
IS left PCA	5	7,7	6	18,8
IS right ACA	1	1.5	10	31,3
IS right MCA	31	47,7	4	12,5
IS right PCA	3	4,6		
IS left ACA+ IS left PCA	1	1.5	1	3,1
IS left MCA+ IS right MCA	1	1.5		
IS left MCA+ IS right PCA	1	1.5		
IS left MCA + Sequel from bleeding	3	4,6	2	6,3
IS left PCA+ IS right PCA	1	1.5		
IS right MCA+ IS left MCA	2	3,1		
IS right MCA+ IS right PCA	1	1.5		
Total	65	100.0	35	100.0

IS-ischemic stroke; MCA-middle cerebral artery; ACA-anterior cerebral artery; PCA-posterior cerebral artery

Discussion

Our study confirmed high prevalence, 81%, of early, reactive stage of PSD. It is higher compared to studies with a similar design which is probably due to different depression symptoms quantification scales [11], language barrier (most of the patients were of

Albanian nationality, and Macedonian is not their mother tongue), the existence of different types of dysphasia. An early, mild stage of PSD was diagnosed in the majority of the patients, 55%, with a spontaneous remission after 5 months in 12% of the patients which corresponds with the dynamics of early PSD determined from previous epidemiological studies [3] [4] [5] [6]. In 65% of the patients, PSD was also diagnosed after 5 months and regardless of the severity of the depression symptoms they should receive treatment with antidepressants because a spontaneous remission cannot be expected. Prospective studies that observed the patients several years following the stroke indicate that if the depression symptoms emerge and are not spontaneously improved in 6 months, then PSD will most likely become chronic [6].

Certainly, the limitation of the study is the fact that the patients were only monitored for 5 months. Studies that analyze a convalescent post-stroke period of 5 and more years, such as the study conducted on 3689 patients documented in the London stroke registry, besides pointing to the variable dynamics of PSD, confirmed that the risk for the disease exists as long as the risk factors are present, or the disease can occur at any moment during the rehabilitation period of the patient [3].

The results confirm that the risk for PSD is higher in patients with a moderately severe stroke and moderate disability because, patients with symptoms of severe stroke could not be included in the study because those were patients with aphasia, disorders of consciousness and finally a fatal outcome.

In previous studies, the decreased functional ability for performing ADL is considered as the most consistent risk factor for PSD which was also confirmed in our study [3] [12]. The study demonstrated that the patients with diagnosed PSD have low BI on both examinations, i.e. in the early and the chronic stage of the disease. On the other hand, the determined, strong, negative correlations between BI and the HAM-D score indicates that the fast improvement of the depression symptoms in patients correlates to the significant improvement of the ability to perform ADL. Therefore, there is a necessity for an early prediction of PSD, but also diagnosing and treatment, which would raise the level of remission and would contribute to more rapid and more successful rehabilitation of the patients.

Our study showed that patients with an ischemic stroke in the vascular area of the right middle cerebral artery have a higher risk for developing PSD, which correlates with the occurrence of a significant motor neurological deficit and disability.

In conclusion, the results of our study confirmed the multifactorial nature of PSD. The disease presented itself as a common complication of stroke that should be taken into consideration in daily clinical practices. Thus, there is a need for preparing and introducing precise instruments for early assessment of the risk for occurrence of the disease in every patient in the rehabilitation phase. In this manner, an early prediction of PSD will be achieved, which will enable a more successful individualised treatment approach for every patient, as well as a timely education of the patient's family.

Additional studies for analysing the late and chronic stage of the disease and preparing treatment recommendations are also required.

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