

## Case Report

## Imaging Evaluation of the Orbit in Graves Ophthalmopathy

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**ABSTRACT:** Diagnosis of Graves ophthalmopathy is based on the typical eye signs and symptoms, the exclusion of other orbital pathologies and evidence of thyroid autoimmunity. We report the case of a non-smoker 61 years old woman, known with Graves disease, which performed a 3T MRI examination in order to evaluate the orbits. The MRI exam revealed eye protrusion, increased orbital fat with compression on the optic nerve and increased volume of the extraocular muscles. We concluded that MRI, using high-field 3T imaging techniques, is very important for diagnosis of these anomalies, making the differential diagnosis with other pathology and also providing additional information in the decision for therapy.

**KEYWORDS:** Graves ophthalmopathy, magnetic resonance imaging, computed tomography, ultrasound

### Introduction

Thyroid eye disease is an autoimmune disorder of the orbit associated with Graves' disease (GD), the clinically activity being detected in a few cases [1]. Thyroid associated ophthalmopathy refers to the changes of intra- and periorbital soft tissues occurring in the course of autoimmune thyroid diseases presenting with signs and symptoms in 50% of the cases [2, 3]. It occurs more frequently in women, but men tend to develop more severe symptoms at a later age [3]. To diagnose the thyroid eye disease is necessary a multidisciplinary approach between ophthalmology, endocrinology and radiology [4]. The diagnosis is based on symptoms, result of examination and imaging techniques.

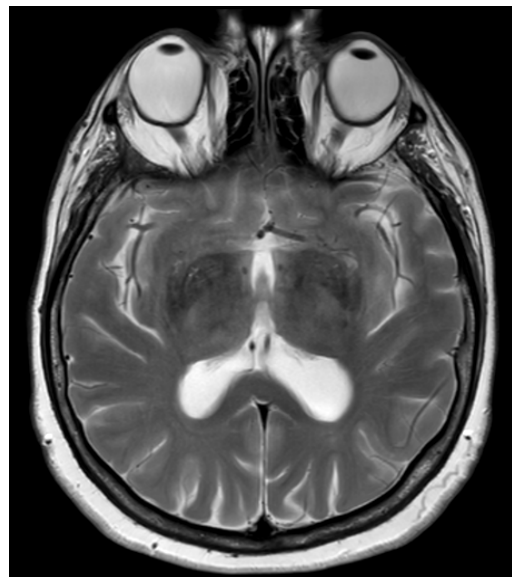
The most widely imaging methods used in Graves ophthalmopathy are ultrasound, computer-tomography (CT) and magnetic resonance imaging (MRI). The MRI and CT scans of the orbits and brain are very important, because these tests will accurately show which muscles are affected and exclude other eye pathology [5].

### Case report

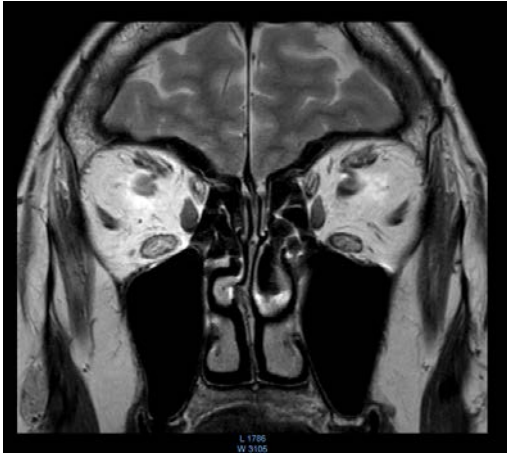
A 61 years old woman, known with Graves disease, non-smoker and being under treatment presented in the Ophthalmology Department for eye protrusion. The ophthalmologist indicated MRI examination in order to evaluate the orbits. Orbital MRI was analyzed by the same radiologist using a 3.0 Tesla MR unit head coil (Philips Ingenia 3T). The pulse sequences were T1-weighted, T2-weighted in axial, sagittal and coronal plane for evaluation of brain. The

specific orbit sequences were T2, 3D T1-weighted sequences and inversion recovery sequence (STIR) in axial and coronal plane, with fat-saturation used for muscle thickness assessment and edema presence.

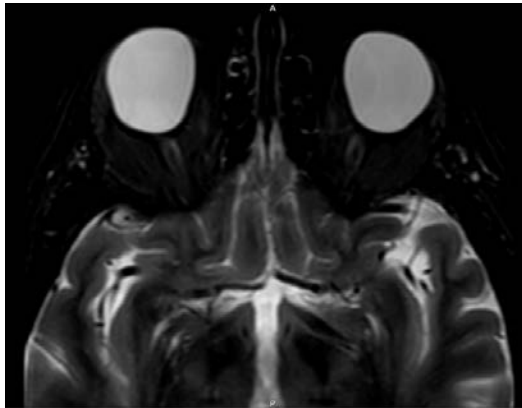
At the examination the patient presented eye protrusion (Fig.1) increased orbital fat with compression on the optic nerve and increased volume of the extraocular muscles, mostly inferior rectus muscle and medial rectus muscle, more at the right eye (Fig.2). The diameter of the optic nerve was increased at 5.5 mm at the right eye, because of the orbital fat compression (Fig.3).



**Fig.1 M.B, 61 years old woman, MRI axial T2 weighted image of the orbit showing eye protrusion**



**Fig.2 MRI, T2 weighted image, coronal section of the orbit shows increased volume of extraocular muscles (mostly inferior rectus muscle and medial rectus muscle, with increased orbital fat making compression on the optic nerve at both eyes ( more on the right eye), with increased diameter of the optic nerve , at the right eye, due to compression of the orbital fat.**



**Fig.3 Axial inversion recovery sequence (STIR) showing the absence of edema in optic nerve.**

## Discussion

The examination of patients with thyroid eye disease shows that the eye movements are limited because the eye muscles are affected. Cigarette smoking increases the risk of developing thyroid eye disease. Patients with Graves disease who smoke are more prone to have severe eye symptoms than non-smokers [6]. In our case the patient was a non-smoker, thus the severity of disease was moderate. Severity of eye symptoms depends also on the activity of the autoimmune process. Besides eye lid changes, extraocular muscle involvement is a characteristic feature of Graves ophthalmopathy. Detecting activity of the inflammation in Graves ophthalmopathy is crucial for selecting the most appropriate therapy. In the active stage of the disease, immunosuppressive medical treatment

or radiation therapy is indicated. In the inactive stages, these treatment methods are avoided, because of the side effects. This is the reason why it is important to have imagistic investigations of the orbits to choose the proper way of treatment for these patients. In the later stages of the disease, surgical decompression of the bony orbit or correction of the extraorbital muscles may be a therapeutic option. In very severe Graves ophthalmopathy with imminent sight loss, acute surgical decompression is indicated [7].

In our case the MRI performed in a non-smoker female revealed mild to severe modification of the orbit consisting in protrusion, with muscle involvement but without optic nerve edema.

The therapeutic conduct of Graves ophthalmopathy has to be the result of an interdisciplinary approach (endocrinologist, radiologist, ophthalmologist), the treatment of severe and progressive disease being difficult. Thus the disease activity and severity are determined by clinical assessment and imaging techniques. Ultrasound performed on patients with Graves ophthalmopathy can detect intraorbital masses, soft tissue heterogeneity and thickening of the extraocular muscles. The main advantages are low price, no ionizing radiation, short examination time, and the disadvantages are impossibility of visualizing the apex of the orbit and variable measurements [8]. Computed tomography (CT) with multiplanar reconstructions is used in the orbital pathology. The orbital components have different attenuation values so they can be well separated with CT. Muscle diameters and cross sectional areas can be measured on CT scans. CT is also used for patients with metal implants and for evaluation of the bones in planning a surgical decompression of the orbit. The disadvantages of the CT are the risk of possible radiation damage to the crystalline lens if repeated measurements are required and also it is not able to identify inflammation of muscle [9]. Magnetic resonance imaging (MRI) is very efficient not only in detecting inflammation in the extraocular muscles, but also in ruling out other pathology [10]. The standard protocol includes T1 and T2 weighted images with planary reconstructions. The muscular changes consist in fusiform enlargement, compression to the optic nerve, intra- and extraconal fat enlargement, protrusion. MRI makes possible the distinguish between acute inflammation and fibrotic changes, by using contrast media, acute inflammations

appear as enhancement on T1 weighted images, while fibrotic changes do not enhance [11]. Edematous changes are easy to highlight with contrast media on T2 images [12].

As related to the previous studies the high field 3T MRI exam was able to detect the orbital changes entirely, with eye protrusion, increased volume of the extraocular muscles and increase diameter of optic nerve but without edema. Also the MRI was also very important to make the differential diagnosis with other pathology including infection, tumors or malformation in the orbit or brain. In our case the brain MRI analysis showed no anomalies.

Thus the MRI exam was important for diagnosis and providing additional information in the decision making for immunosuppressant therapy.

## Conclusion

The imaging assessment of all orbital structures is mandatory in every patient with Graves ophthalmopathy. We concluded that MRI, especially a high-field imaging system, is the modality of choice for evaluation of anatomical structures of orbit, being useful in doubtful cases, and also to identify active inflammatory changes and assess the proper treatment and follow-up.

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