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To The Question Of The Use Of Neuroimaging Examination In The Diagnosis Of Ischemic Strokes.

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ABSTRACT
The relationship between the clinical picture of ischemic stroke and MRI in assessing changes in brain matter and cerebral hemodynamics was studied. It was found that changes in the venous circulation of the brain are detected on the MRI and MRI angiography and reveal a stable and reliable natural connection with different brain states and carry important information about the organization of its blood supply and identification of the degree and severity of vascular lesions.

Keywords: ischemic stroke, diagnostics of ischemic strokes, venous dyscirculation, venous outflow, cerebral hemodynamics, venous circulation.

1. INTRODUCTION

Today in the world about 9 million people suffer from cerebrovascular diseases. The main place among them is occupied by strokes, which infect 5.6 to 6.6 million people and take 4.6 million lives each year, mortality from cerebrovascular diseases is second only to mortality from heart diseases and tumors of all localizations and reaches in economically developed countries 11 –12% [3, 4]. Manymillionsofpeoplebecomedisabled.
The successful development and implementation of highly informative technologies in medicine has led to the discovery of discoveries in the etiology and pathogenesis of cerebrovascular disorders and the revision of approaches to their prevention and treatment. Science has made significant progress in the diagnosis of the pathologist type of stroke due to the widespread use of MRI and MR angiography [1].
In the last decade, interest has grown in studying venous discirculation of cerebral circulation, in the formation of which an important role is played by changes in the tone of intracranial veins and impaired outflow of venous blood from the cranial cavity caused by various etiological factors [5, 6]. The significant frequency of occurrence of cerebral venous discirculationis also confirmed systematically by additions to the list of causes of impaired venous circulation and studies of cerebral hemocirculation in various diseases of the nervous system and somatic sphere [2]. It should be remembered that the clinical picture of cerebral venous discirculation is not well understood and specific, which complicates its timely diagnosis.
The aim of our study was to study the relationship of the clinical picture of IS and MRI in assessing changes in brain matter and cerebral hemodynamics.

Our study was conducted in the Department of Neurology in Regional vascular center of Novosibirsk city, Clinical hospital number 1 from the period 2017-19. We examined 110 patients with IS confirmed by MRI and clinically. The distribution of patients by type of ISis presented in table 1.

During a neurological examination of patients, 86 (78.2%) patients showed motor disorders in the form of mild or moderate right-sided hemiparesis - of which 60 (54.5%) patients, left-sided hemiparesis - in 26 (23.6%) patients; coordinating (77.4%) and sensitive (64.5%) disorders. All of these symptoms were not detected with lacunar IS. Elements of motor aphasia were observed in 7 (6.4%) patients, sensory aphasia in 5 (4.5%), mixed aphasia in 4 (3.6%).

Table 1.
Distribution of patients by gender, age and subtype of ischemic stroke.

Typesof stroke	Old (year)	male		Female		Total	
		n	%	n	%	N	%
Atherothrombotic (At)	62,6±3,2	19	17,3	23	20,9	42	38,2
Lacunar (Lac)	59,4±2,7	16	14,5	14	12,7	30	27,3
Cardioembolic (Ce)	57,2±3,1	12	10,9	10	9,1	22	20,0
Hemodynamic (Hd)	75,2±3,4	7	6,4	9	8,2	16	14,5
Total	65,9±3,1	54	49,1	56	50,9	110	100,0

MRI was performed on a Siemens Magnetom Symphony apparatus equipped with a superconducting magnetic system with a field strength of 1.5 Tesla. Tomograms were obtained by the standard method in axial, sagittal and coronal projections using pulse sequences T2, T1, FLAIR and DWI programs. In the interpretation of brain MRI, the presence of focal, diffuse (leukoaraiosis) and atrophic changes in the white matter of the brain was assessed.

In the analysis of the study, we identified the following MRI signs of IS: the absence of a signal of blood outflow through the vessel in the affected area, a change in signal intensity in T1 and T2 modes, compression and / or dislocation of the median structures of the brain, and local edema of the brain tactic.

The image of the ischemic focus in MRI has a certain dynamics, which is due to a combination of signs of cerebral discirculation and changes in the substance of the brain. The earliest MRI sign reflects a violation of hemodynamics and the state of the lumen of the vessel (usually the absence of a blood flow signal), but appears only in a quarter of all examined on the first day. Often determined with extensive and large infarction foci with occlusion of the large arteries of the brain. With occlusion of the cortical and deep branches of the cerebral arteries, this symptom is usually not possible to identify.

In 36 (32.7%) of the studied patients with MRI, the expansion of the ventricular system and cerebrospinal fluid of the brain of varying severity was observed: weak in 29 (26.4%) patients, moderate in 66 (60%), slight in 15 (13.6%) patients.

Local ischemic changes in brain matter on MRI were observed in 107 (97.3%) patients. In most patients (102, 92.7%), focal changes in the form of deep small infarcts of the brain substance were localized in the white matter of the semi-oval centers, in the area of the subcortical ganglia, inner capsule, and also in the trunk structures - in the cerebellum,

thalamus, bridge hippocampus. In 33 (30%) patients, large-focal changes were combined with ischemia of medium size, and in 9 (8.2%) patients with several small ischemic area
A decrease in the density of the white matter of the brain (leukoaraiosis) was detected in 97 (88.2%) patients. Focal changes in the area of periventricular white matter were recorded as limited leukoaraiosis in 30 (27.3%) patients, moderate diffuse changes in periventricular white matter were noted in 14 (14.5%) patients, and pronounced diffuse changes in the white matter of the subcortical region were found in 9 (8.2%) patients.

Ischemic lesions in the brain tissue more accurately demonstrate the prevalence and dynamics of ischemia and are manifested by a change in the intensity of the MRI signal and signs of local edema. Local edema of the brain was often detected in the period up to three days, subsiding in the acute period (up to 21 days); in the rehabilitation period was not observed in any patient. Local edema was better visualized in the T1-mode; in the majority of patients (107, 97.3%) was detected by the end of the first day of IS. However, the identification of IS area of cortical localization and stem foci was more often displayed in the T2 mode, compared with the T1 mode.
The dynamics of MRI was showed in a change in the signal from heterogeneous to homogeneous and contouring of the AI focus with more clear demarcation. In the first 12 hours on an MRI, signal inhomogeneity was observed in 88 (80%) patients, by 7 days in 50 (45.5%), and at the time of discharge from the hospital (20-21 days) - only in 8 (7.3%) examined ($p < 0.05$).
It was revealed that in the acute period of IS, unclear contours of the focus were more common (90 patients, 81.8%). However, by the beginning of the acute period (7 days), an increase in the number of foci with clear contours was noted, and at the time of discharge from the hospital (20-21 days), the focal contours were clear in 102 (92.7%) patients ($p < 0.05$) . Clearly limited areawere found more often in the T2 mode.
Thus, MRI is highly informative in the diagnosis of area of the ischemic process, and early MRI signs of IS are vascular changes that visualize blood flow disturbance and vascular lumen, along with changes in the brain material, manifested by a change in signal in T2 and local edema in the T1 mode.
The sensitivity and accuracy of MRI for the diagnosis of IS was about 90%, and the specificity of the method was 100%.
The method of MR angiography made it possible to visualize the multidimensional picture of the vessels of the brain and neck in all examined patients without introducing a contrast medium, to identify the location (level) of the lesion, to determine the anatomical deviations of their structure and to assess the possibility of collateral blood flow. MR angiography along with MR imaging should be included in the protocol of MR studies of patients with IS in the acute period of the disease.
Analysis of MRI and MR angiography showed that the most common complication of IS was volumetric exposure to various sections of the cerebrospinal fluid system, the median structures of the brain and stem sections. The severity of this effect depended on the size and location of the ischemic area. The maximum lateral and axial dislocation was observed with extensive cerebral infarction. Large ischemic area in the MCA basin, we observed a mixture of the median structures of the brain, not to the same extent as with extensive infarction. At area of IS in the basins of the anterior and posterior cerebral arteries, the displacement of the brain structures was visualized as a compression of the corresponding sections of the lateral ventricles without displacement of the median hemispheric structures of the brain substance. The volumetric effect in middle hemispheric IS located in the deep parts of the brain parenchyma was manifested by compression of the adjacent parts of the ventricles. With small focal cerebral infarction, the effect of displacement was absent. We have proven a

direct reliable significant relationship between the volume of damage to the substance of the brain and the occurrence of complications ($p < 0.05$).

Based on the research data obtained, it was proved that the presence of an extensive infarction leads to complications and has an extremely unfavorable prognosis. Significant criteria for the severity of the course of IS on MRI are: severe perifocal edema, detection of leukoaraosis, severe internal and external hydrocephalus. The combination of these signs gives reason to predict the worst outcome of ischemic stroke. So, with large infarct sizes with a morphologically significant defect, but without the presence of these three factors, positive clinical and neurological dynamics are more pronounced than in patients with smaller infarct sizes, but with the presence of these components.

Most often, changes in the MRI picture were seen with atherothrombotic and lacunar types of IS. Moreover, according to MRI and MR angiography, in 57 (79.2%) patients with atherothrombotic and lacunar IS, asymmetry of the main cerebral veins was noted; jugular veins and cerebral sinuses were dilated on the right in 26 (36.1%) patients, on the left - in 31 (43.1%). In 6.9% (5 people) cases, congenital malformations of the brain drainage system were detected - in 2 (2.8%) patients - hypoplasia of one of the transverse sinuses, in 2 (2.8%) of the examined - transverse sinus aplasia, in 1 (1.4%) patient - sigmoid sinus hypoplasia. In all patients with abnormalities of the development of venous sinuses, we observed a compensatory expansion of the contralateral sinuses.

When conducting MR angiography in the venous phase of cerebral circulation in the group with atherothrombotic IS in 32 patients (76.2%) and 25 (83.3%) patients of the group with lacunar IS, structural changes in the cerebral venous system corresponding to different stages of ischemic lesion were detected brain and having some variability of the anatomical structure. The cerebral venous channel is characterized by significant structural resistance to hemodynamic changes in stroke due to compensatory capabilities.

The most common forms of damage to extra- and intracranial vessels in patients of both groups were: lengthening of the vessels, narrowing of the lumen or occlusion of the vessel (table 2).

Table 2.

Frequency of occurrence of various forms of vascular lesions

Typesofpathology	Atherothrombotic (At)		Lacunar (Lac)	
	side	2 side	1 side	2 side
Vessellengthening	7	1	5	0
Vessel narrowing	21	11	19	8
Vessel occlusion	6	1	2	0
Slight curvature	9	3	7	2
Middelcurvature	5	2	4	2
Severcurvature	1			

The frequency of detection of bends of at least one vessel in patients with IS was 48.6% (35 patients), in 9 (12.5%) patients, the bends were bilateral. According to localization, the initial segment and ICA siphon most often damaged (13 (18.1%) patients).

With a pronounced and prolonged violation of the outflow along one of the internal jugular veins, the cross-sectional area of the contralateral internal jugular vein increases by 3-8 times. With hemodynamically significant compression, the cross-sectional area and other venous collectors increase, collaterals and shunts appear, which achieve maximum development with

bilateral damage. The lower the level of damage, the less pronounced are the compensatory changes.

Changes in the venous and arterial blood circulation of the brain are detected on MRI and MR angiography and reveal a regular relationship with various brain conditions and carry important information about the organization of its blood supply and identification of the degree and severity of vascular brain damage.

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