

CLINICAL FEATURES OF CEREBRAL VASCULAR REACTIVITY WITH NEGATIVE SYMPTOMS IN PATIENTS WITH PARANOID SCHIZOPHRENIA

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<https://doi.org/10.5281/zenodo.11031955>

Abstract. *This article discusses the results of a study of the reactivity of cerebral vessels in patients with paranoid schizophrenia and traces the x link to the psychopathological complex of negative symptoms in this group of patients.*

Keywords: *paranoid schizophrenia, negative symptoms, vascular reactivity, cerebral disorders, pathomorphosis.*

The existing concept of paranoid schizophrenia (PS) assumes the presence of a complex cluster of pathological agents that play a dominant role in the etiopathogenetic mechanism of development of the endogenous process [2,3]. The biological components of this complex are undoubtedly one of the leading factors in the development of trajectories of the clinical course of paranoid schizophrenia [1,4,5]. Unfortunately, the current level of knowledge about paranoid schizophrenia does not allow us to indicate with great confidence the direct biological hazards leading to the initiation of the disease [6,7,9]. However, it has been convincingly proven that comorbid conditions in general, and hemodynamic disorders in particular, significantly worsen the course and prognosis of the disease [8,10].

The purpose of the study to study the effects of cerebral vascular reactivity indicators on negative symptoms in paranoid schizophrenia

Materials and methods. The assessment of hemodynamic disorders in patients with paranoid schizophrenia was carried out using spectral transcranial dopplerography using the color duplex scanning method using a complex of echoencephalographic and Doppler examinations KEHEDO SONOMED-325.

The study group consisted of 48 patients with paranoid schizophrenia without concomitant chronic cerebral ischemia (CCI). Cerebral blood flow indicators were compared with accepted normative indicators according to literature data.

The indicators of systolic blood flow in the great vessels differed from similar normative data. Thus, the peak velocity of the middle cerebral artery (MCA) was reduced in patients with paranoid schizophrenia by 3.1% and amounted to 90.4 cm/sec. Indicators of peak activity of the right cerebral artery (RCA) by 9.3%, and indicators of the posterior cerebral artery (PCA) by 2.49% were lower than similar normative data, and were statistically significant.

A comparative analysis of diastolic blood flow also demonstrated a significantly significant decrease in cerebral perfusion in patients with paranoid schizophrenia without chronic cerebral ischemia. The analysis of the average statistical peak indicators of blood flow in the main arteries of the brain in a group of patients with paranoid schizophrenia showed changes in the decrease in the amplitude of d-grams towards a decrease in perfusion and a tendency to narrow the spectral “window” of the main vessels.

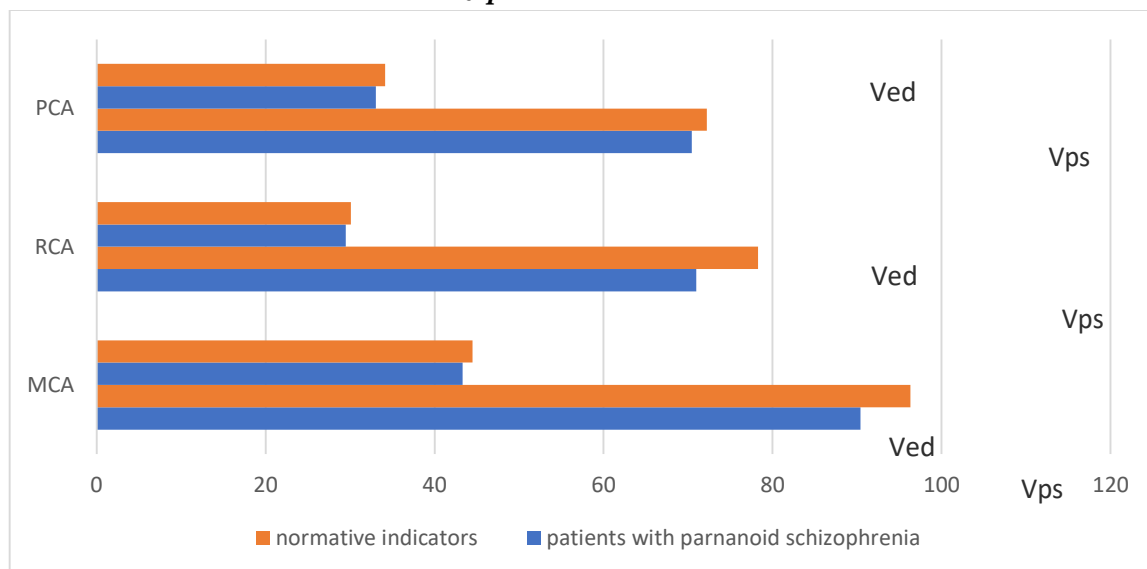
Table 1.

Indicators of cerebral hemodynamics in the main arteries of the brain in patients with paranoid schizophrenia without a diagnosis of CCI

Basin	Parameters	Study group (n=48)	Normal data (N)	P
MCA	Vps	90,40 ± 18,35	96,3±11.2	0,42
	Ved	43,33 ± 07,59	44,5±21.4	0,549
	RI	00,72 ± 00,05	00,82 ± 00,05	0,765
RCA	Vps	70,98 ± 15,29	78,28 ± 1,29	0,202
	Ved	29,50 ± 07,83	30,10 ± 06,32	0,034 *
	RI	00,87 ± 00,05	00,77 ± 00,05	0,075
PCA	Vps	70,43 ± 07,29	72,23 ± 05,1	0,884
	Ved	33,05 ± 05,48	34,15 ± 06,18	0,236
	RI	00,74 ± 00,09	00,64 ± 00,1	0,076

Diagram 1.

Indicators of peak activity of systolic and diastolic blood flow in patients with paranoid schizophrenia without CCI



In all cases there was bilateral and symmetrical slowing of peak systolic and end-diastolic blood flow velocities.

Although peripheral vascular resistance indices were slightly reduced, these differences were not of moderate statistical significance

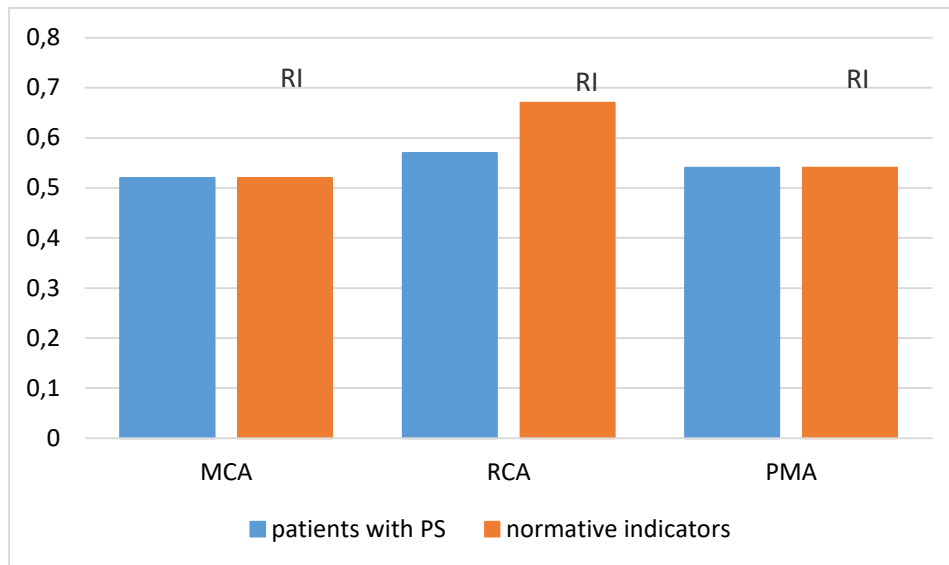
Thus, we can conclude that cerebral perfusion at the level of the great vessels in patients with paranoid schizophrenia tends to reduce peak activity, but the peripheral resistance index is not statistically significant.

To study patients with paranoid schizophrenia with concomitant chronic cerebral ischemia, patients in the main group were divided into 2 groups according to clinical indicators, patients with CCI 1 (subgroup 1) and CCI 2 (subgroup 2).

Thus, the group of patients with CCI 1 consisted of 44 patients, and the group with CCI 2 of 39 patients.

Diagram 2.

Analysis of the peripheral vascular resistance index in patients with PS without CCI



Analysis of cerebral perfusion data at the level of the great vessels in patients with paranoid schizophrenia with CCI 1 showed a significant decrease in the peak activity of systolic and diastolic blood flow, in Table 2. clearly demonstrated the blood flow indicators of the main great vessels.

Table 2.

Perfusion indicators in the main arteries brain in patients with paranoid schizophrenia DE1 (CIB1)

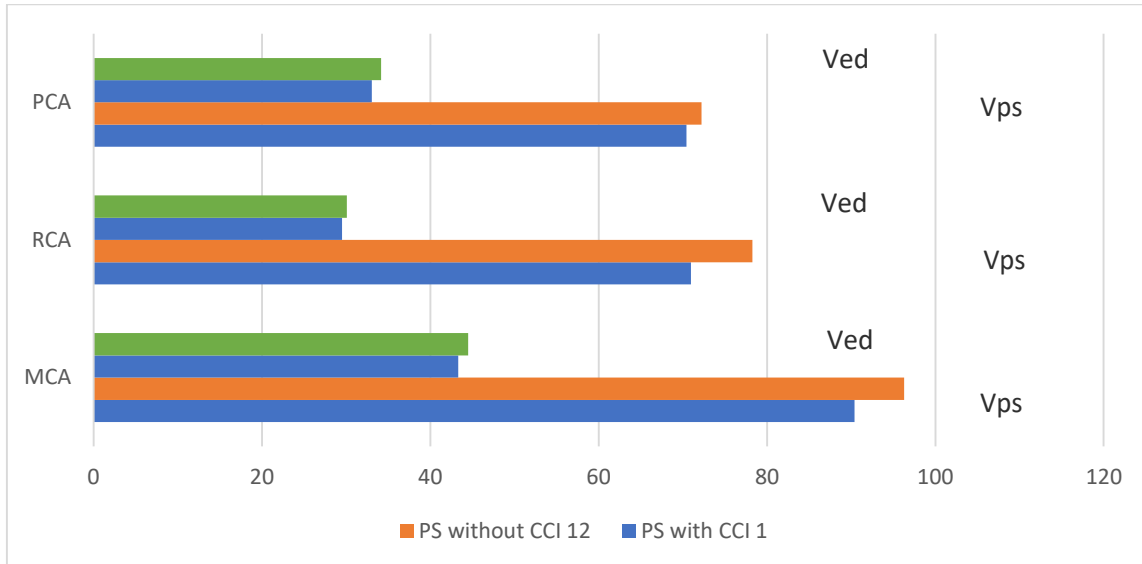
Basin	Parameters	Subgroup 1 N =44	Comparative group	P
MCA	Vps (cm/сек)	63,95±20,09	90,40 ± 18,35	0,001 *
	Ved (cm/сек)	34,62±13,14	43,33 ± 07,59	0,001 *
	RI (y.e.)	0,866±0,103	00,72 ± 00,05	0,001
RCA	Vps (cm/сек)	55,28±13,55	70,98 ± 15,29	0,001 *
	Ved (cm/сек)	23,68±8,18	29,50 ± 07,83	0,001 *
	RI(y.e.)	0,994±0,112	00,87 ± 00,05	0,001 *
PCA	Vps (cm/сек)	59,57±16,52	70,43 ± 07,29	0,001 *
	Ved (cm/сек)	26,64±7,99	33,05 ± 05,48	0,001 *
	RI(y.e.)	0,982±0,108	00,74 ± 00,09	0,001 *

Analysis of the indicators given in Table 2 demonstrates a significant decrease in blood flow in the great vessels in patients of subgroup 1. The average peak systolic activity in the middle cerebral artery (MCA) is 29.2% lower than the comparison group and amounts to 63.95±20.09 cm/sec. (p<0.001), while the same indicator for the comparison group was 90.40±18.35 cm/sec. (p<0.001). The average values of peak systolic perfusion of the anterior main artery (AMA) and posterior main artery (PMA) are 55.28±13.55 cm/sec, respectively. (p<0.001) and 59.57±16.52 cm/sec., which is 22.1% and 15.4% less than the average cerebral perfusion in the comparison group.

An assessment of the peak diastolic activity of the great vessels also shows a significantly significant decrease in blood flow in the MCA by 20.1%, the RCA by 19.7%, and the PCA by 19.3% from similar parameters in the comparison group.

Diagram 3.

Indicators of peak activity of systolic and diastolic blood flow in patients with paranoid schizophrenia CCI-1



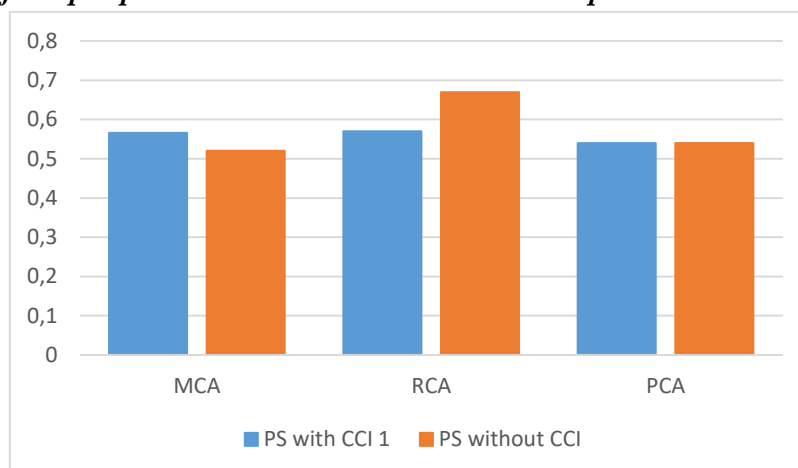
In patients with PS with concomitant CCI 1, persistent vasospasm of the great vessels, a decrease in d-gram amplitudes, low hemodynamic patency on both sides, and an undulating vertebrobasilar deficiency of blood supply were noted. The changes were largely functional in nature.

An assessment of indirect signs of intracranial arteries in patients with PS with CCI 1 showed that in 42.1% of patients there was pathological tortuosity of vessels for the ICA (18.7%) and extravasal compression of the vertebral arteries (17.9%). The shape was C-shaped, S-shaped and loop-shaped (2.6%) tortuosity. Tortuosity and extravasal compression, as a rule, were noted to be hemodynamically insignificant.

The unified resistance index of peripheral vessels characterizing the tone of the vascular wall and the specific resistance to blood flow in the PS group with CCI1 was significantly lower than the similar values in the comparison group, which is clearly presented in Diagram 4.

Diagram 4.

Analysis of the peripheral vascular resistance index in patients with PS with CCI 1



The peripheral vascular resistance index (PVRI) in the PS group, comorbid with CCI 1, MCA in the main intracranial great vessels was significantly higher, in the MCA by 19.4% ($p < 0.001$), in the ACA by 13.7% ($p < 0.001$), PCA by 32.4% ($p < 0.001$).

To summarize the above, we can summarize that in patients with paranoid schizophrenia with concomitant chronic cerebral ischemia of the first degree, on average, a significantly more frequent decrease in peak blood flow activity in the main great vessels of the brain was observed, and significant hemodynamic disturbances were confirmed by an increase in the resistance index of peripheral cerebral vessels.

The sample of patients with paranoid schizophrenia with chronic cerebral ischemia stage 2 was 39 (patients).

Hemodynamic parameters in patients with PS with CCI are shown in Table 3.

Table 3.

Perfusion indicators in the main arteries of the brain in patients with PS with CCI 2, PS with CCI1, PS without PS

Basin	Parameters	Subgroup 2 N =39	Subgroup 1 N =44	Comparative group	P
MCA	Vps (cm/cek)	52,15 ± 19,14	63,95±20,09	90,40 ± 18,35	0,001
	Ved (cm/cek)	29,86 ± 11,64	34,62±13,14	43,33 ± 07,59	0,001
	RI (y.e.)	1,21 ±00,10	0,866±0,103	00,72 ± 00,05	0,001
RCA	Vps (cm/cek)	49,15 ± 14,81	55,28±13,55	70,98 ± 15,29	0,001
	Ved (cm/cek)	20,21 ±05,39	23,68±8,18	29,50 ± 07,83	0,001
	RI(y.e.)	01,61 ±00,11	0,994±0,112	00,87 ± 00,05	0,001
PCA	Vps (cm/cek)	52,89 ±20,38	59,57±16,52	70,43 ± 07,29	0,001
	Ved (cm/cek)	23,54 ±09,16	26,64±7,99	33,05 ±05,48	0,001
	RI(y.e.)	01,60 ±00,15	0,982±0,108	00,74 ± 00,09	0,001

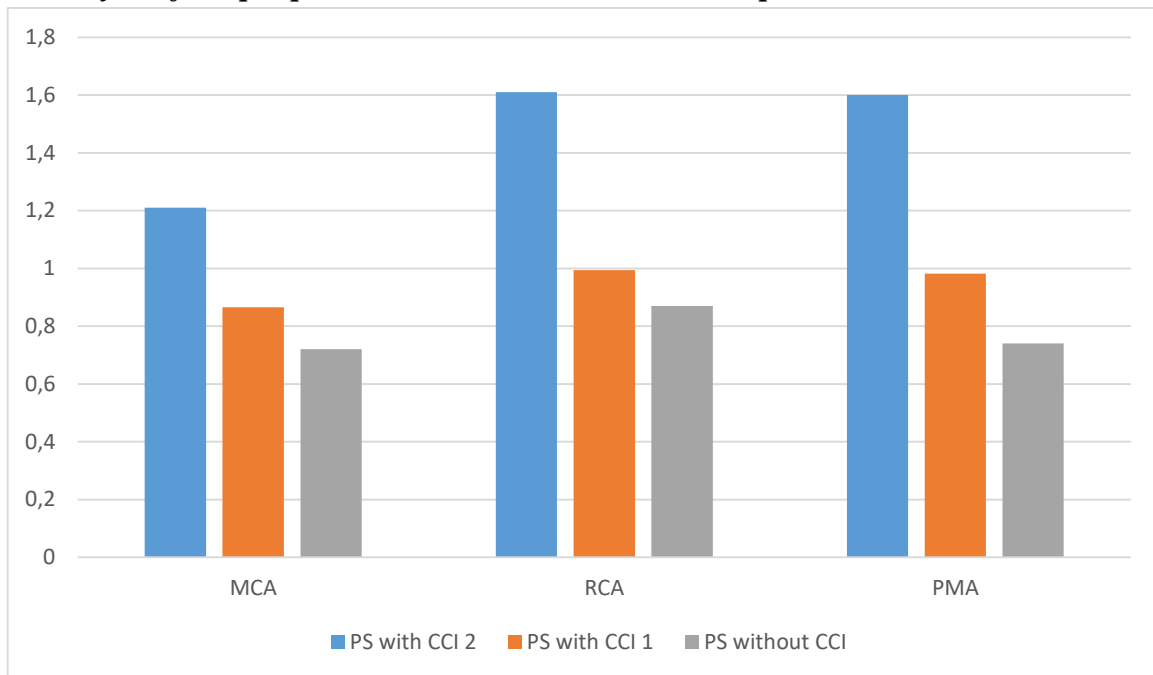
Analyzing the data presented in Table 5.3, we can conclude that in patients with PS with CCI 2, the severity of significant hemodynamic disorders was significantly higher than in the groups of PS with CCI and PS without CCI. The average statistical indicators of peak blood flow activity for the MCA during PS with CCI 2 are 18.45% ($p < 0.001$) lower than those of the PS group with CCI 1, and in comparison with the PS group without CCI by 42.11% ($p < 0.001$), which reflects a significant impairment of perfusion in the middle cerebral artery basin.

The indicators of the anterior cerebral artery also largely reflected the poor hemodynamics in its basin; the average statistical indicator of peak systolic activity of the RCA with CCI 2 was 11.08% ($p < 0.001$) and 29.85% ($p < 0.001$) lower than the corresponding indicators in patients with PS with CCI 1 and patients with PS without CCI

The conclusions of the transcranial spectrography protocols in patients with PS with CCI 2 were characterized by permanent vasospasm, a systemic decrease in systolic and diastolic peak hemodynamic parameters, and persistent stenosis of the spectral window. The indicators were more related to the organic nature of the decrease in the lumen of the vascular bed of the great vessels (atherosclerotic plaques). In favor of organic changes in the architectonics of the vascular wall, a significant, statistically significant change in the PVRI for the main vessels is also indicated. The data presented in Diagram 5.5 indicates an increase in peripheral vascular resistance in patients with PS with CCI 2.

Diagram 5.

Analysis of the peripheral vascular resistance index in patients with PS with CCI 1



The average statistical indicator of the peripheral vascular resistance index (PVRI) in the group of PS with comorbid CCI 2 was significantly higher and amounted to 1.21 ± 00.10 ($p < 0.001$) on the main vessels of the MCA RI (c.u.), RMA RI (c.u.) 01.61 ± 00.11 ($p < 0.001$) and for PMA RI (c.u.) 01.60 ± 00.15 , which in percentage terms with the comparison groups was for PS with CCI 1 +40.6%, +61.9% and +62.9% of similar indicators, and for PS without CCI by +68.0%, +85.0% and +116.2% of similar indicators, respectively.

Based on the data obtained, we can summarize that patients with PS with concomitant chronic cerebral ischemia stage 2 have a pronounced impairment of significant hemodynamic changes of a predominantly organic nature, which is confirmed by the obtained transcranial spectroscopy data, and is expressed in significantly significant decreases in systolic and diastolic peak activity, as well as high rates peripheral vascular resistance index.

The idea of a material substrate for disorders was expressed from the very beginning of the study of schizophrenia; in the famous concept of dementia praecox, Emil Kraepelin assumed the presence of a progressive pathological process in the cerebral cortex.

Unfortunately, despite the simply huge amount of research on this topic, we currently do not have a convincingly proven anatomical structure that is fully responsible for all manifestations of paranoid schizophrenia; the modern scientific world has long come to the conclusion that the clinical picture of an endogenous process is a phenomenon with a multilocal anatomical substrate. A promising solution to establishing the substructures of this pathological system is to study the influence of perfusion of a particular area of the brain of a patient with paranoid schizophrenia.

Using transcranial Doppler sonography, we established correlations between perfusion disorders in individual vessels and the manifestation of negative symptoms in patients with paranoid schizophrenia with CCI. Depending on the decrease in the reactivity of the main vessels of the AA and IBA, patients were divided into 2 subgroups, 1 subgroup (patients with disorders in the VA $n=31$), and 2 subgroup (patients with disorders in the VA $n=39$)

Changes in five areas are presented: flattening and rigidity of affect, speech disorders, apatho-abulic disorders, anhedonia-asociality and attention. In the presented sample of PS patients with hemodynamic disorders in the IBA, the average values of indicators for flattening and rigidity of affect, speech disorders, apatho-abulic disorders, anhedonia-asociality and values were significantly higher than in the control group.

Table 5.4.

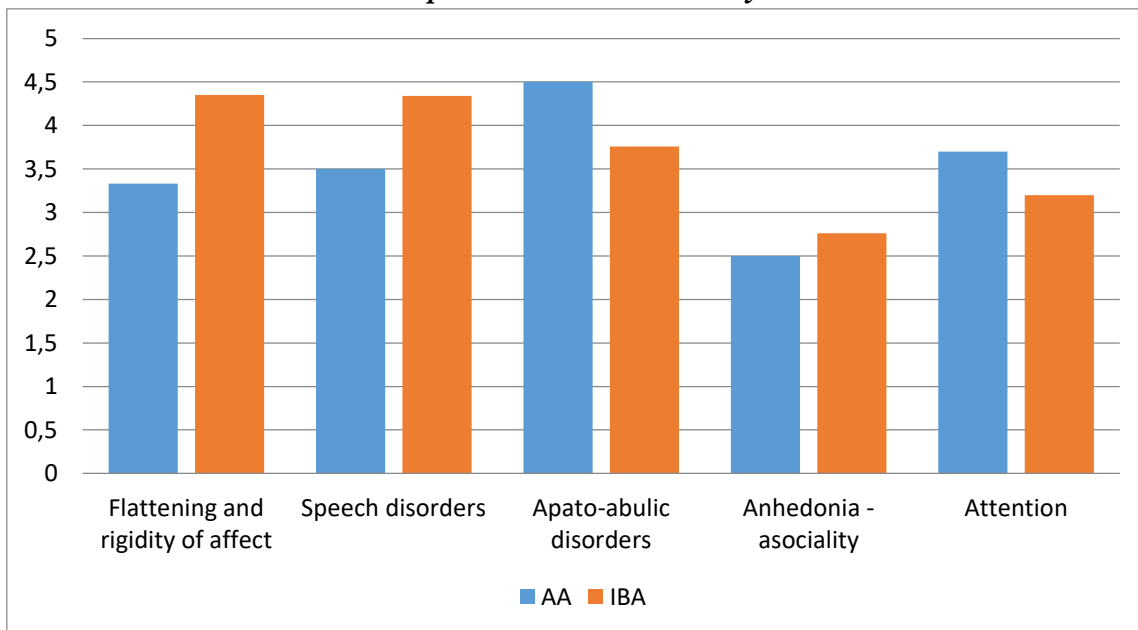
Hemodynamic parameters in the right AA and left IBA

Vessels	Vmax cm/c	Vmin, cm/c	V cm/c	Ri	Pi	HR, уд/мин	Ai, m/c	IPP W	SBI
RAA									

A direct correlation was found between indicators of AA reactivity and negative symptoms in patients with PS $R = 0.51$. AA (in right-handers) within the average values $V_{max} 53.8$ cm/s, $V_{min} 29.5$ cm/s. The patients had psychopathic-like symptoms with effects of anger, hetero- and auto-aggressive tendencies.

Diagram 6.

Correlation relationships between the components of negative symptoms of SANS and impaired vascular reactivity



Left IBA (in right-handers) within the average values of $V_{max} 29.5$ cm/s, $V_{min} 7.82$ cm/s, deficit symptoms were characterized by a reduced motivational component (inactive, withdrawn, autistic), a decrease in the components of social intelligence $R=0.49$

Conclusions: A statistically significant predominance of negative symptoms was found in patients with reduced cerebral perfusion and decreased reactivity of the right vertebral artery (PAA) within the average values of V max 53.8cm/s, V min 29.5 cm/s. Patients had psychopathic symptoms with anger affects, heteroaggressive and autoaggressive tendencies. With reduced reactivity of the basilar artery (BA) within the average values of V max 29.5 cm/s, V min 7.82 cm/s, deficiency symptoms were characterized by a reduced motivational component (inactive, withdrawn, autistic) and a decrease in social intelligence.

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