

# ULTRASOUND CRITERIA IN THE DIAGNOSIS OF ORBIT PATHOLOGY

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**Abstract:** *Ultrasound exploration of the orbit represents a priority indication of the echographic examination. The contribution and the collection of the ultrasound data, as well as the information supplied by other imagistic methods represent elements that reduce the rate of the diagnosis error at maximum. When evaluating the tumoral pathology, echography is seen, both as an investigation of first intention – having as a purpose the screening orientation of the subsequent investigations – and as a method to differentiate the tumoral histologic structure, based on their ultrasonic character.*

**Keywords:** orbit, ultrasonography

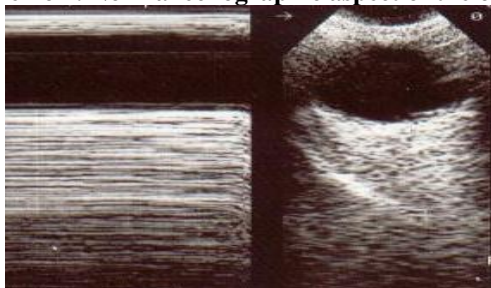
**Rezumat:** *Explorarea ultrasonică a orbitei reprezintă o indicație prioritară a examinării ecografice. Aportul și corelarea datelor ultrasonografice cu informațiile furnizate de alte metode imagistice, constituie elemente ce au redus la maxim rata erorilor de diagnostic. În evaluarea patologiei tumorale, ecografia se remarcă atât ca investigație de primă intenție – având ca scop orientarea screening – ului investigațiilor ulterioare – cât și ca metodă de diferențiere a structurii histologice tumorale, pe baza caracterului lor ultrasonic.*

**Cuvinte cheie:** orbită, ultrasonografie

The diagnosis value of the ultrasound investigation in the orbit pathology is materialized in the capacity of elucidating the inflammatory, endocrine or tumoral etiology of an exophthalmia, being a major criterion in the adoption of the therapeutic conduct.

From the acoustic point of view, the normal orbit presents a hyperreflectivity with multiple echoes, with a decreasing intensity – aspect due to its heterogeneous structure

**Picture no 1. Normal echographic aspect of the orbit.**



Pathologic structures of the orbit – with the exception of liposarcoma – are echographically viewed under the form of gaps, because their reactivity is inferior to that of the adipose lobes.

The ultrasound criteria of the differential diagnosis are the following:

- **Reflectivity.** The most echogenous structures are the cavernous angiomas of the orbit, followed by the tumours of solid or dense type. The liquidian structures are less echogenous, due to their histologic structure.
- **Attenuation** may be appreciated by the decrease of the intensity of the echoes during the penetration of the ultrasound fascicles and the occurrence of the orbit shadow.
- **Reductibility** is studied by compressing the examined structure against a wall of the orbit. A cyst is reducible as against a dense structure that is not reducible.
- **Homogeneity.** The dense and liquid structures are usually homogenous, but they present a different level of reflectivity. (8) The cavernous angiomas, haematomas and certain inflammatory pseudotumours are heterogeneous.

The regular or irregular character of their detected pathological structures is appreciated, taking into account the more or less continuous aspect of the echoes that delimitate the pathological structure. The irregular character of the limits is one of the characteristics of certain tumours regarded as infiltrating (liposarcomas). A less clear limit is characteristic for an inflammatory pseudotumour and not for a tumoral formation.

## Changed orbit structures

Unilateral inflammatory or endocrine exophthalmias are echographically characterized by a diffuse or positioned homogenous hyperreflectivity of the orbit adipose tissue.

The localized forms represented by myositis are well viewed in the B module, the oculomotor muscles being thickened. (picture no. 2)

In the early stages of the evolution of the thyroidian ophthalmopathy, which are histopathologically characterized by edema and cellular infiltrate between the muscles fibres, the quantitative echography shows a

reduction of the muscle reflectivity. In the advanced stages, one could notice an increase of the reflectivity due to the occurrence of the muscle fibrosis.

**Picture no. 2. Basedowian myositis**



The pathology of the optic nerve may represent the object of the echographic examination.

The papillary edema is viewed as an echogenous prominence in vitros, in relation to the posterior scleral concavity. Echographically, it may be assessed when the size of edema is higher than the device resolution with almost 1mm. The quantitative echography allows the differential diagnosis regarding the pseudoedema (papillary stasis), which presents a constant reflectivity in the conditions of the variation of the ultrasound intensity, as against the edema, whose echographic image is changed.

Papillary drusen is echographically examined by using the oblique longitudinal section, in order to avoid the shadow phenomenon, brought about by the calcium contents of the drusen. By the reduction of the intensity of the ultrasound fascicle from 80Db to 50 or 40 dB, only the echoes generated by drusen persist, in comparison with the echoes of the ocular structures that disappear.

The papillary excavation is viewed as a small encoche in the regular concavity of the posterior scleral echo, with the possibility of echographically viewing a size of 0,5 mm.

The tumours of the optic nerve being of dense type, are weakly echogenous, in comparison with the tumours of the meningiomas, which are heterogeneous and present an increased reflectivity.

Optic nerve glioma is echographically viewed as a weakly homogenous gap, with dull lines, which increases the image of the optic nerve. (picture no. 3)

Meningiomas present an echographic image well delimited by the surrounding orbit tissue. The echographic aspect is also characterized by the presence of certain dispersed echoes, with low reflectivity, that represent the phenomenon of "internal reflexes" generated by acoustic discontinuities from inside the tumour. (picture no. 4). These acoustic discontinuities are due to the histologic structure of the tumour that presents reflecting interfaces between the planes of the tumoral cells, conjunctive septal tissue and blood vessels inside the tumoral tissue.

### Orbit pathologic structures

The echographic classification of the orbit tumours is based on two main criteria: the level of reflectivity and the homogeneity of the structure. There are three categories of the orbit pathologic structures:

- Heterogeneous structures;
- Homogenous structures;
- Dense, reflecting;
- Liquidian structures.

**Picture no. 3. Optic nerve glioma**



**Picture no. 4. Optic nerve meningioma**



### Tumours with heterogeneous structures

Are defined by an intensely echogenous character.

- Cavernous angiomas are strongly echogenous structures, slightly reducible, with echoes that decrease rapidly in their depth. They may be mobile – when they are placed inside the muscle cone – and immobile – when they are placed extraconically. The examination by compression may produce an indentation of the tumoral echographic image at the level of the posterior scleral echo. (2)
- Recent orbit haematomas may present a heterogeneous echographic aspect. (picture no. 5)
- Orbit abscess presents irregular limits and a heterogeneous structure. (picture no. 6)

### Tumours with homogenous dense structure

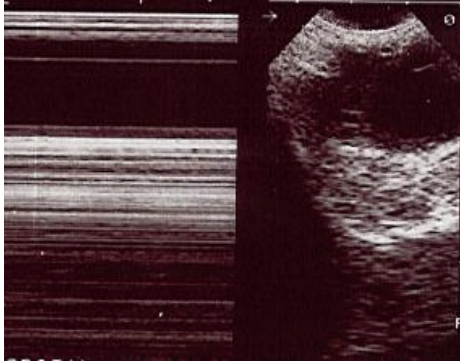
Are slightly echogenous:

- primitive tumours of the orbit;
- rabdomyosarcoma;
- lymphoma;

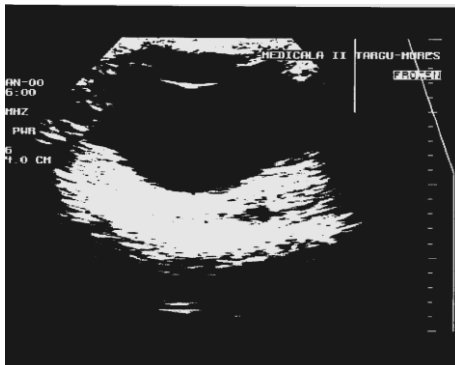
## CLINICAL ASPECTS

- plasmacytoma;
- optic nerve tumours;
- inflammatory pseudotumours;
- tumours of the lacrimal glands;
- metastatic tumours;
- invasive tumours;

**Picture no. 5. Recent orbit hematoma**



**Picture no. 6. Orbit abscess**



The primitive tumours are mildly echogenous, usually irreducible and with variable limits. (9) (picture no. 7)

**Picture no. 7. Primitive orbit tumour**



*Orbit lymphomas* present in the B module:

- irregular shape;
- homogenous structure;
- high acoustic absorption;
- no “internal reflexes” inside the tumour, because there is no acoustic discontinuity in the tumoral mass.

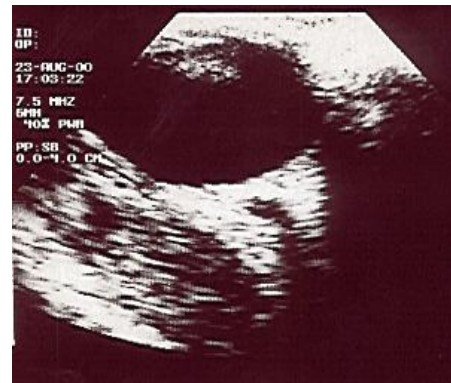
Orbit metastatic tumours present acoustic characteristics similar with those of the primitive tumours, but less reflecting, irregular and infiltrating. (3) (Picture no. 8)

The etiologic diagnosis is based on the existence of the primitive tumour at a distance.

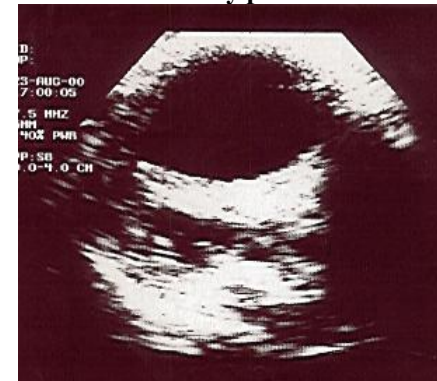
The tumours of the lacrimal gland are less echogenous and well delimited.

The inflammatory pseudotumours present irregular limits and a sort of heterogeneity. (10) (picture no. 9)

**Picture no. 8. Metastatic tumour**



**Picture no. 9. Inflammatory pseudotumour**



*Tumours with homogenous cystic structure*

Are represented by:

- mucocele;
- orbit varices;
- arterial-venous malformations;
- collected hematoma;
- dermoid cyst;

Diagnosis acoustic criteria (picture no.10):

- decreased or absent reflectivity;
- compressible;
- net delimitation;
- homogenous.

These echographic characteristics must be nuanced according to the nature of the structure:

- orbit mucocele present a homogenous aspect, well delimited, with reduced or average reflectivity, incompressible. (7)
- Dermoid cystic is presented as a non homogenous structure with tissue density.

## CLINICAL ASPECTS

- Orbit varices present reduced reflectivity, homogenous internal structure and weak sonic attenuation. The size of the echographic image increases during the jugular compression. (4) Election examination is the colour Doppler ultrasonography.
- Arterial-venous malformations present reduced reflectivity, regular internal structure, weak sonic attenuation. (5) Kinetic and Doppler ultrasonography echography suggest the presence of a strong vascularization and the increase of the venous volume.
- The collected hematoma presents an echographic aspect that depends on the evolutive stage. In a recent stage, the aspect is heterogeneous. In collected stage (picture no.11) it may present an irregular reflectivity.

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**Picture no. 10. Orbit tumour with cystic structure**



**Picture no.11. Orbit hematoma**



Echography should not be interpreted in a competitive context with other investigation techniques, but only in the context of the mutual information completion, leading to the elucidation of the diagnosis.

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