International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 02 ISSUE 03 Pages: 01-06
SJIF IMPACT FACTOR (2021: 5. 694) (2022: 5. 893)
OCLC – 1121105677 METADATA IF – 5.654
Publisher: Oscar Publishing Services

Research Article

DIAGNOSTIC VALUE OF MAGNETIC RESONANCE IMAGING IN ASSESSING CHANGES IN THE BRAIN SUBSTANCE AND CEREBRAL HEMODYNAMICS IN ACUTE CEREBROVASCULAR PATHOLOGY

Submission Date: February 27, 2022, **Accepted Date:** March 17, 2022,
Published Date: March 29, 2022
Crossref doi: https://doi.org/10.37547/ijmscr/Volume02Issue03-01

N.A. Khodjaeva
Republican Scientific Center for Emergency Medical Care Bukhara Branch, Uzbekistan

ABSTRACT

The relationship between the clinical picture of ischemic stroke and magnetic resonance imaging in assessing changes in the brain substance and cerebral hemodynamics was studied. It was stated that changes in the venous circulation of the brain are detected on magnetic resonance imaging and magnetic resonance angiography and show a stable reliable regular relationship with various states of the brain and carry important information about the organization of its blood supply and identification of the degree and severity of vascular damage to the brain.

KEYWORDS

Clinical picture, ischemic stroke, magnetic resonance, brain substance, cerebral hemodynamics.

INTRODUCTION

At the present time, about 9 million people in the world suffer from cerebrovascular diseases. The main place among them is occupied by strokes, which every year affect from 5.6 to 6.6 million people and claim 4.6 million lives, mortality from cerebrovascular diseases is second only to mortality from heart diseases and tumors of all localizations and reaches 11–12% in economically developed countries [3, 4]. Millions of people become disabled.The successful development and introduction of highly informative technologies into medicine has led to discoveries in the etiology and pathogenesis of cerebrovascular disorders and a

International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 02 ISSUE 03 Pages: 01-06
SJIF IMPACT FACTOR (2021: 5. 694) (2022: 5. 893)
OCLC – 1121105677 METADATA IF – 5.654
Publisher: Oscar Publishing Services

revision of approaches to their prevention and treatment. Science has made significant progress in diagnosing the pathogenetic variant of stroke due to the widespread use of MRA and MR angiography [1].

THE MAIN FINDINGS AND RESULTS

In the last decade, interest has grown in the study of venous cerebral circulation dyscirculation, in the formation of which an important role is played by changes in the tone of intracranial veins and disturbances in the outflow of venous blood from the cranial cavity caused by various etiological factors [5, 6]. A significant frequency of occurrence of cerebral venous dyscirculation is also systematically confirmed by additions to the list of causes of venous circulation disorders 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 dyscirculation is not well understood and specific, which complicates its timely diagnosis.

The aim of our study was to study the relationship between the clinical picture of AI and MRA in assessing changes in the brain substance and cerebral hemodynamics.

We examined 110 patients with MRA and clinically confirmed AI. The distribution of patients by type of AI is presented in Table 1.

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

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

Stroke subtype	Age (years)	Men		Women		Total	
		N	%	n	%	n	%
Atherothrombotic (At)	62,6±3,2	19	17,3	23	20,9	42	38,2
Lacunar (Lacquer)	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

MRA was performed on a Siemens Magnetom Symphony machine equipped with a superconducting magnetic system with a field strength of 1.5 Tesla. Tomograms were obtained according to the standard

International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 02 ISSUE 03 Pages: 01-06
SJIF IMPACT FACTOR (2021: 5. 694) (2022: 5. 893)
OCLC – 1121105677 METADATA IF – 5.654
Publisher: Oscar Publishing Services

method in axial, sagittal and coronal projections using T2, T1 pulse sequences, FLAIR and DWI programs. When interpreting MRA of the brain, the presence of focal, diffuse (leukoareosis) and atrophic changes in the white matter of the brain was assessed.

When analyzing the study, we identified the following MRA signs of AI: the absence of a signal of blood outflow through the vessel in the affected area, changes in signal intensity in T1 and T2 modes, compression and/or dislocation of the midline structures of the brain, and local swelling of the brain tissue.

The image of the ischemic focus in MRA has a certain dynamics which is due to a combination of signs of cerebral dyscirculation and changes in the very substance of the brain. The earliest MRA sign reflects a violation of hemodynamics and the state of the lumen of the vessel (usually the absence of a blood flow signal), but it manifests itself only in a quarter of all subjects on the first day. It is often determined with extensive and large infarct foci with occlusion of large arteries of the brain. With occlusion of the cortical and deep branches of the cerebral arteries, this symptom is usually not detected.

In 36 (32.7%) of the studied patients, MRA revealed an expansion of the ventricular system and cerebrospinal fluid spaces of varying severity: mild - in 29 (26.4%) patients, moderate - in 66 (60%), severe - in 15 (13.6%) patients.

Local ischemic changes in the substance of the brain on MRA were observed in 107 (97.3%) patients. In the majority of patients (102, 92.7%), focal changes in the form of deep small infarcts of the brain substance were localized in the area of the white matter of the semioval centers, in the area of the subcortical ganglia, the internal capsule, as well as in the structures of the trunk - in the cerebellum, thalamus, pons, hippocampus. In 33 (30%) patients, large-focal changes were combined with medium-sized foci, and in 9 (8.2%) patients - with several small foci.

A decrease in the density of the white matter of the brain (leukoareosis) was detected in 97 (88.2%) patients. Focal changes in the area of the periventricular white matter were recorded as limited leukoaraiosis in 30 (27.3%) patients, moderate diffuse changes in the 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 foci in the brain tissue more accurately demonstrate the prevalence and dynamics of ischemia and are manifested by a change in the intensity of the MRA signal and signs of local edema. Local swelling of the brain tissue was often detected within a period of up to three days, subsiding in the acute period (up to 21 days); during the rehabilitation period was not observed in any patient. Local edema was better visualized in the T1 mode, in most patients (107, 97.3%) it was detected by the end of the first day of AI. However, detection of cortical AI foci and stem foci was more often displayed in T2-mode than in T1-mode.

The dynamics of MRA was manifested in a change in the signal from heterogeneous to homogeneous and contouring of the AI focus with a clearer demarcation. On MRA in the first 12 hours, signal inhomogeneity was noted 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 found that in the most acute period of AI, fuzzy 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

International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 02 ISSUE 03 Pages: 01-06
SJIF IMPACT FACTOR (2021: 5. 694) (2022: 5. 893)
OCLC – 1121105677 METADATA IF – 5.654
Publisher: Oscar Publishing Services

with clear contours was noted, and at the time of discharge from the hospital (20-21 days), the clarity of the contours of the foci was noted in 102 (92.7%) patients ($p<0.05$) . Well-defined foci were found more often in T2-mode.

Thus, MRA is highly informative in diagnosing foci of the ischemic process, and early MRA signs of IS are vascular changes that visualize impaired blood flow and vascular lumen, along with changes in the substance of the brain, manifested by a change in the signal in T2 and local edema in T1 mode.

The sensitivity and accuracy of MRA for diagnosing AI was about 90%, and the specificity of the method was 100%.

The MR angiography method made it possible to visualize, without the introduction of a contrast agent, a multiplanar picture of the vessels of the brain and neck in all examined patients, 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 tomography should be included in the protocol of MR examination of patients with AI in the acute period of the disease.

An analysis of MRA and MR angiography showed that the most common complication of AI was a volume effect on various parts of the liquor system, midline brain structures and stem parts. The severity of this effect depended on the size and localization of the infarction focus. Maximum lateral and axial dislocation was found in extensive brain infarcts. With large infarction foci in the MCA basin, we observed a mixture of median brain structures, not to the same extent as with extensive infarcts. With AI foci in the basins of the anterior and posterior cerebral arteries, the displacement of brain structures was visualized as compression of the corresponding sections of the lateral ventricles without displacement of the median hemispheric structures of the brain matter. The volume effect in medium hemispheric AI, located in the deep parts of the brain parenchyma, was manifested by compression of the adjacent parts of the ventricles. With small-focal cerebral infarctions, the effect of displacement was absent. We have proven a direct significant significant relationship between the volume of damage to the brain substance and the occurrence of complications ($p<0.05$).

Based on the data obtained from the study, a regularity was proved that the presence of an extensive infarction leads to complications and has an extremely unfavorable prognosis. Significant criteria for the severity of AI on MRA are: severe perifocal edema, detection of leukoareosis, severe internal and external hydrocephalus. The combination of these features gives grounds to predict the worst outcome of ischemic stroke. So, with a large infarct with a morphologically significant defect, but without the presence of these three factors, the positive clinical and neurological dynamics is more pronounced than in patients with a smaller infarct, but with the presence of these components.

The most frequent changes in the MRA picture were found in atherothrombotic and lacunar types of AI. At the same time, according to MRA and MR angiography, 57 (79.2%) patients with atherothrombotic and lacunar AI showed asymmetry of the main cerebral veins; 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 anomalies in the development of the drainage system of the brain were stated - in 2 (2.8%) patients - hypoplasia of one of the transverse sinuses, in 2 (2.8%) patients - aplasia of the transverse sinus, in 1 (1.4%) patient - hypoplasia of the

International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 02 ISSUE 03 Pages: 01-06
SJIF IMPACT FACTOR (2021: 5. 694) (2022: 5. 893)
OCLC – 1121105677 METADATA IF – 5.654
Publisher: Oscar Publishing Services

sigmoid sinus. In all patients with anomalies in the development of the venous sinuses, we noted a compensatory expansion of the contralateral sinuses.

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

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

Table 2. The frequency of occurrence of various forms of vascular lesions

Type of violation	Atherothrombotic AI		Lacunar AI	
	1 side	2 side	1 side	2 side
Vessel elongation	7	1	5	0
Narrowing of the vessel lumen	21	11	19	8
Vessel occlusion	6	1	2	0
Slight curvature	9	3	7	2
Average curvature	5	2	4	2
Sharp angle bend	1			

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

With a pronounced and prolonged outflow disturbance 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 of other venous collectors also increases, collaterals and shunts appear, which reach their maximum development in bilateral lesions. The lower the level of damage, the less pronounced compensatory changes.

CONCLUSION

Thus, changes in the venous and arterial circulation of the brain are detected on MR angiography and show a regular relationship with various states of the brain and carry important information about the organization of its blood supply and identifying the degree and severity of vascular damage to the brain.

REFERENCES

1. Bykova O.N., Guzeva O.V. Risk factors and prevention of ischemic stroke. Bulletin of the Russian Military Medical Academy.2013;4(44):46–8.

International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 02 ISSUE 03 Pages: 01-06
SJIF IMPACT FACTOR (2021: 5. 694) (2022: 5. 893)
OCLC – 1121105677 METADATA IF – 5.654
Publisher: Oscar Publishing Services

2. Gusev E.I., Martynov M.Y, Kamchatnov P.R. Ischemic stroke. The current state of the problem. Doctor. RU.2013;5:2–7.
3. Sidorov A.M., Lukyanov A.L., Shamalov N.A. Organization of medical care for patients with cerebral stroke at the prehospital stage. Neurology, neuropsychiatry, psychosomatics. Special Issue Stroke.2013;(2S):4–8.,
4. Kaste M, Fogelholm R, Rissanen A. Publ Hlth 1998; 112: 103–12.
5. Valdueza J.M. et al. Postural dependency of the cere-bral venous outflow. Lancet 2000; 355; 200-201.
6. Zamboni P. et al. Venous Collateral Circulation of the Extracranial Cerebrospinal Outflow Routes. J Cur Neurovasc Res2009; 6; 204-212.