Ultrasound Elastography In Assessment Of Thyroid Nodules

Essay

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LIST OF ABBREVIATION

BCE	Before The Christian Era
C cells	Calcitonin-producing parafollicular cells
cAMP	Cyclic adenosine monophosphate
CCA	Common carotid artery
CT	Computed tomography
ES	Echographic Score
FNAC	Fine Needle Aspiration Cytology
kPa	Kilo Pascal
NHT	Nodular Hashimoto's thyroiditis
P1-4	Pattern 1-4
PKA	Protein kinase A
RF	Radiofrequency
ROI	Region of interest
RTE	Real time elastography
SEG	Sonoelastography
SR	Strain Ratio
TSH	Thyroid Stimulating Hormone
TSHR	Thyroid Stimulating Hormone Receptor
US	UltraSound
HZ	Hertz
MHZ	Mega Hertz
MS	Milli Seconds

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INTRODUCTION

Thyroid nodules are common in general population ranging from 3%-8%:, their prevalence is being dramatically increased in iodine-deficient areas and is greater than 50% after age 65 years ***(Alam et al., 2008).***

. The number of thyroid nodules being detected has increased because of improvements in medical imaging (Utiger, 2005).

Thyroid cancer is the most common type of endocrine malignancy and accounts for the most of deaths due to endocrine cancers, Studies indicate a 5%-15%. prevalence of malignancy for thyroid nodules ***(Robbins et al., 2005)****.*

In the assessment of thyroid nodules, clinical evaluation is very important. In particular, as reported by consensus, a firm or hard consistency is associated with an increased risk of malignancy. However, this clinical parameter is highly subjective and dependent on the experience of the examiner ***(Rago et al., 2007).***

Ultrasonographic (US) examination is a sensitive method for detecting thyroid nodules, but its use in differentiating between benign and malignant thyroid nodules is relatively low ***(Mandel et al., 2008).***

US elastography is a newly developed dynamic technique that has been used in assessment of thyroid nodules and evaluates *the degree of distortion of a tissue under the application of an external force. Because softer parts of tissue deform more readily than the stiffer parts,and pathological tissues are usually harder than normal tissues. this technique enables objective evaluation of tissue stiffness from the deformation rate this can be represented through colored map ranging between red and blue colors.* ***(Kagoya et al., 2010).***

US elastography is non stressful for patients, easy to perform, and requires not more than a few minutes of additional examination time and is a very useful examination to avoid unnecessary procedures ***(Cooper et al., 2006)***

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).***

It is possible to distinguish between papillary carcinomas and other lesions with the thyroid stiffness index calculated from US elastography using carotid arterial pulsation ***(Richardson & Dubinsky, 2008).***

The combination of highly specific elastography with highly sensitive conventional B-mode sonography has the potential to further improve the diagnosis of metastatic enlarged cervical lymph nodes ***(Alam et al., 2008).***

AIM OF WORK

The aim of this work is to review the role of ultrasound elastography for assessment of thyroid gland nodules and differentiation between benign and malignant conditions.

ANATOMY OF THE THYROID GLAND

The normal thyroid gland is located in the anterior neck at the level of the thoracic inlet. The majority of the gland consists of two lateral lobes connected anteriorly by the isthmus. Approximately 50% of people have a pyramidal lobe, which is a remnant of the distal end of the thyroglossal duct ***(Amdur & Mazzaferri, 2005).***

The location of the thyroid gland relative to important structures in the neck explains the complexity of symptoms and potential surgical complic ations. The main structures of interest are the recurrent laryngeal nerve, the trachea, the esophagus, the sympathetic trunk, the vagus and phrenic nerves and the carotid arteries. The parathyroid glands lie close to the posterior surface of the thyroid and vary in number and exact location ***(Bliss et al., 2000).***

The spinal cord is located in the midline, approximately 4 cm posterior to the thyroid gland. This distance, and the intervening muscles of the floor of the neck and bone of the vertebral column, makes the tumor rarely spreads directly from the thyroid area to the spinal canal. The proximity of the thyroid gland to the spinal cord is a major factor when planning external beam radiotherapy ***(Amdur & Mazzaferri, 2005).***

RELATIONS OF THE LOBES:(Fig.1)

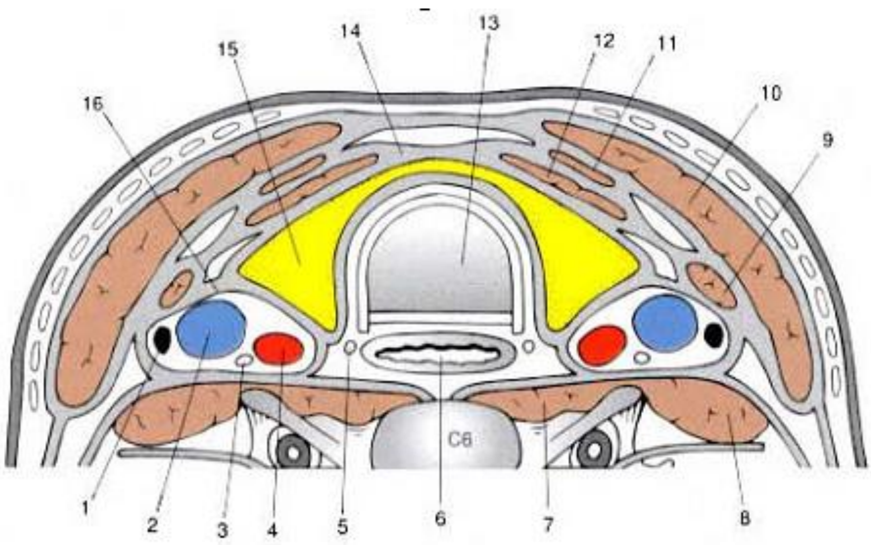

Fig. 1 Transverse section at the level of C6 showing anatomy of the thyroid. 1.cervical lymph node 2.internal jugular vein 3.vagus nerve 4.common carotid artery 5.recurrent laryngeal nerve 6.oesophagus 7.longus colli 8.Scalenus anterior muscle 9.Omohyoid muscle 10.Strenocleidomastoid 11.sternohyoid 12.sternothyroid 13.trachea 14.Paratracheal fascia 15.thyroid gland 16.Carotid sheath ***(Quoted from Ahuja & Evans, 2006).***

Superficially:

Strap muscles (sternothyroid & sternohyoid) and Sternocleidomastoid.

Posterolaterally:

Carotid sheath containing common carotid artery, internal jugular vein and vagus nerve.

Medially:

Larynx, trachea and esophagus.

Posteriorly:

Longus colli muscle and recurrent laryngeal nerve.

(Ahuja & Evans, 2006).

ARTERIAL SUPPLY:(Fig.2)

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 ***(Standring, 2008).***

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 ***(Standring, 2008).***

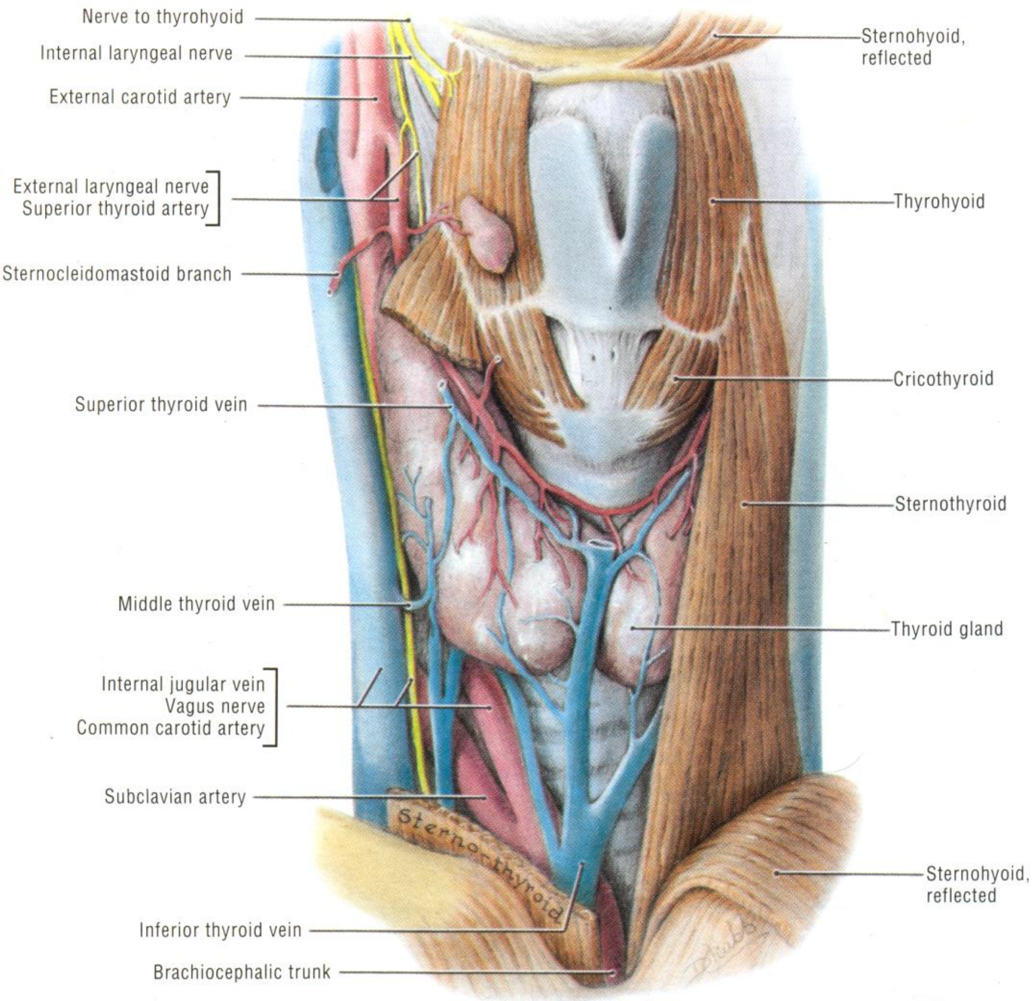

Fig. 2 Thyroid arteries & veins**(*Quoted from*Young, 2011).**

VENOUS DRAINAGE:

Superior thyroid vein:

One on each side, runs with superior thyroid artery and ends in the internal jugular vein ***(Standring, 2008).***

Middle thyroid vein

One on each side, very short vein. It arises near the base of the lobe. Ends in the internal jugular vein (Standring, 2008).

Inferior thyroid vein

It descends in front of the trachea to ends in the left brachiocephalic vein (Standring, 2008).

LYMPHATIC DRAINAGE:(Fig.3)

The thyroid gland has a dense lymphatic network characterized by interconnections that drain each area of the gland in multiple different directions. The concept of a stepwise progression of nodal metastasis from one nodal station to another determines the extent of the neck dissection for thyroid cancers and the extent of the irradiated volume in patients who receive external beam radiotherapy ***(Amdur & Mazzaferri, 2005).***

The first echelon nodal metastases from thyroid cancer are the nodes of the central compartment of the neck, the nodes of the superior mediastinum, and the lateral cervical nodes. The central compartment nodes are level VI, which is bounded by the hyoid