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Magnetic Resonance Imaging Procedure In The Study Of Neoplasms Of The Eye And Orbit

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Abstract
In recent years, there has been a trend of increasing incidence, which is largely due to the wide increase in the possibilities and availability of early instrumental diagnostics. The neoplasms of the organ of vision are characterized by significant polymorphism, which is due to the histological diversity of the structures in the eye socket. Almost all types of neoplasms described in humans are found in the orbit. In a retrospective study, which included 2480 patients with orbital tumors, a 68% specific share of benign tumors was verified morpho-histologically, among which dermoid cysts (14%) and cavernous hemangiomas (9%) took the leading position.
The paper presents the results of the study of 67 patients with pathological processes of the orbit, whose ages ranged from a few months to 81 years. Of them, 23 (34.3%) were men and 44 (65.7%) were women. The number of children from 0.5 to 18 years of age was 12 (17.9%), of which 7 (58.3%) were boys and 5 (41.7%) were girls. Magnetic resonance imaging was performed on a Siemens MAGNETOM Vida 3T device in three projections.
As a result of the analysis of MRI semiotics of primary tumors of the orbit and eyeball (Table 1), their common features were revealed: the predominance of oval-shaped tumors - 72.1%, tumors of the wrong shape were observed only in 27.9%. Also, in most cases, the contours of the tumors were regular and clear, in 81.4% of cases, they were irregular, and unclear only in 18.6% of cases. The structure of the pathological formation was homogenous in 74.4% of cases. The heterogeneity of the structure of the tumors was revealed in 25.6% of cases, while in more than half of the patients, no additional inclusions were detected, and in the rest, the presence of areas of fat density and calcinites was determined.
During studies under intravenous bolus contrast with Cyclolux and Gadovist, 62.8% showed active high accumulation of contrast in the tumor, indicating a developed vascular network in the tumor formation. In 20.9% of cases, a moderate accumulation of the contrast agent was observed, and in 16.3%, the contrast agent was insignificantly accumulated in the tumor tissue.
Of all tissue imaging methods, the magnetic resonance imaging procedure provides the most complete pathoanatomical picture, and also allows for conducting non-invasive angiographic examination and obtaining diffusion, perfusion, and spectroscopy images.
Keywords: *sagittal and axial slices; orbital neoplasms; intravenous bolus contrast; melanoma; cavernous hemangioma; adenoma of the lacrimal gland; lymphoma; retinoblastoma; menangioma; perfusion.*

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I. Introduction

Ophthalmo-oncology is among the most complex areas of ophthalmology. In recent years, there has been a growth tendency in the incidence, which is largely due to the wide availability and accessibility of early clinical and instrumental diagnostics. The statistics given in different sources of literature are quite contradictory. According to statistics, in 2007, the share of tumors of the organ of vision is 0.1% of all oncological diseases and 18% of all orbital diseases [10]. Taking into account the age group, the highest share of malignant tumors - 9.51 cases per 1 million inhabitants occurs in the population aged ≥50 years. In patients aged 0-19, the corresponding rate is 0.56 cases per 1 million inhabitants. The increase and diversity of oncological pathologies in ophthalmic oncology has led to the demand for differential diagnostics aimed at early detection of tumors and timely treatment [15].

Anatomic and topographic features of the orbital structure are due to its close connection with the structures of the skull and the paranasal sinuses, which indicates that there is a risk of possible dissemination of inflammatory and neoplastic processes from these areas to the orbit and retrogradely. The difficulty in diagnosing the pathology of the eyeball is not only with its anatomical structure, but also with the similarity of the clinical symptoms of many diseases of different etiologies (tumor, inflammatory, vascular, endocrine), whose radiological and clinical pictures are quite similar. Considering the above reasons, early detection and differentiation of orbital tumors and tumor-like formations remains one of the important challenges of diagnostic radiology [11, 16].

The neoplasms of the organ of vision are characterized by significant polymorphism, which is due to the histological diversity of the structures in the eye socket. Almost all types of neoplasms described in humans can be found in the orbit [4]. In a retrospective study, which involved 2480 patients with orbital neoplasms, a 68% specific share of benign tumors was verified morpho-histologically, among which dermoid cysts (14%) and cavernous hemangiomas (9%) occupied the leading position [9, 7].

In the practice of ophthalmology, the differential diagnosis of orbital tumors, as well as intraocular neoplasms, is still among the most responsible procedures. Regardless of the nature of the pathological process, neoplasms of the orbit often cause loss of visual function and disability in the patient. The loss of visual function in benign tumors and the threat to the patient's life in the case of malignant tumors of the orbit and eyeball substantiate the medical and social importance of early diagnosis and timely therapeutic measures.

II. Material And Research Methods

The paper presents the results of the study of 67 patients with pathological processes of the orbit, whose ages ranged from a few months to 81 years. Of them, 23 (34.3%) were men and 44 (65.7%) were women. The number of children from 0.5 to 18 years of age was 12 (17.9%), of which 7 (58.3%) were boys and 5 (41.7%) were girls. The highest number of patients were of active working age (41 to 60 years), and women were more numerous than men (65.7% and 34.3%, respectively). Table 1 presents data on the distribution of patients by gender and age.

Table 1.

The distribution of patients by gender and age

Age, year		0-10	10-50	50-70	>70
Number of studies	Men	2 (2,98 %)	10 (14,92 %)	11 (16,42 %)	2 (2,98)
	Women	3 (4,48 %)	18 (26,87 %)	18 (26,86 %)	3 (4,49%)
Total		5 (7,46 %)	28 (41,79%)	29 (43,28%)	5 (7,47%)
Totally		67 (100 %)			

When analyzing data on the prevalence of orbital diseases in different age groups, it was determined that the maximum number of observations in both men and women falls on the fifth and sixth decades of life.

The largest group consisted of patients with primary neoplasms - 43 (64.2%). Secondary orbital tumors were detected in 24 (35.8%) patients. For all patients, morphological confirmation of the diagnosis was obtained according to the results of the cytological study of the biopsy or histological examination of the tumor removed during surgery.

Magnetic resonance imaging was performed on a Siemens MAGNETOM Vida 3T device in three projections. Table presents technical data for this procedure.

This method is based on the measurement of the electromagnetic response of the nuclei of hydrogen atoms during their excitation by a certain combination of electromagnetic waves in a constant high-intensity magnetic field. The method allows for high differentiation of the orbit, paranasal sinuses, and the brain.

The studies were performed mostly in the axial plane, in parallel to the optic nerve. The scanning area included all orbital structures and the intracranial part of the optic nerves. In addition, for a more detailed evaluation of the contents of the retrobulbar space, we examined the orbital area in the sagittal and frontal planes. The thickness of the slices was 2-4 mm.

Table 2.

Magnetic resonance imaging technical data

Magnetic system	
Field intensity	3 tesla
Size of the gantry	70-cm open hole design
Helium consumption	Zero evaporation technology of helium
Regulation	Passive and active
Gradient force	XQ gradients 45/200 simultaneously XT gradients 60/200 simultaneously

In order to differentiate orbital neoplasms, studies were conducted with sagittal and axial slices using T1tse, T2tse, tirm, GRE, and DWI modes. Additionally, to specifically evaluate intraorbital structures, the study was conducted with T1tse 2mm slices in the coronal and sagittal planes, T2tse coronal and axial slices with *fs* addition, that is, by fat suppression, and in T1tse slices with fat suppression for each eye separately. In order to study the orbital tumors in more detail, to determine their exact location and size, in the research process, intravenous injection of a contrast substance was performed, and then post-contrast T1 axial, coronal and sagittal slices were taken, the thickness of the slice is 2 mm. Ciclolux and Gadovist drugs were used as the contrast agents.

During the study, the patient lies on his back, and the head is placed centrally with respect to the gantry. A head and neck coil is applied to the patient's head and neck. In rare cases, a specialized eye socket coil (loop coil) is used, which is attached to the eye socket (Figures 1 and 2).

Fig. 1. Specialized eye socket coil (loop coil)

Fig. 2. The head and neck coil

The condition of the orbital structures (optic nerve, extraocular muscles, retrobulbar fat) and the location of the eyeball were determined using the obtained MRI tomograms. At the same time, the state of the paranasal sinuses and the brain surrounding the orbit was evaluated on all tomograms and the spread of tumor formations in these spaces.

In our studies, along with standard MRI, we used diffusion and perfusion magnetic resonance methods with contrast enhancement, which allows us to more reliably distinguish between cancerous and non-cancerous processes and make a differentiated diagnosis of neoplasms in the orbit in the early stages.

III. Literature Review

Magnetic resonance imaging (MRI) is one of the magnetic resonance endoscopy options. MRI, as well as computed tomography, allows to obtain an image of any layer of the human body. In the late 1970s, magnetic resonance imaging and computed tomography were proposed to improve medical imaging. A tissue image, as during CT, can be obtained in three planes: axial, coronal, and sagittal. Currently, MRI has significant advantages over CT. The slice thickness varies between 2-5 mm, which is significantly greater than in the case of CT (1 mm).

MRI allows us to evaluate all parts of the visual analyzer, provides high visual resolution in the differentiation of soft tissues and their multi-plane examination, which, in turn, allows us to refuse other methods of radiation diagnostics. An absolute contraindication for MRI is the presence of metallic foreign bodies that are incompatible with the magnetic field, both of traumatic origin (intraocular, intraorbital) and iatrogenic (cochlear implants, intracranial vascular clips, pacemakers, etc.), as well as foreign magnetic bodies of the eye and orbit. which can move under the influence of a magnetic field. In the modern world, limiting the use of MRI due to the difficulty with operation and the high cost of the device is practically irrelevant, because the number of diagnostic devices has increased dramatically. MRI is limited to imaging bony structures in the presence of calcifications, as well as non-magnetic foreign bodies in the eye, orbit, and maxillofacial region.

Magnetic resonance imaging (MRI) is one of the newest methods among radiological methods. Currently, MRI has significant advantages over CT. Magnetic resonance imaging can obtain a cross-sectional image of any part of the body with a high possibility of soft tissue differentiation. Also, the absence of ionizing radiation provides an additional advantage over other high-tech studies.

The main components of MRI scanners are a powerful magnet, a radio transmitter, a radio frequency receiving coil, and a computer. The inside of the magnet is tunnel-shaped, large enough to fit an adult inside. Most magnets have a magnetic field oriented parallel to the longitudinal axis of the patient's body. Magnetic field strength is measured in tesla (T) or in gauss. For clinical MRI, force fields of 0.02 to 3 tesla are used. When a patient is placed in a strong magnet, all the protons (hydrogen nuclei) in the patient's body rotate in the direction of the magnetic field like a compass needle. In addition, the magnetic axis of each proton begins to rotate in the direction of its own magnetic field. This specific rotational motion is known as the precession, and its frequency is called the resonance frequency, or Larmor frequency (after the French physicist). MRI tomograms are constructed by the re-emission of radio waves by hydrogen nuclei (protons) in the body's tissues after they receive energy from the radio wave signal that the MRI machine directs to the patient. Contrast in magnetic resonance imaging is determined by differences in the magnetic properties of tissues. Anatomical areas with a low number of protons, such as air-containing organs (lungs), always induce a very weak magnetic resonance signal and are therefore represented in black in the image. Water and other liquids that have a very high proton density are present at high intensities. However, this is not always the case. The reason for this phenomenon is that the contrast of the image is determined not only by the density of protons. Other parameters also play a part; two of them are the most important - relaxation times in T1 and T2 modes. T1 is the recovery time of longitudinal magnetization, while T2 – is that of transverse magnetization. In practice, they try to get an image that depends only on one of the relaxation times. These are known as Tl-(TIWI) or T2-(T2WI) weighted images. The use of this or that weighted image allows changing the contrast of tissues. For example, the vitreous body or cerebrospinal fluid is dark on a T1 image but bright on a T2 image. The acquisition of weighted images using a certain impulse sequence varies with both the relaxation time (TR) and the echo delay time (TE). The use of TlWI images provides good anatomical details, while the T2WI images are good for evaluating the pathological process (exception can be considered uveal pigmented melanoma, for which a high intensity signal is specific on the T1WI images). During MRI, it is possible to use the method of intravenous enhancement with the introduction of drugs based on gadolinium, which is especially important for the diagnosis of tumor processes. Tissue imaging can be obtained in three planes: axial, coronal, and sagittal, however, unlike computed tomography, where multiplanar reconstruction is used, each plane image is obtained independently in magnetic resonance imaging [2, 8]. Non-contrast magnetic resonance angiography (MRA) is used to obtain images of vascular structures. MRA has a significant advantage - no contrast material is used during its performance, and the method is non-invasive, it can be performed during other, routine procedures. The basis of image acquisition is the registration of signals from stationary structures (tissues) and from structures moving at different speeds. The advantages of MRI are: 1. A particularly high contrast ability of tissues, which is not based on density, but on several parameters that depend on the physical and chemical properties of tissues, and visualization thanks to these changes, which are not differentiated during ultrasound and CT examination. 2. During intravenous contrast, it is possible to provide the imaging of not only the degree of vascularization but also the physical-chemical properties of tissues (using perfusion, spectroscopic, and other modes). 3. The absence of artifacts from bones, which often complicate differentiation (especially the structures of the posterior fossa) on CT. 4. MRI shows blood flow without artificial contrast due to the sensitivity of the simplest modes to movements. 5. MRI has led to a further reduction in the scope of invasive diagnostic studies, intravenous contrast during CT, and contrast X-ray studies. 6. The diagnostic capabilities of MRI are expanded by the use of paramagnetic contrast media as a result of intravenous contrast. The negative aspects of MRI are: 1. Unlike CT, the difficulty with differentiating calcified foci. 2. Magnetic resonance imaging is highly sensitive to dynamic and respiratory artifacts. 3. Long image acquisition time, which is often additional discomfort for the patient and the main cause of respiratory or movement artifacts. The presence of a cardiac pacemaker in the patient, foreign bodies in the orbit and skull cavity, and limb prostheses incompatible with magnetic resonance imaging is a contraindication, since the main risk of the study is the impact of magnetic fields on metal foreign bodies in the organism, as well as the impact of radio frequency fields on the implanted electronic devices.

Since primary malignant tumors of the orbit do not exceed 0.1% of all human malignant tumors, there are few publications regarding their computed tomography semiotics, which should be due to the active implementation of magnetic resonance imaging as a leading diagnostic tool in oncophthalmology [12, 13, 14].

Among the modern imaging tools, the high diagnostic role of magnetic resonance and positron emission tomography in the diagnosis and differential diagnosis of voluminous formations of the eye and eye socket can be noted. The use of magnetic resonance imaging modes such as T1WI, T2WI, FLAIR/STIR, post-contrast T1-weighted image with fat suppression, post-contrast perfusion study, DWI, and ADC maps in some cases allow not only the identification of the tumor but also study of its functional and morphological characteristics. [6, 1, 5, 3].

IV. Research Results

The paper presents the results of the study of 67 patients with pathological processes of the orbit. Of them, primary orbital tumors were detected in 43 (64.2%) and secondary orbital tumors were detected in 24 (35.8%) patients.

The magnetic resonance imaging procedure was the final stage of differentiation of the diagnosis after preliminary clinical, ultrasonographic, and computed tomography examinations. The purpose of the study was to determine the differential diagnostic signs of orbital neoplasms of different origins and to detect the spread of the lesions to the surrounding tissues.

Magnetic resonance imaging examination involved 43 patients with primary neoplasms of the orbit and eyeball. While performing the examination, we evaluated the following parameters:

- Location of neoplasms
- Dimensions of the tumor
- The shape of the tumor
- Neoplasm structure
- Connection between the tumor and orbital structures

As a result of the analysis of MRI semiotics of primary tumors of the orbit and eyeball (Table 1), their common features were revealed: the predominance of oval-shaped tumors - 72.1%, tumors of the wrong shape were observed only in 27.9%.

Also, in most cases, the contours of the tumors were regular and clear, in 81.4% of cases, they were irregular, and unclear only in 18.6% of cases.

The structure of the pathological formation was homogenous in 74.4% of cases. The heterogeneity of the structure of the tumors was revealed in 25.6% of cases, while in more than half of the patients, no additional inclusions were detected, and in the rest, the presence of areas of fat density and calcinites was determined.

During studies under intravenous bolus contrast with cyclolux and Gadovist, 62.8% showed active high accumulation of contrast in the tumor, indicating a developed vascular network in the tumor formation. In 20.9% of cases, a moderate accumulation of the contrast agent was observed, and in 16.3%, the contrast agent was insignificantly accumulated in the tumor tissue.

Table 3

MRI signs of primary neoplasms of the orbit and eyeball

MRI signs	Primary neoplasms (n – 43)	
	Abs.	%

Architectonics	Solitary	41	95.3
	Multi-node	2	4.7
Shape	Oval	31	72.1
	Irregular	12	27.9
Structure	Heterogeneous	11	25.6
	Homogeneous	32	74.4
Inclusions	Calcined inclusions	3	7.0
	Fat density inclusions	7	16.3
	Combination	-	-
	No inclusions	22	51.2
Contours	Regular, clear	35	81.4
	Irregular, unclear	8	18.6
Accumulation of contrast	High	27	62.8
	Medium	9	20.9
	Low	7	16.3

When analyzing the magnetic resonance image of the primary tumors of the orbit and eyeball, the following features were revealed, depending on the morphological version of the tumor.

Melanomas that were mostly found in the eyeball had a regular, clear contour (92.3%) and a uniform structure. In some studies, small retinal detachments were visualized. No changes were observed in the ocular motor muscles or orbital tissue.

Here is an example of a clinical study:

Patient **C.,** a 64-year-old woman. She came to the clinic with complaints of a sharp deterioration in the right eye.

On the tomograms obtained after the magnetic resonance imaging (Fig. 3) in the right eyeball, adjacent to the posterior membranes, in the vitreous body, on the meridian of 8:00-10:00, there are observed an irregular shape, heterogeneous structure, hyperintense (T1tse - MR data indicated the presence of melanin), an intensely contrasted volumetric neoplasm that allows limited diffusion, with the following dimensions: the maximal transverse diameter - 0.7 cm, the maximal transverse diameter on the short axis - 0.6 cm, craniocaudal measurement - 0.8 cm, the tumor extends to the optic papilla, does not extend to the retrobulbar space. Adjacent to the neoplasm, retinal detachment is observed.

Fig. 3. Magnetic resonance imaging fragment of Patient C., 64 years old.

In the right eyeball, adjacent to the posterior membranes,
A neoplasm of the irregular shape and heterogeneous structure is observed.

Of particular note is the hyperintense signal of neoplasm in the right eyeball in the precontrast T1tse mode, which indicates the presence of melanin or hemoglobin breakdown products. Post-contrast subtraction studies are crucial for differentiation. The patient was diagnosed with melanoma of the right eyeball.

Most of the cavernous hemangiomas were solitary - 94.5% of cases. The shape of the cavernous hemangioma was irregular in all cases, contours were not clear in 57.4%. The internal structure of cavernous hemangioma was mostly equally heterogeneous - 88.6%, inclusions were determined in 30.8% of neoplasms, and inclusions of a mixed nature were visualized in 12.7%.

Here is an example of a clinical study:

Patient **D.,** 65 years old, was referred to an ophthalmologist with complaints of right-sided proptosis and double. The patient underwent the magnetic resonance imaging procedures (Fig. 4).

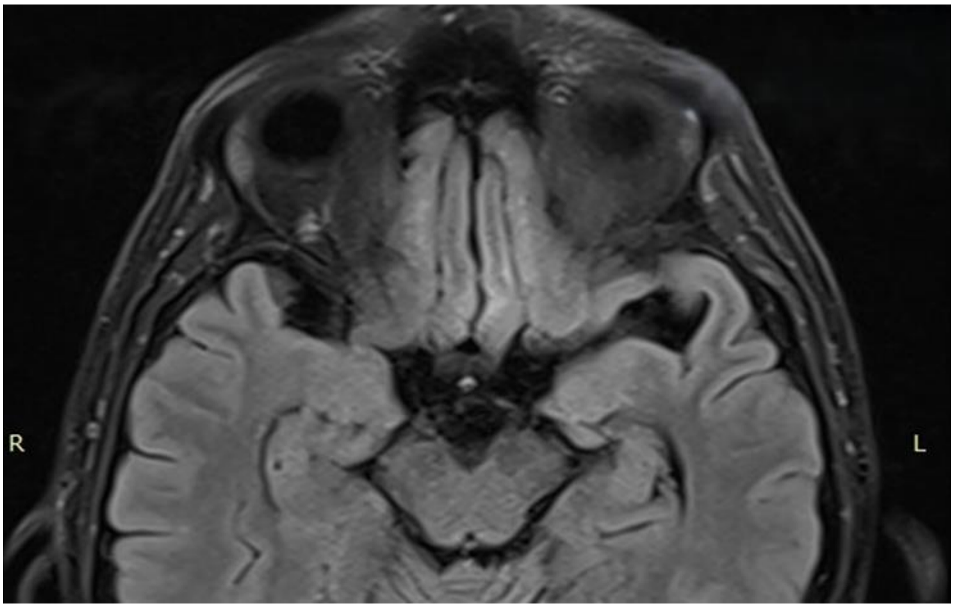

Fig. 4. Magnetic resonance imaging fragment of Patient D., 65 years old

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On the presented images in T2 tse and Flair modes, a small hyperintense, somewhat inhomogeneous tumor located in the right orbit is revealed.

On the obtained tomograms, in the right eye socket, cranially and laterally, a smooth, clearly contoured, inhomogeneous structure, an intensively contrasted volumetric tumor, measuring 0.5X0.9X0.5 cm, is shown, which does not cause pressure on the surrounding anatomical structures.

To make a final decision in radiological diagnostics, postcontrast imaging and its interpretation are of crucial importance. Figure 5 illustrates an image obtained using postcontrast T1 tse and subtraction modes.

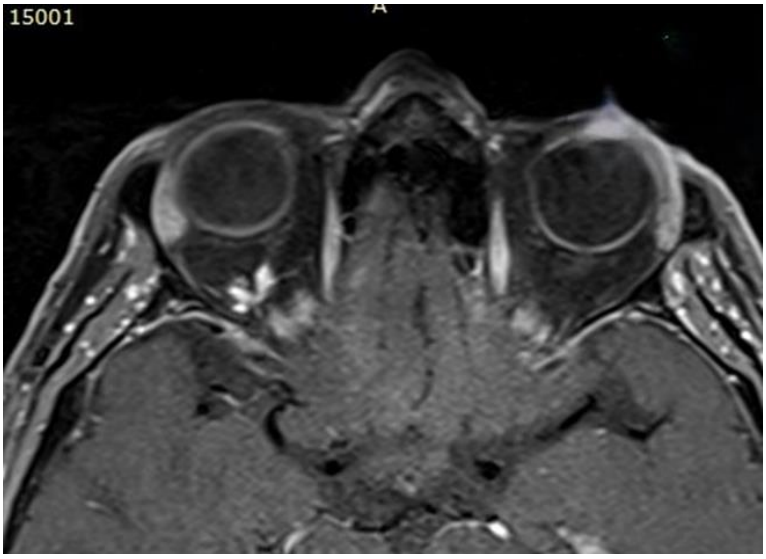

Fig. 5. Postcontrast magnetic resonance imaging fragment of Patient D., 65 years old,

The above neoplasm displays a homogeneous and intense inclusion of the contrast – by MR semiotics, it corresponds to cavernous hemangioma. The patient's final diagnosis is cavernous hemangioma.

For lacrimal gland adenoma, the characteristic localization of the tumor is observed - in the upper outer parts of the orbit, which corresponds to the localization of the lacrimal gland.

The shape of the tumor was irregular, with unclear contours in 88.5% of cases. In 75.4% of cases, the heterogeneity of the structure was revealed due to the large number of cystic structures.

Here is an example of a clinical study:

Patient V., a 60-year-old man, came to the clinic with complaints of worsening vision, pressure, and compression in the right eye.

Ophthalmological examination revealed restriction of movement of the eyeball laterally and narrowing of the palpebral fissure above and to the right. Visual acuity on the affected side is 0.6, and on the healthy side - 1.0. Fundus has signs of optic disc congestion. The boundaries of the visual fields are not changed.

The patient underwent the magnetic resonance imaging procedures (Fig. 6).

Fig. 6. Magnetic resonance imaging fragment of Patient V., a 65-years-old man

On the obtained tomograms, the right projection area of the lacrimal gland shows a homogeneous and well-contrasted volumetric growth, which is inhomogeneous in the T2 mode, does not cause true diffusion restriction, and does not invade the surrounding structures. MRI of perineural tumor growth (through the ophthalmic division of the trigeminal nerve -- V1). No signs were detected, which is of crucial importance in determining the treatment and future outcome. Adenoid cystic carcinoma of the lacrimal gland was morphologically verified.

In orbital lymphomas, the oval shape of the neoplasm prevailed, with clear contours in 83% of cases. The tumor was most often localized in the posterolateral parts of the orbit.

The heterogeneity of the structure (84%) is characteristic. Densitometric inclusions of low and high density were found in an equal percentage ratio.

Contrast agent accumulation by tumor tissue was high in 60% of cases, and moderate contrast accumulation was observed in the remaining 40%. A change in the surrounding tissues was detected in 38% of cases - a decrease in their densitometric density and a change in structure were observed.

Here is an example of a clinical study:

Patient O., a 56-year-old woman. She came to the clinic with complaints of left-sided exophthalmos and a sharp deterioration in vision.

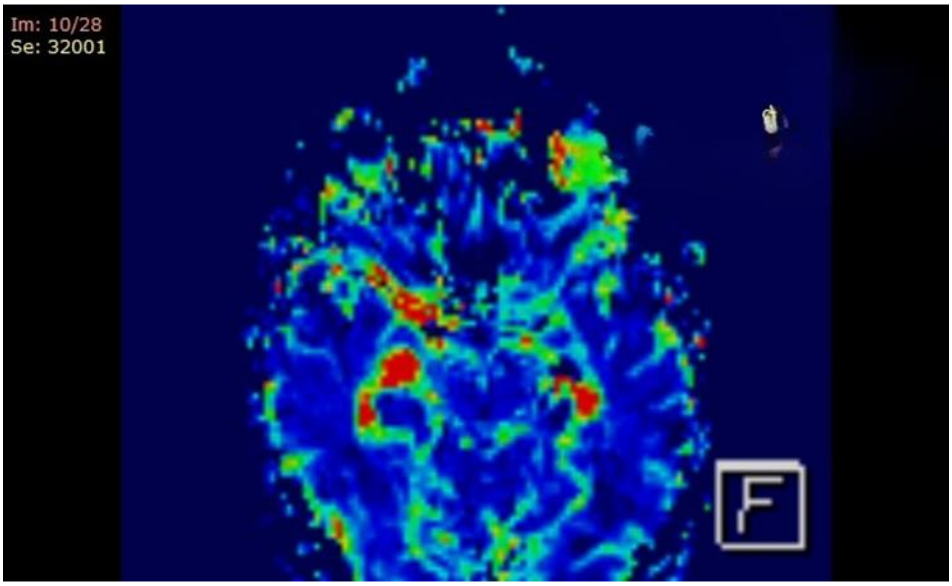

Fig. 7. Magnetic resonance imaging fragment of Patient O., 56 years old

On the tomograms obtained after the magnetic resonance imaging (Fig. 7) in the apex of the left eyeball, around the optic nerve, cranially, laterally, and caudally, there is an irregularly shaped, intensely contrasted mass with unclear contours, with the following dimensions: anterior-posterior 1.2 cm, transversal - 0, 9 cm, craniocaudal measurement - 0.8 cm, giving limited diffusion (indicating cellular proliferation).

MR perfusion refers to increased perfusion. A small defect of the lateral wall is revealed in the area of the apex, the said mass extends slightly into the middle fossa. The optic nerve is not differentiated distal to the said mass. The eye-moving muscles are thickened and infiltrated in the apex of the eyeball, especially the superior rectus muscle. The left eyeball is deformed, the vitreous body has a non-homogeneous structure, and MR retinal detachments are observed with a centrally fibrous stroma - intraorbital lymphoma is suspected by MR semiotics. The patient was finally diagnosed with lymphoma.

The majority of retinoblastomas were characterized by an irregular shape, with unclear contours in 75% of cases. The tumor was most often localized in the eyeball and lower quadrant. In the case of retinoblastoma, structural heterogeneity prevailed (87%).

Here is an example of a clinical study:

Patient R., 1 year old, with left-sided proptosis. There is no trauma of any kind in the anamnesis. A magnetic resonance imaging procedure was performed (Fig. 8).

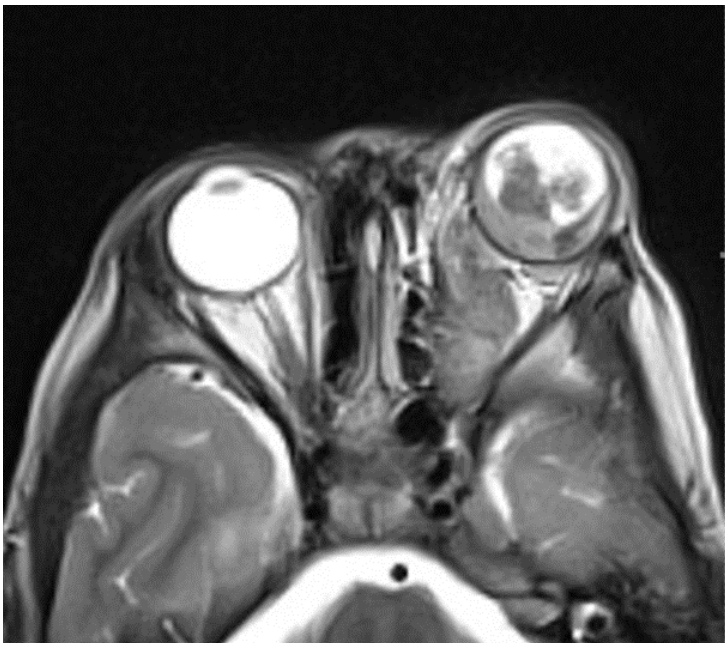

Fig. 8. Magnetic resonance imaging fragment of Patient R., 1 year old

On the obtained tomograms, T2 and post-contrast slices visualized a strongly inhomogeneous structure, partially patchy (hypointense in T2 mode), and inhomogeneously contrasted intraorbital volumetric neoplasm, which extends dorsally along the optic nerve. The intracranial spread of the tumor near the optic chiasm is also observed. The tumor shows increased perfusion and pathological restriction of diffusion. Considering the patient's age and magnetic resonance data, retinoblastoma is an alternative diagnosis, which was confirmed by the morphological verification of the drug.

In the case of menangiomas, the irregular shape of the tumor prevailed, with clear contours in 87% of cases. Meningiomas are characterized by heterogeneity of structure (89%).

Here is an example of a clinical study:

Patient U., a 25-year-old woman, came to the clinic with complaints of deterioration of vision in the right eye.

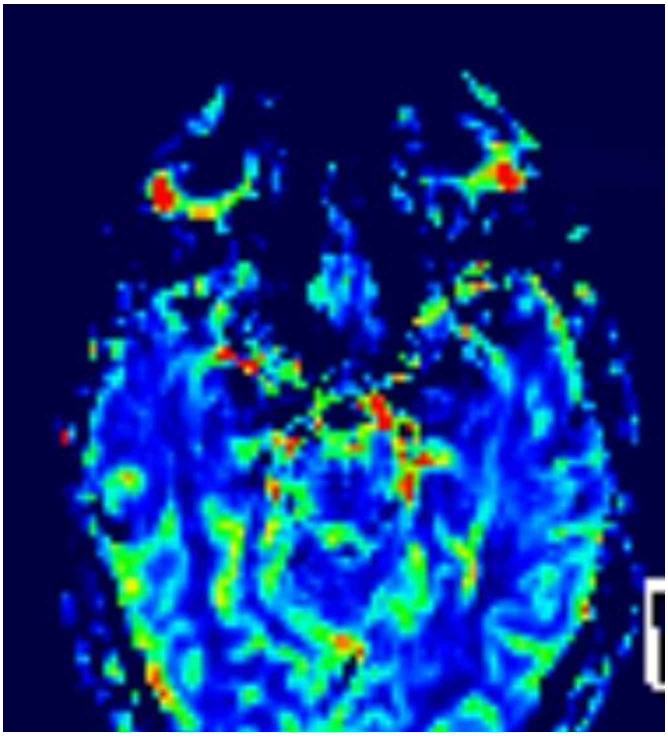

Fig. 9. Magnetic resonance imaging fragment of Patient U., 25 years old

On the obtained tomograms (Fig. 9) in the right eye socket, dorsally and in the area of the apex of the eye socket, adjacent to the optic nerve - laterally and craniocaudally, there is an irregular, clearly contoured, inhomogeneous structure, intensively contrasting volumetric neoplasm the following with dimensions: anterior-posterior - 2.1 cm, transverse - 1.1 cm, length - 1.3 cm, which does not extend intracranially. The right optic nerve is sharply pinched and intact approximately 1 cm dorsal to the eyeball.

In the postcontrast perfusion mode, the tumor showed no significant increase in perfusion parameters, as well as pathological restriction of diffusion - indicating a highly differentiated cellular matrix of the tumor.

Considering the homogeneity of the contrast and the close connection with the optic nerve, by MR to semiotics, the presence of a neoplasm of the optic nerve is probable - a meningioma of the right optic nerve sheath was morphologically verified.

V. Discussion Of Results

As a result of the analysis of the obtained data, the sensitivity of MRI in the diagnosis of primary tumors of the orbit and eyeball was 99%, and specificity was 96.4%.

From the data presented in Table 4, it follows that according to magnetic resonance imaging data, eye movement muscle infiltration was suspected in 11.6% of cases, since a clear border between the tumor and any muscle group was not defined, while there was a corresponding muscle size increase.

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Table 4

The prevalence of eyeball and orbital primary neoplasms on different orbital structures according to magnetic resonance imaging data

Magnetic resonance imaging signs	**Primary neoplasms** (n – 43)	
	Abs.	%

Infiltration of eye movement muscles	Yes	5	11,6
	No	38	88,4
Dimensions of eye movement muscles	Remained unchanged	35	81,4
	Reduced	-	-
	Enlarged	8	18,6
Retrobulbar tissue changes	Yes	10	23,3
	No	33	76,7
Optic nerve infiltration	Yes	2	4,66
	No	41	95.34
Destruction of the bone wall of the orbit	Medial	1	2,33
	Lateral	4	9,30
	Upper	3	6,98
	Lower	-	-

In 4.66% of cases, it was assumed that optic nerve infiltration occurred based on the close location of the tumor and the impossibility of its clear visualization.

Changes in the retrobulbar tissue and its infiltration were detected in 23.3% of cases.

In 18.61% of cases, the destruction of the orbital bone wall was observed, while the destruction of the medial orbital wall was observed in 2.33% of cases, lateral - in 9.3%, and the upper one - in 6.98%. When evaluating the condition of the orbital bone walls, it was noted that destructive changes were more often detected in the lateral and cranial parts of the orbit.

The results obtained by magnetic resonance imaging were fully confirmed by the morphological study of tissues obtained during surgery.

The capabilities of traditional instrumental research methods are limited by their resolution capability. Diagnostic errors are also common. Therefore, the interest caused by the development and implementation of new additional research methods for timely diagnosis of orbital diseases is understandable.

Currently, the most important methods for diagnosing orbital tumors are computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound examination.

Of all tissue imaging methods, the magnetic resonance imaging procedure provides the most complete pathoanatomical picture, and also allows for conducting non-invasive angiographic examination and obtaining diffusion, perfusion, and spectroscopy images.

MRI, unlike CT, can diagnose small tumor foci, which allows us to differentiate neoplasms in time and plan further treatment.

MRI is more sensitive in terms of detecting small tumors of both soft tissues and bone structures of the orbit and eyeball than CT and ultrasound examination, so the MRI procedure is definitely on the front line in the differential diagnosis of orbital neoplasms.

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