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**Thyroid Ultrasound 101:
What Is It? And What Can I Expect?**
by Dr. Cherie Vaz

Abstract

Ultrasound is a well established diagnostic test used in management of thyroid diseases. Some of the indications for thyroid or neck ultrasound are thyroid nodules, goiter, thyroid cancer and other neck masses. Ultrasound guidance is used to perform thyroid biopsies and improves the diagnostic accuracy of fine needle biopsy.

This article will provide details on thyroid ultrasound, how the test is performed, indications, results obtained with ultrasound imaging and benefits of the test.

What is Ultrasound?

Ultrasound uses pulses of sound waves to create a visual image of a structure. Ultrasound works by

converting electrical energy into mechanical energy, i.e. sound energy.

An ultrasound transducer is the component of the ultrasound machine which is placed in contact with the patient during the test. Crystals located in the transducer receive ultrasonic waves and convert them into electrical impulses to generate a computer image.

With advances in technology, high resolution ultrasound uses computer generated models to process images and create a high quality image of the thyroid or other structure being studied.

Since ultrasound uses sound waves instead of ionizing radiation as in most other diagnostic tests like CT, PET and x-ray, there is no exposure to radiation during the procedure. This makes thyroid ultrasound extremely

safe for patients, and they are safe to perform during pregnancy.

A thyroid ultrasound is in actuality a cervical or neck ultrasound which studies not only images of the thyroid but also its surrounding structures in the neck, importantly neck lymph nodes and sometimes neighboring parathyroid glands. Doppler ultrasound characterizes blood flow to the thyroid gland, nodules, and lymph nodes and is a routine part of the evaluation.

How is thyroid ultrasound performed?

Thyroid ultrasound and ultrasound guided fine needle biopsy of the thyroid is an office procedure performed by doctors trained in the technique. Endocrinologists, radiologists and ENT

surgeons are specialists that may have expertise in thyroid ultrasound.

Thyroid ultrasound takes a series of images of the thyroid gland and other neck structures and so the physician can assess them for abnormalities. The whole test typically lasts between 15-30 minutes but this can vary depending on the operator technique, proficiency, and complexity of the case.

Proper patient positioning is critical to performing high quality ultrasound. The patient is made to lie flat and adequate neck extension is achieved by placing pillows under the shoulders. Coupling gel is then placed on the transducer to enhance image generation. The transducer is moved over the patient's neck to obtain a series images of the thyroid gland and other neck structures.

High quality thyroid ultrasound reports include measurement of thyroid gland size, architecture, blood flow on Doppler evaluation, presence of nodules, nodule size and characteristics and any other periglandular pathology like neck lymph

nodes or parathyroid glands. In addition, evidence of compression or displacement of adjacent structures like trachea or internal jugular vein should be assessed.

Why is thyroid ultrasound performed?

Established indications for thyroid ultrasound include the following:

1. Goiter (enlarged thyroid gland)
2. Thyroid nodule (lump or mass felt in the thyroid gland during a physical examination)
3. Thyroid incidentaloma (thyroid nodule discovered incidentally during other imaging tests, commonly CT neck, MRI neck, PET scan and carotid ultrasound)
4. Monitoring size of thyroid nodules
5. Prior to thyroid cancer resection (preoperative evaluation)
6. Monitoring for disease recurrence in patients with thyroid cancer
7. Along with radioactive iodine uptake scans in establishing the diagnosis of Grave's disease

8. Management of drug-induced hyperthyroidism
9. Diagnosis of a neck mass
10. Guidance of fine needle aspiration biopsy
11. Drainage and ethanol ablation of thyroid cysts
12. Hyperparathyroidism

Thyroid ultrasound should not be routinely performed in patients with normal thyroid on physical examination.

The 2 most common indications for thyroid ultrasound are briefly summarized below.

Ultrasound and Thyroid Nodules

Thyroid nodules are a common clinical problem found on physical examination in 3-7% of the population. A thyroid nodule is a lesion in the thyroid gland which is distinct from the surrounding glandular tissue. The prevalence of thyroid nodules increases with age, and can be seen on ultrasound before they are felt on physical examination. Up to 60% of the population age 50-

60 may have a thyroid nodule on ultrasound.

Thyroid ultrasound is mandatory in all patients with suspected thyroid nodules.

It is the most sensitive test for evaluation of thyroid nodules, with high resolution ultrasound capable of detecting thyroid nodules as small as 2mm in size.

Nodules are assessed for location, size, shape, architecture and indicators of malignancy like calcifications. Doppler ultrasound is used to assess nodule blood flow and provides valuable information on potential for malignancy of a thyroid nodule.

Thus ultrasound aids in distinguishing between benign and malignant thyroid nodules.

Ultrasound is used to predict malignant potential of thyroid nodules but is not recommended as a substitute for fine needle aspiration biopsy which is the most accurate test for diagnosis of malignancy.

Most nodules less than 1cm in size do not need a biopsy unless certain clinical risk factors are present. Some of these risk factors include previous history of thyroid cancer, history of thyroid cancer in a first degree relative, exposure to external radiation in childhood or adolescence and presence of suspicious neck lymph nodes.

Occasionally there is a worrisome feature within a nodule on the ultrasound that raises suspicion for cancer and warrants a biopsy of a nodule less than 1 cm in size.

Nodules 1cm or more in size may need a fine needle aspiration biopsy based on assessment of risk factors and imaging characteristics. Nodules are followed with ultrasound in 6-12 months based on individual risks. If size remains stable, frequency of ultrasound may be reduced.

Some nodules are almost always benign and do not need biopsy irrespective of size. A purely cystic nodule which only contains fluid is definitively diagnosed on thyroid ultrasound and does not warrant fine

needle biopsy. However, thyroid cysts which cause cosmetic or pressure symptoms are treated using ultrasound guidance.

Ultrasound and Thyroid Cancer

Diagnostic ultrasound may aid in the early diagnosis of thyroid cancer in high risk groups, i.e. certain types of familial thyroid cancer, and in patients with a history of exposure to external beam radiation during childhood or ionizing radiation in childhood or adolescence.

Diagnostic ultrasound is the most sensitive test for monitoring for thyroid cancer recurrence in neck lymph nodes. Thyroid ultrasound identifies suspicious lymph nodes with better accuracy than CT. Studies have shown that thyroid ultrasound is the most sensitive test for early detection of recurrent thyroid cancer, with earlier detection than whole body radioactive iodine scans and serum thyroglobulin levels, the other tests used in follow up of thyroid cancer.

Currently thyroid ultrasound is the only imaging test recommended in the routine follow up of thyroid cancer. Further imaging modalities like whole body radioactive iodine scans and CT scans are used if an abnormality is detected on thyroid ultrasound. Typically one should have an initial postoperative follow up ultrasound 6-12 months after thyroid cancer resection. The subsequent frequency of repeat ultrasounds depends on the individual patient's risk and measured serum thyroglobulin.

Recent Advances in Thyroid Ultrasound Technology

3-D Contrast enhanced ultrasound uses contrast

agents to enhance images and information obtained with high resolution ultrasound. Ultrasound Elastography is a new technique which assesses nodule stiffness to predict malignant potential. Initial studies on these technologies are extremely exciting but they are still investigational and restricted to research studies.

Conclusions

Thyroid ultrasound is becoming an extension of the physical examination and high resolution ultrasound is ubiquitous in the diagnosis of most common thyroid diseases. With superior sensitivity in the detection and characterization of thyroid nodules, malignant lymph nodes and recurrent thyroid cancer, thyroid

ultrasound is especially important in the care of patients with thyroid nodules and thyroid cancer.

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