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TO RADIOLOGICAL DIAGNOSIS OF ISCHEMIC STROKES

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Abstract: The results of ionizing research methods, namely, X-ray computed tomography of patients with acute cerebrovascular accident according to ischemic type, are analyzed. The dominant symptoms of ischemic stroke are highlighted. Symptom of a hyperdensity artery, smoothness of the furrows, lack of differentiation of gray and white matter, including the basal nuclei, the presence of a zone of reduced density, the dislocation of median structures are pathognomic for ischemic strokes during computed tomography. MSCT makes it possible to dynamically monitor changes in the nature of the focus, to prevent life-threatening dislocation phenomena.

Key words: computed tomography, ischemic stroke, diagnostics, ionizing methods.

Introduction. Every year in the world more than 15 million people suffer a stroke, which is the main cause of mortality and severe disability. According to the WHO, mortality from cerebral strokes in some countries ranks second in the overall structure of mortality. [2,3,7]. One of the causes of deaths after the acute stage of a stroke is a violation of the compensatory mechanisms of homeostasis, the development and progression of the systemic inflammatory response syndrome and multiple organ failure [4,6,10]. The presence of concomitant somatic diseases, such as arterial hypertension, myocardial infarction, coronary heart disease, angina pectoris, diabetes mellitus, gastric and duodenal ulcer, bronchial asthma and others have an adverse effect on the course and prognosis of cerebrovascular disease [1,8,12]. Therefore, the high medical and social significance of this problem is quite obvious and, of course, the study of diagnostic problems and aspects of stroke is very relevant [1,2,4].

The clinical symptoms of ischemic strokes are characterized by nonspecificity and require the use of special instrumental diagnostic methods. Of all the methods of neuroimaging that have received the widest distribution and have certain advantages, is multispiral computed tomography (MSCT). This method is based on measuring and complex computer processing of the difference in the attenuation of x-ray radiation by tissues of different density [5,6]. CT allows you to determine the nature, location, magnitude of cerebral infarction, makes it possible to clearly differentiate fresh cerebral hemorrhage from acute ischemia, allows you to identify the mechanism of stroke, respectively determine the prognosis of the disease, excludes other diseases that mimic ischemia. CT is the first diagnostic method that allows one to reliably determine the presence, severity and prevalence of cerebral edema during the patient's life [9,11].

Based on the foregoing, the **aim of this work** was to study the capabilities and role of multispiral computed tomography (MSCT) in the diagnosis of ischemic strokes.

Material and methods. To solve the tasks, we analyzed the results of a survey of 50 patients in whom, according to clinical studies, an ischemic type of acute cerebrovascular accident was suspected or established. In all patients, neurological status was assessed.

MSCT was performed on a Brilliance 16 apparatus (PHILIPS). When conducting computed

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tomography, x-rays are used, which are considered ionizing rays. As you know, ionizing is the name of all those radiations that, when interacting with the environment, including the tissues of a living organism, turn neutral atoms into ions — particles that carry positive or negative electric charges [5,6].

The results of the study. The distribution of patients by age showed that acute ischemic-type cerebrovascular accident prevailed in patients older than 50 years of age, and was most often observed in the group of 51-60 years old. Among the examined patients, men accounted for 70%, women - 30% (table 1).

The examined patients, depending on the size of the ischemic focus, were divided into 4 groups. The first group consisted of 16 patients with an extensive stroke area. The second group included 22 patients with a large lesion zone. The third group consisted of 6 patients with an average focus and, finally, 6 patients were included in the fourth group, the size of the ischemic focus of which was small (Fig. 1).

As a result of the study, the MSCT symptoms of ischemic strokes were studied. The following were identified as priority signs: the presence of a zone of reduced density, a symptom of a hyperdensity artery, smooth grooves, lack of differentiation of gray and white matter, including basal nuclei, dislocation of median structures, fuzzy contours of the insular gyrus, compression of median structures (Fig. 2; Fig. 3) .

Age (years)	**Number of patients**	
	Abs.	**%**
Under 40	3	6,0
41-50	5	10,0
51-60	15	30,0
61-70	8	16,0
71-80	11	22,0
Over 80	8	16,0
Total	50	100

Table 1. The distribution of patients by age.

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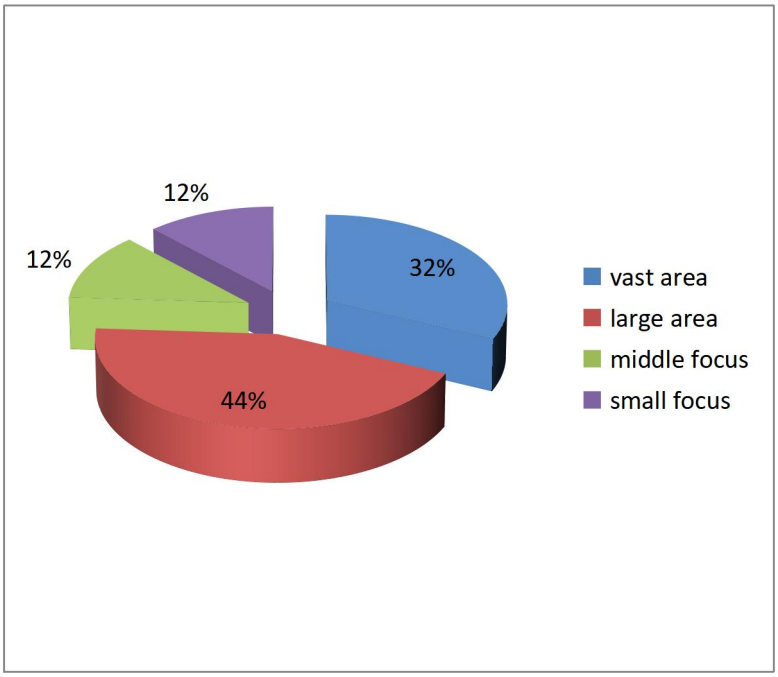

Figure 1. Distribution of the examined patients depending on the size of the ischemic focus.

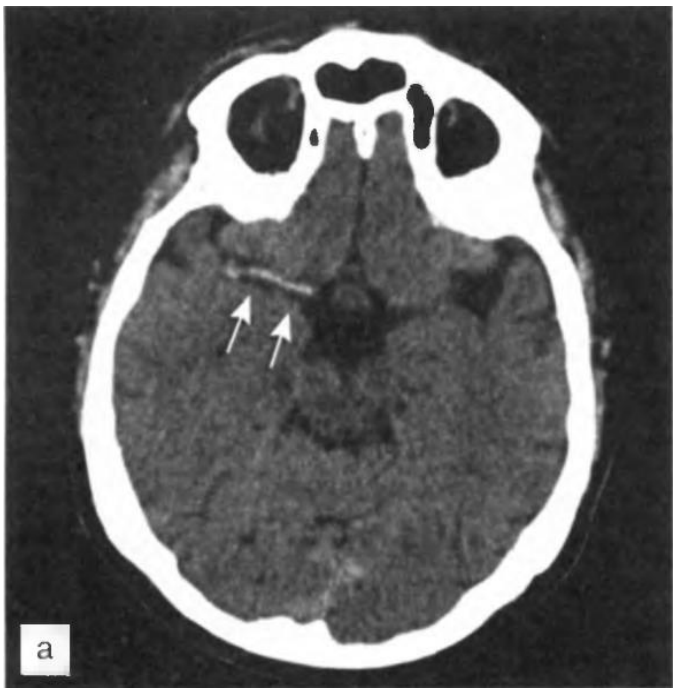

Figure 2. CT scan of the brain of a patient with ischemic stroke. Early signs of a stroke (a few hours after its development). Increased density of the right middle cerebral artery (sign of blood stasis; indicated by arrows).

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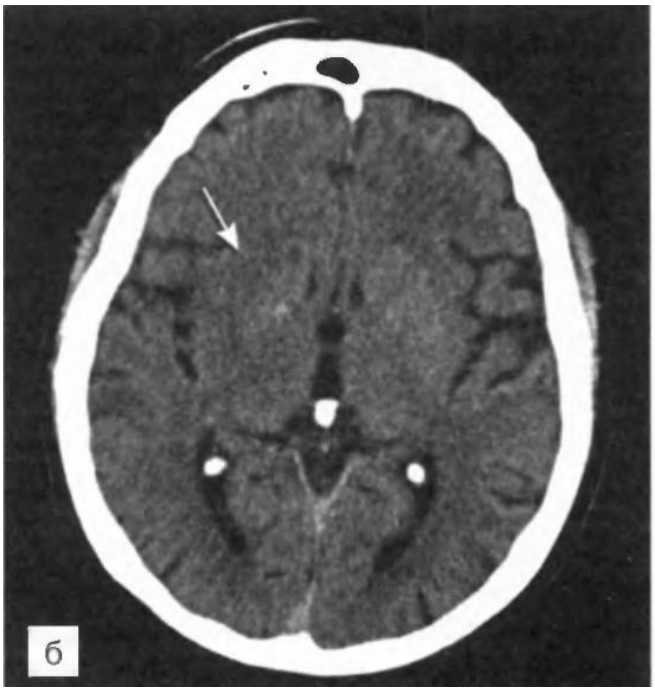

Figure 3. CT scan of the brain of a patient with ischemic stroke. Early signs of a stroke in the pool of the right internal carotid artery (several hours after its development). On the tomogram in the right frontal, temporal and parietal lobes, a zone of reduced density is determined to 24-27 HU, with a fuzzy contour, without clear boundaries between the gray and white matter, including the basal nuclei (indicated by the arrow). The islet gyrus is not clearly visualized. The smoothness of the furrows is determined, which indicates the onset of edema.

The analysis of tomograms showed that the lesions of the branches of the carotid basin (82%) prevailed, in which the middle cerebral artery and its branches were most often affected (42 sites of ischemic changes): left (30 lesions), right (12 lesions) (Fig. 4). At the vertebral-basilar level, only 16% of lesions were identified.

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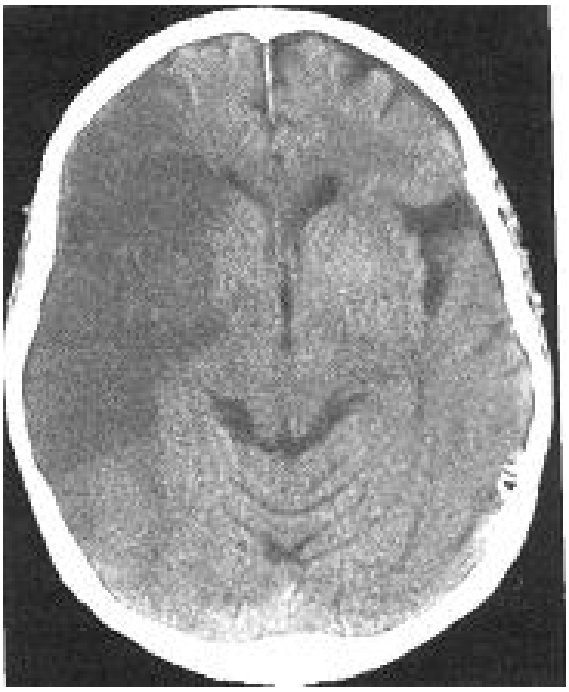

Figure 4. CT scan of the brain (after 72 hours). Territorial stroke in the pool of the right midbrain artery. On a CT scan in the right frontal, temporal and parietal lobes, a zone of reduced density is determined up to 20-22 HU, with a relatively clear contour, the furrows are not clearly differentiated. The boundary between gray and white matter is not defined. The islet gyrus does not differentiate. The middle structures are shifted to the right by 6 mm, with compression of the left lateral ventricle, signs of lateral and axial dislocation of the brain are determined.

Depending on the location and extent of the lesion, the timing and severity of changes in the tomograms were different. The analysis showed that the earliest (from 6 hours or more) revealed large and large heart attacks with the spread of ischemic changes in the cortex and subcortical structures. Extensive supratentorial infarcts were characterized by distinguished symptoms in all patients, except for the lack of differentiation of the islet gyrus (Fig. 4).

The pathogenicity of the "mass effect" was different depending on the duration of the study. So, compression of the ventricles in the first 12 hours was detected in 1 patient. Some shift in the middle structures to 2-5 days was observed in 8 patients. In 2 patients, the hemorrhagic component was visualized as a plot of increased density against the background of a zone of reduced density.

In the second group, in patients with large heart attacks, the lesion zone, identical to the above, captured the cortex and subcortical structures. In 32% of patients after 6 hours there was a narrowing of the furrows, and in 68% of these changes were noted by the third day. Lack of differentiation of gray and white matter was detected after 6 hours in 66% of patients, and by the third day in 88% of cases. It should be noted that in the area of the basal nuclei was found only in 52% of patients with heart attacks in the middle cerebral artery basin. In the pool of the posterior and anterior cerebral artery, the blurred boundaries

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of the islet gyrus were not revealed in any patient and was found only with heart attacks in the basin of the middle cerebral artery. Depending on the localization, the volumetric effect on the surrounding structures had its own characteristics. So, in 6 patients with strokes in the middle cerebral artery basin, the volumetric effect was manifested from a slight narrowing of the lateral fossa of the cerebrum and lateral ventricle on the side of the heart attack to a certain displacement of the middle structures (from 3 to 9 mm) and complete compression of the lateral ventricle. In heart attacks in the pool of the posterior and anterior cerebral arteries, the volumetric effect was expressed in compression of the corresponding horn of the lateral ventricle without displacement of the median structures. Symptoms in the form of a decrease in density in the early stages from the onset (after 6 hours) were observed in 66%, and after 48 hours they were visualized in all examined patients.

In the third group, with medium foci of a heart attack, changes in density on tomograms had the same pattern as for large heart attacks. The lack of differentiation of gray and white matter was observed in 74%, while in the area of the basal nuclei in only 32% of patients. When the focus was localized only in the basin of the middle cerebral artery, blurred contours of the islet gyrus were detected in 28% of cases. The narrowing of the brain grooves involving the cortex was visualized in 58% of patients. It should be noted that in no patient was narrowing of the grooves with heart attacks localized in the deep sections was detected by us.

A characteristic symptom of a heart attack, independent of localization, was a decrease in the density of the substance of the brain, detected only 12 hours from the beginning of the clinic and was found in half of the examined. On the second day, this symptom was already detected in 100% of patients (Fig. 5). In 1 patient from this group, a heart attack was localized in the cortex and the “mass effect” was manifested by the lack of visualization of large furrows. In 5 patients with localization of moderate heart attack in the deep parts of the cerebral hemispheres, the volumetric effect of the focus on the adjacent part of the ventricular system was expressed. With cerebellar infarction, a slight deformation of the IV ventricle was noted. On tomograms of patients from this group, lateral and axial displacements did not occur.

In the fourth group with a small stroke, the diagnosis and study of the evolution of heart attacks presented some difficulties. An accurate densitometric assessment of a small heart attack was possible only in the presence of a site of reduced density. Indirect radiation semiotics for small heart attacks, such as blurred differentiation of the islet gyrus, detected in 6% of patients, the absence of a border between gray and white matter, noted in 16% of cases, and narrowing of the furrows visualized in 16% of patients depended directly on the location of the lesion. The pathognomic “mass effect” for any localization of a small heart attack in our observations was absent.

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Figure 5. CT scan of the brain after 24 hours. The area of cytotoxic edema that formed at the site of the stroke (indicated by arrows).

Analysis of the results of the study revealed an increase in the density of the cerebral artery in 6 patients. Three of them visualized this symptom at a certain distance from the carotid siphon. In a repeated MSCT study in one patient, the middle cerebral artery was not determined, which confirmed the presence of this symptom as a manifestation of ischemic stroke. It should be noted, given the age of the patients and the possible calcification of the walls of the arteries, this symptom is not always a reliable manifestation of ischemic stroke.

The densitometric assessment in the dynamics of the study showed that there was a change in the nature of the zone of reduced density from heterogeneous to homogeneous, to a more clear contouring of the focus. The dynamics of the change in density was characterized by a slightly reduced (24–26 HU) in the first 6-12 hours, decreasing to 18–22 HU for 4-9 days, a relative increase in density to 24-26 HU on 10-14 days and a progressive decrease in density to 6-15 HU in the period after 21 days.

The most common complication of ischemic stroke was a volumetric effect on the median structures and stem sections of the brain, that is, the "mass effect" detected in 22 patients, as well as various sections of the cerebrospinal fluid system.

Thus, when using an ionizing X-ray imaging method, such as multispiral computed tomography, despite the patient receiving radiation exposure, the technique is highly informative and non-invasive in the diagnosis of ischemic strokes. It makes it possible to detect cerebral infarction, especially in the acute stage. The role of MSCT is undeniable in the dynamic monitoring of changes in the size, shape and nature of the focus, determining the tactics of managing patients. The dislocation phenomena detected in the brain using a double-ray radiological technique can prevent life-threatening conditions.

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Conclusions. The direct and most reliable signs of ischemic brain damage in MSCT is a focal decrease in density. Indirect CT semiotics of cerebral infarction includes a set of symptoms, namely, the lack of differentiation of gray and white matter, smoothness of furrows, blurred contours of the islet gyrus, symptom of a hypertension artery, compression and dislocation of the midbrain structures of the brain. CT symptoms can help diagnose an acute period of ischemic stroke. However, their reliability decreases with a decrease in heart attack, and with small heart attacks, only a few indirect signs can be observed.

MSCT, being an ionizing method of radiation diagnostics, allows visually more accurately assessing the prevalence of ischemic changes in the brain using densitometry, as well as assessing the dynamics of the process, which is necessary when conducting differential diagnostics with various cerebral pathologies.

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