Sonographic differentiation of the autoimmune thyroid diseases

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Learning objectives

The purpose of this educational exhibit is to:

1- Discuss the most common sonographic (US) findings of the autoimmune thyroid diseases (AITD) and correlate them with the two major subtypes: Graves disease (GD) and Hashimoto thyroiditis (HT).

2- Demonstrate in a case based series how US evaluation can help in the differential diagnosis of the AITD.

3- Discuss the role of US in the follow up evaluation of AITD.
Background

AITD are the most common organ-specific autoimmune disorders affecting up to 5% of the Western population. Clinical and laboratorial findings usually allow differentiation between the two major subtypes of AITD. However, in some cases these findings may overlap, which makes the definitive diagnosis challenging.

In this scenario thyroid gland sonography appears a useful diagnostic tool to establish the differential diagnosis. Accordingly, a growing demand for ultrasound has been observed and so this method has been included as routine screening for women in some countries.

Additionally, ultrasound technological developments allow the identification of minimal alterations of the thyroid gland.
Findings and procedure details

The US examination should begin with the patient in supine position, with a pillow placed under their shoulders and hyperextend neck. Ultrasound gel is applied over the thyroid area. The transducer is directly placed on the skin over the thyroid gland and images of each lobe are obtained in transverse and longitudinal planes. Craniocaudal and sagittal dimensions of both lobes are measured on the longitudinal image. The transverse dimension is measured on the transverse image.

The thyroid gland volume is calculated using the formula: Volume = length x width x thickness x 0.532 (conversion factor), where: length = craniocaudal dimension, width = transverse dimension, thickness = sagittal dimension. Normal volume: 6 to 15 cm$^3$ (3-4 + 10-11 cm$^3$). Fig. 1 on page 6

The normal gland has characteristic echogenicity, easily distinguishable from adjacent muscular structures. The thyroid gland characteristic ecogenicity is due to its follicular structure: the interface among thyroid cells and colloid produces high acoustic impedance, causing high frequency sound waves to be reflected back to the probe. Fig. 2 on page 6. This results in greater ecogenicity than neck muscles and as intense (or even greater) ecogenicity than submandibular glands. Thus, it is very important to classify the gland ultrasonographic aspect as isoechogenic, hipoechogenic or hiperechogenic.

However, heterogeneous textural patterns are included in this array of sonographic alterations. Some tips to avoid this pitfall are: observe whether these hypoechogenic areas are present throughout the whole parenchyma (following a symmetrical pattern of distribution); observe whether there is no prominent hypoechogenic area; observe whether there is not a nodule conformation in the several cuts performed on a same dubious lesion. These findings are compatible with pseudonodular areas, false nodules consisting of lymphocytic infiltrate typical of thyroiditis. Fig. 3 on page 7 and Fig. 4 on page 7

If doubt persists, another resource can be used: color Doppler mapping. In cases where a true nodule is not characterized, color Doppler mapping demonstrates the absent deviation of vessels in that region of the thyroid parenchyma.

In case the study indicates a non-characterization of a true nodule, it is recommended that these hypoechogenic alterations are described as "ill-defined hypoechogenic area" or a similar terminology, avoiding the term "nodule". This prudent measure is important since a physician faced with a sonographic report asserting the existence of a nodule will be induced to proceed with the diagnostic investigation. US color Doppler can
provide valuable information. However, extra care should be taken in performing color Doppler. The technique, the transducer and equipment set-up are essential factors for the accuracy of thyroid US. Equipment sensitivity and knowledge of the technique (particularly the transducer pressure on the skin must be minimal) should be added to these variables in the case of the color Doppler method. It is usually observed in GD: diffusely increased vascularity ("thyroid inferno") and elevated systolic peak velocity (SPV) (>50 cm/s). Fig. 5 on page 8. Fig. 6 on page 8. In HT the most common findings are: normal or increased volume and vascularization (never as high as in GD) and moderately elevated SPV (30 cm/s < SPV < 50 cm/s).

In the case of autoimmune thyroiditis, ultrasound may or not demonstrate textural alterations. If so, subtle to marked textural alteration of the gland may be identified. It is important to note that 90% of hypoechogenic glands result from autoimmune diseases, most of them HT or GD.

The classic pattern of thyroiditis is a marked gland hypoechogenicity with hyperechogenic fibrotic tissue crossing the parenchyma.

At the study completion, it is convenient to perform cervical lymph nodes scan. In cases of thyroiditis, round and hypoechoic level VI lymph nodes are common. This finding is especially significant, since level VI lymph nodes are responsible for the drainage of tumors of larynx, thyroid and other structures. Thus, when lymph nodes in this region are reported, it is necessary to describe their characteristics and define their pattern (suspect or inflammatory).
Fig. 1: Scheme demonstrating how thyroid lobes should be measured in the longitudinal and transverse axis.

Fig. 2: Normal gland has an echogenicity characteristic in ultrasound, easily distinguishable from adjacent muscular structures. Notice in figure greater ecogenicity in thyroid relative to the neck muscles.

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Fig. 3: Changes characteristic of the thyroid parenchyma in Graves’ disease are seen in these sonographic the way B. reduced echogenicity and heterogeneous texture with fibrotic beams between.

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Fig. 4: Changes characteristic of the thyroid parenchyma in HT are seen in these sonographic images. Reduced echogenicity and diffuse heterogeneous texture with fibrotic beams in between and hypoechoic areas compatible with lymphocytic infiltrate.

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Fig. 5: Power Doppler and color Doppler of the right lobe in cross section in a patient with Graves’ disease without treatment, showing the sharp increase in vascularization of the parenchyma, this framework known as ("thyroid inferno").

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**Fig. 6:** Spectral analysis of the thyroid arteries with greatly increased systolic velocities in patients with untreated Graves' disease and in those unresponsive to drug treatment.

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**Fig. 7:** In color Doppler ultrasonography observed usual vascularization / increased glandular parenchyma, with flow velocities in the lower enlarged thyroid arteries (A- right = 45.0 cm / s; B- left = 49.3 cm / s).

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Conclusion

Sonographic evaluation of thyroid gland has an important role in the differential diagnosis of AITD subtypes. The correlation of the ultrasonographic findings with clinical and laboratory information is essential to establish an accurate diagnosis.
References


3- Graves, R.J. (1835) Newly Observed Affection of the Thyroid. London Medical and Surgical Journal, 7, 515.


