Abstract

Elastography is still an immature technology with many variants and pitfalls. To use it effectively, one must understand what is being measured and what technical factors can affect image quality and diagnostic accuracy.

Key word: US, FNA, FNAC

Thyroid Nodules: Ultrasound Elastography Versus FNAC

Essay
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List of Abbreviations

CT	Computed tomography
FNAC	Fine needle aspiration cytology
FT3	Free triiodothyronine
FT4	Free thyroxine
KPa	Kilo- Pascal
LNs	Lymph nodes
MTC	Medullary thyroid carcinoma
NPV	Negative predictive value
PPV	Positive predictive value
RF	Radiofrequency
RI	Resistive index
SWE	Shear wave elastography
TSAB	Thyroid Stimulating Anti Bodies
TSH	Thyroid stimulating hormone
TSI	Thyroid Stimulating Immunoglobulin
U/S	Ultrasound

INTRODUCTION

The prevalence of thyroid nodules is about 3%–8% in the general population and is greater than 50% after age 65 years. The number of thyroid nodules being detected has increased because of improvements in medical imaging. Studies indicate a 5%–15% prevalence of malignancy for thyroid nodules ***(Utiger, 2005).***

The prevalence of thyroid nodules increases with age. The likelihood that a nodule is malignant is affected by a variety of risk factors. Malignancy is more common in nodules found in patients who are younger than 20 or older than 60 years of age than in patients between 20 and 60 years of age ***(Hegedus et al, 2003).***

Ultrasonographic (US) examination is an accurate method for detecting thyroid nodules, but its use in differentiating between benign and malignant thyroid nodules is relatively low ***(Takashima et al, 1995).***

In the assessment of thyroid nodules, clinical evaluation is also very important. In particular, as reported by recent consensus, a firm or hard consistency is associated with an increased risk of malignancy ***(Cooper et al, 2009).***

The basic principle of US-E is that compression of the examined tissue produces a strain, which is smaller in hard tissues than in soft tissues. The results of this technique are scored by measuring the degree of distortion of the US beam under the application of an external force ***(Chaturvedi et al, 1998).***

In general, two criteria have to be satisfied for successful clinical elastographic imaging, namely the ability to apply a quasi-static deformation and the ability to ultrasonically image the tissue being deformed ***(Thitaikumar et al, 2008).***

The thyroid gland is a superficial gland that is a viable target for quasi-static elastography. Due to the accessibility of the thyroid gland, external deformation of the thyroid using the ultrasound transducer has been utilized by several groups. Deformations introduced from pulsations due to blood flow through the carotid artery has also been utilized as a deformation source ***(Bae et al, 2007).***

The achievement of optimal results of thyroid FNA, with increased efficacy and decreased inadequacy rates, requires not only a skillful aspiration technique and attention to the factors that affect material adequacy but also awareness of the indications for and limitations of FNA biopsy and a strategy for postprocedural management ***(Serna et al, 2006).***

Scintigraphy is not used routinely to assess thyroid nodules. It is primarily of use in patients with a suppressed thyroid-stimulating hormone level, in whom it allows assessment of the functional activity of a thyroid nodule and of the whole gland. A functioning, or “hot,” thyroid nodule is rarely malignant, with only a few reported cases of such malignancy. Although a nonfunctioning, or “cold,” nodule at scintigraphy is commonly thought to indicate an increased risk of thyroid malignancy, as many as 77% of cold thyroid nodules may be benign ***(Majima et al, 2005).***

AIM OF WORK

-The aim of this study is to evaluate the thyroid nodules by ultrasound elastography in comparison to FNA.

ANATOMY OF THE THYROID GLAND

Gross Anatomy:

The thyroid gland is placed anteriorly in the lower neck at the level of fifth cervical to first thoracic vertebrae ***(Williams et al, 1995).***

It consists of two lateral lobes interconnected in front of the second, third and fourth tracheal rings by a narrow median isthmus ***(Pansky, 2000).***

The lobes are approximately conical, their ascending apices diverge laterally, and they may reach the junction of middle and lower thirds of the thyroid cartilage ***(Pansky, 1995).***

Their bases are at the level of the fourth tracheal cartilage. Each lobe is about 5 cm long, its greatest transverse and antero-posterior extent being about 3 cm and 2 cm respectively. Its postero-medial aspect is attached to the side of the cricoid cartilage by a lateral thyroid ligament ***(Williams et al, 1995).***

The lateral (superficial) surface is convex and covered from superficial to deep by skin, superficial platysma and deep fascia, sternomastoid muscle, superior belly of omohyoid muscle, sternothyroid and sternohyoid muscles, and visceral (pretracheal) fascia ***(Pansky, 2000).***

The medial surface is adapted to the larynx and trachea contacting at its superior pole the inferior pharyngeal constrictor and the posterior part of the cricothyroid muscle. The external laryngeal nerve is medial to this part of the gland, on its way to the cricothyroid muscle. The recurrent laryngeal nerve and oesophagus (closer on the left) are lower medial relations ***(Williams et al, 1995).***

The postero-lateral surface is next to the carotid sheath, overlapping the common carotid artery. The thin anterior border, near the anterior branch of the superior thyroid artery, slants down medially. The rounded posterior border is related below to the inferior thyroid artery and its anastomosis with the posterior branch of the superior thyroid artery ***(Williams et al, 1995).***

The parathyroid glands are usually related to this border, whose lower end on the left is near the thoracic duct ***(Williams et al, 1995).***

The isthmus connects the lobe's lower parts, it measures about 1.25 cm transversely and vertically and is usually anterior to the second and third tracheal cartilages, though often higher or sometimes lower ***(Williams et at, 1995).***

The pyramidal lobe is a small portion of gland substance often projects upwards from the isthmus generally to the left of the midline. It represents a development of glandular tissue from the caudal end of the thyroglossal duct. If the pyramidal lobe is not resected when a bilateral subtotal thyroidectomy is done, it will hypertrophy in the post operative period and result in a midline lump that is annoying to the patient and plainly visible ***(McVay, 1984).***

BLOOD SUPPLY:

The superior thyroid artery arises as the first branch from the anterior aspect of the external carotid artery supplies the upper thyroid pole ,It lies on the outer surface of the inferior constrictor muscle of the larynx, with the superior laryngeal nerve situated only a little higher up. So this nerve may be included in ligation of the superior thyroid artery unless care is exercised ***(McVay, 1984).***

The inferior thyroid artery arises from the subclavian artery by way of the thyrocervical trunk ,most of its branches penetrate the posterior aspect of lateral thyroid lobe ,closely associated with the recurrent laryngeal nerve***(McVay, 1984).***

The superior thyroid vein runs from the upper pole to either the internal jugular or common facial vein., the inferior thyroid veins drains into the brachiocephalic veins ***(Last, 2006).***

The lymphatic drainage includes superior deep cervical lymph nodes, inferior deep cervical lymph nodes, submental, submandibular, prelaryngeal, paratracheal and pretracheal lymph nodes ***(McVay, 1984).***

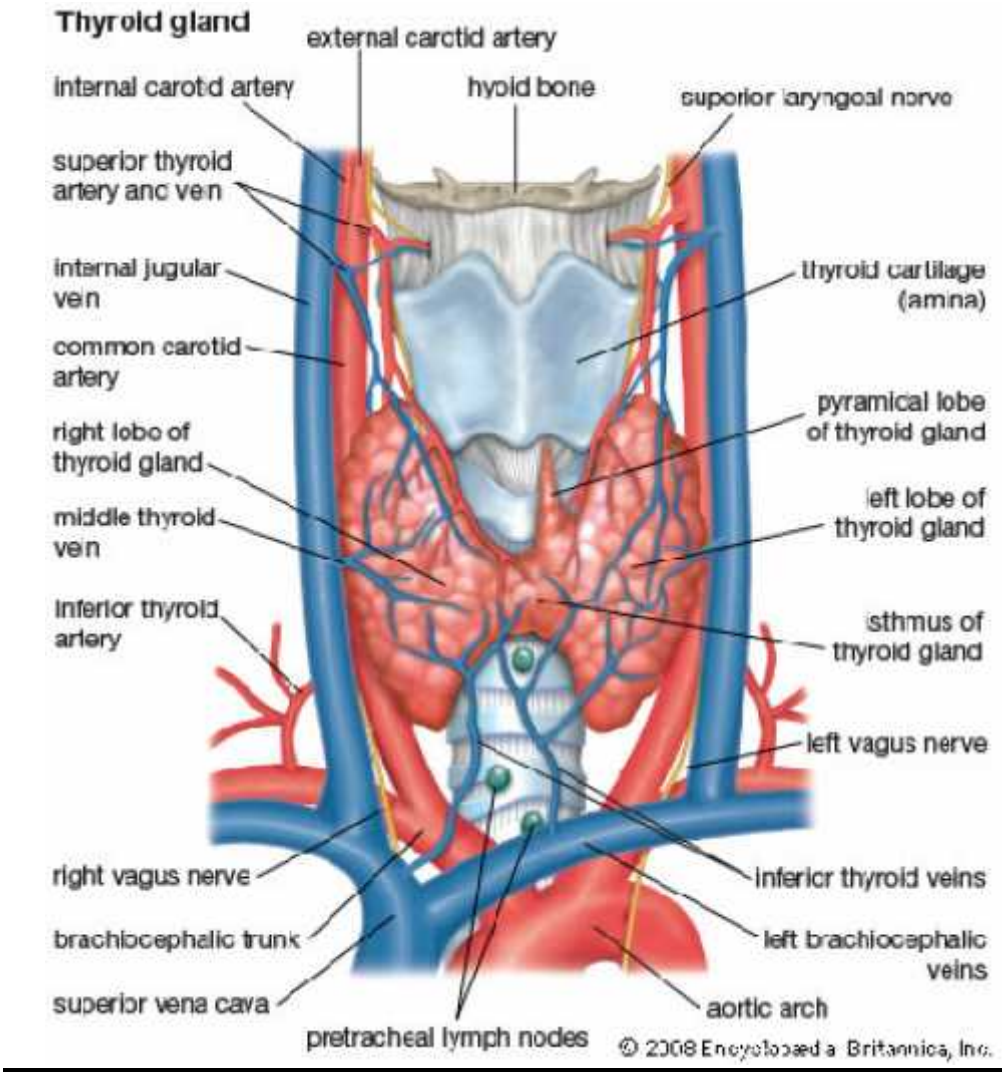

Fig. 1: Thyroid gland anatomy ***(Encyclopedia Britannica, 2008)***.

Normal U/S Scan of the Thyroid Gland:

Normal thyroid tissue is homogenous with moderate density echoes. A firm fibrous capsule, not defined acoustically, surrounds the gland and penetrates the thyroid tissue forming pseudo lobules ***(Morley, 1983).***

In the transverse scans, the trachea is central and seen anteriorly; it casts a strong acoustic shadow with reverberation artifacts. Lateral to the gland, the carotid artery and internal jugular vein are identified. The vein