DIFFUSION-WEIGHTED MRI IN THE DIFFERENTIAL DIAGNOSTICS OF THE DEGREE OF MALIGNACITY OF PARASAGGITAL BRAIN MENINGIOMAS

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Abstract. The technique of diffusion-weighted magnetic resonance imaging (DW MRI) allows obtaining information about the microstructural state of various tissues and organs. Diffusion-weighted images (DWI) obtained using DW MRI are also used for the purpose of differential diagnosis of benign and malignant tumors.

Keywords: meningiomas , diffusion-weighted MRI, measured diffusion coefficient, diffusion-weighted imaging, cell density.

The technique of diffusion-weighted magnetic resonance imaging makes it possible to obtain information about the microstructural state of various tissues and organs [1–6]. Diffusion-weighted images (DWI) obtained using DW MRI are used for the purpose of differential diagnosis of benign and malignant tumors [1, 4, 5]. According to some authors, in contrast to benign tumors, malignant tumors have lower values of the measured diffusion coefficient (ADC) [1, 3]. At the same time, volumetric formations with an ACD value of less than 1000x10-6 mm2/s suggest their malignant nature [1]. On the other hand, some benign tumors may also have DW MRI characteristics similar to those of malignant neoplasms and have low ADC values [7, 9]. Thus, the ACD of the hypertrophied lymphoid tissue of the nasopharynx varies from 360 to 840x10-6 mm2/s [7]. The ADC values of papillary cystadenoma are significantly lower than those of malignant tumors of the parotid salivary gland [8]. Cholesteatomas are also characterized by low ADC values [9].

The magnetic resonance imaging (MRT) method, which is leading and rapidly developing in the diagnostic stage of parasagittal meningiomas of the top-frontal basal area of the brain, is no less important.

The emergence of magnetic resonance tomographs with high magnetic field strength (1.0 Tl and higher) has further increased the value of this diagnostic method. In meningiomas, it is possible to determine some indicators in MRI (estimation of vascularization of the tumor, determination of its blood supply sources, interaction of the tumor with the arterial blood vessels and venous sinuses of the large brain), which increases its diagnostic value compared to ordinary computed tomography [6, 7].

Meningiomas are usually homogeneous on MRI. However, there may be hemorrhages in hardening planes or numerous small blood vessels feeding the tumor, heterogeneity in the structure of meningioma in cystic spaces [8].

A characteristic feature of MPT for meningioma is the presence of an anatomical junction between the tumor and adjacent brain tissue, which is clearly visible in 50-60% of patients, A. According to N. Konovalov and co-authors, although this border is not always visible along the entire contour of the tumor, it is determined in all cases [9].

These anatomical formations include blood vessels of soft brain tissue, fissured cerebrospinal fluid spaces, newly formed blood vessels, and fragments of hard brain tissue. MR-tomograms show these structures clearly. Blood vessels appear in the form of dotted or curved areas in the low-intensity MR signal in the tumor stroma. Perifocal edema, depending on the histological type of the tumor, is better visible against the bright signal background. Fibroblastic and mixed meningiomas are characterized by a small or moderate tumor. Obvious swelling is detected in angiomatous form and especially in meningiomas of poor quality [10].

Nowadays, substances with a paramagnetic effect (omniscan, magnevist) are often used to increase the speed of MRI in neurosurgery practice. Homogeneous accumulation of contrast material is characteristic of all meningiomas with age, which increases the informativeness of this method. The high contrast effect of meningioma on MRI and CT is associated with a violation of hemato-tissue resistance in the tumor. The maximum

contrast of the tumor is determined in the first minutes of intravenous administration of the contrast agent [11].

In addition, the method of magnetic resonance angiography (MRA) is used in the visualization of parasagittal meningiomas in the top-forehead basal area of the brain. MR-angiogram does not require injection of contrast material, because the blood itself is a contrast "agent", and this method is based on the movement of liquid.

Some researchers note that certain histological types of tumors are characterized by a correlation between the ADC value, their cell density, and the value of the proliferative activity index (Ki67) [2, 6, 9]. Driessen et al . [6] demonstrated a pronounced inverse correlation between the ADC value and cell density in laryngeal and hypopharyngeal carcinomas. Karaman et al . [9] showed that non-small cell lung cancer is characterized by an inverse correlation between ADC values and the Ki67 index. Similar results were obtained for soft tissue sarcomas, prostate and kidney cancers [10, 11]. However, Wu et al . [12] did not find any relationship between ADC value and cell density for diffuse large B-cell and follicular lymphomas . Another observation noted the absence of a significant correlation between the ADC value and cell density for breast cancer, but there is a dependence for other histological types of breast tumors [13].

Invasion of meningioma into venous blood vessels, initially in the superior sagittal sinus, is evident on MRI. In this case, as a result of narrowing or closing of the sinus, signal loss is observed in the blood flowing through it. However, it is difficult to make a differential diagnosis of tumor invasion and compression of the sinus [42].

The study of focal thermal imaging of the brain is also of interest. The advantage of the thermal visualization method is that it is non-invasive, quick to get the result, works in real time and does not affect the organism under study [43].

Early publications on the use of thermal imaging in the diagnosis of brain tumors observed lightening of the scalp coverings in meningiomas [44].

Fraerman A.P. and co-author Kolesov S.N. In a clinical study conducted by, it was proved that thermovisualization is possible in both supra- and subtentorial localization of tumors of various histological structures. Cases related to the topic of the meninges and substance of the tumor localization of the thermovisual image are also described. Thermovisual criteria are distinguished in the comparative diagnosis of membrane-vascular and macroglial tumors [45].

According to the results of a number of foreign studies, the DW MRI technique with the construction of DWI and the calculation of ADC can be used as a marker for predicting the effectiveness of the treatment of various malignant tumors [14-16]. However, publications on the use of DW MRI in brain meningiomas are few and largely contradictory [17-20]. Some authors describe the relationship between the ACD value, histological and immunohistochemical parameters of meningiomas [18, 19, 21]. Other researchers do not note this dependence [17, 20]. It should be noted that meningiomas are often an incidental finding on MRI of the brain. It is important to correctly assess the degree of malignancy and proliferative potential of these neoplasms already at the stage of neuroimaging studies.

When analyzing the world literature, we found only 3 reports devoted to the study of the correlation dependence of the ICD and the pathomorphological characteristics of meningiomas (the number of cells and the proliferative activity index Ki67). Tang et al . [21] noted a significant correlation between ACD values and Ki67 index both in the MI meningiomas group and in the meningiomas groups. Mil and MIII. Ginat et al . no significant correlation between ACD and Ki67 index for MIII meningiomas was found [22]. Fatima et al . [23] also did not note a significant correlation between the ACI and Ki67 values. On the other hand, the authors found a significant inverse correlation between the ICD and the cell density of meningiomas [24]. The ambiguity of the results in these studies can be explained by different approaches to the method of calculating the ADC according to DWI, as well as the lack of gradation according to the grades of malignancy of meningiomas in some cases.

Mean ADC values and Ki67 proliferative activity index of MI and Mill meningiomas , as well as MII and MIII have significant differences. In our observation, there is also a statistically significant correlation between the ACD values and the Ki67 index. In our opinion, this dependence suggests that the ICD indirectly reflects pathomorphological changes in the meningioma tissue .

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