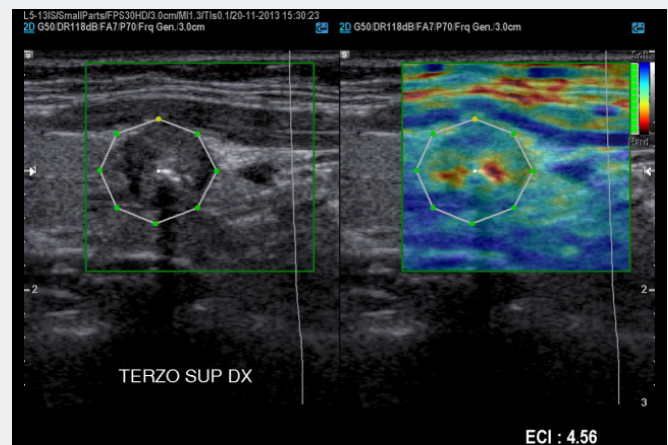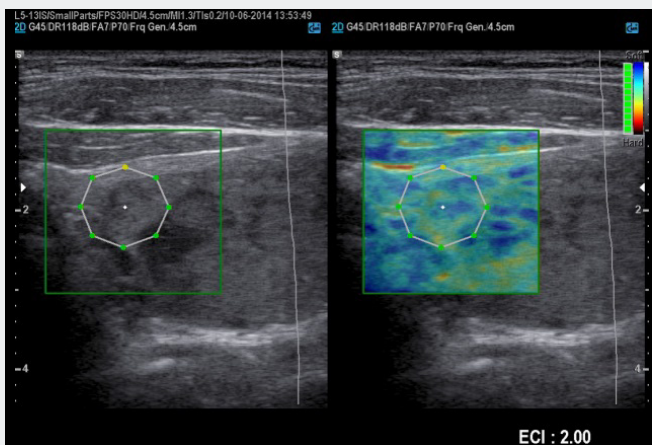# Technique, tips and tricks - differentiation of thyroid nodules with E-Thyroid

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" *Its high sensitivity, specificity, negative and positive predictive values could be of relevant clinical utility in the pre-surgical selection of patients with indeterminate cytology.*

The most accurate cut-off value for ECI index was 3; the median value of malignant nodules was 3.99, and it was 1.99 in benign lesions "

Introduction

Thyroid nodules are a common clinical condition; they have a prevalence of 2-6% at palpation, 19-35% at ultrasound and 8-65% at autopsy. Despite the benignity of the majority of the thyroid lesions, there is an increase in the incidence of differentiated thyroid cancer, which at least partly can be due to the diagnosis improvement with high-resolution ultrasonography (US) and fine-needle aspiration cytology (FNAC)[1].

Baseline US can differentiate between malignant and benign nodules with the aid of the following features: irregular margins, microcalcifications, marked hypoechogenicity, intranodular vascularization greater than perinodular vascularization, interval growth of diameter > 20% and taller than wider shape. Although US has a high sensitivity for the detection of thyroid lesions, its specificity is limited[2].

For this reason, fine-needle aspiration cytology (FNAC) remains the main diagnostic tool in the evaluation of thyroid nodules. However, despite of having the highest specificity (60%-98%), FNAC has a variable sensitivity (54%-90%). Finally, since it is an invasive procedure, though minimal, FNAC can be burdened with periprocedural complications[3].

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Based on this principle, ultrasound elastography (USE) was introduced as a non-invasive technique which obtains information on tissue stiffness. In recent years, USE has been investigated in numerous studies testing its ability to differentiate benign from malignant thyroid nodules[1] and EFSUMB also recently published the first guidelines and recommendation[1].

We report here technique, tips and tricks, together with comments derived from our experience with E-Thyroid, a dedicated quantitative software available on RS80A, WS80A, Accuvix A30 (Samsung Medison Co. Ltd., Seoul, Korea).

E-Thyroid and ECI

Firstly, the accuracy of free hand Elastography depends on the quality of compression applied by the operator. In an attempt to obviate this intrinsic disadvantage, a new quantitative scoring method called elasticity contrast index (ECI) was developed. The ECI index is obtained with the E-Thyroid software, a Steady-State Quasi-static physiological excitation technique which exploits the carotid pulsation as strain inductor to reach a quantitative stiffness evaluation.
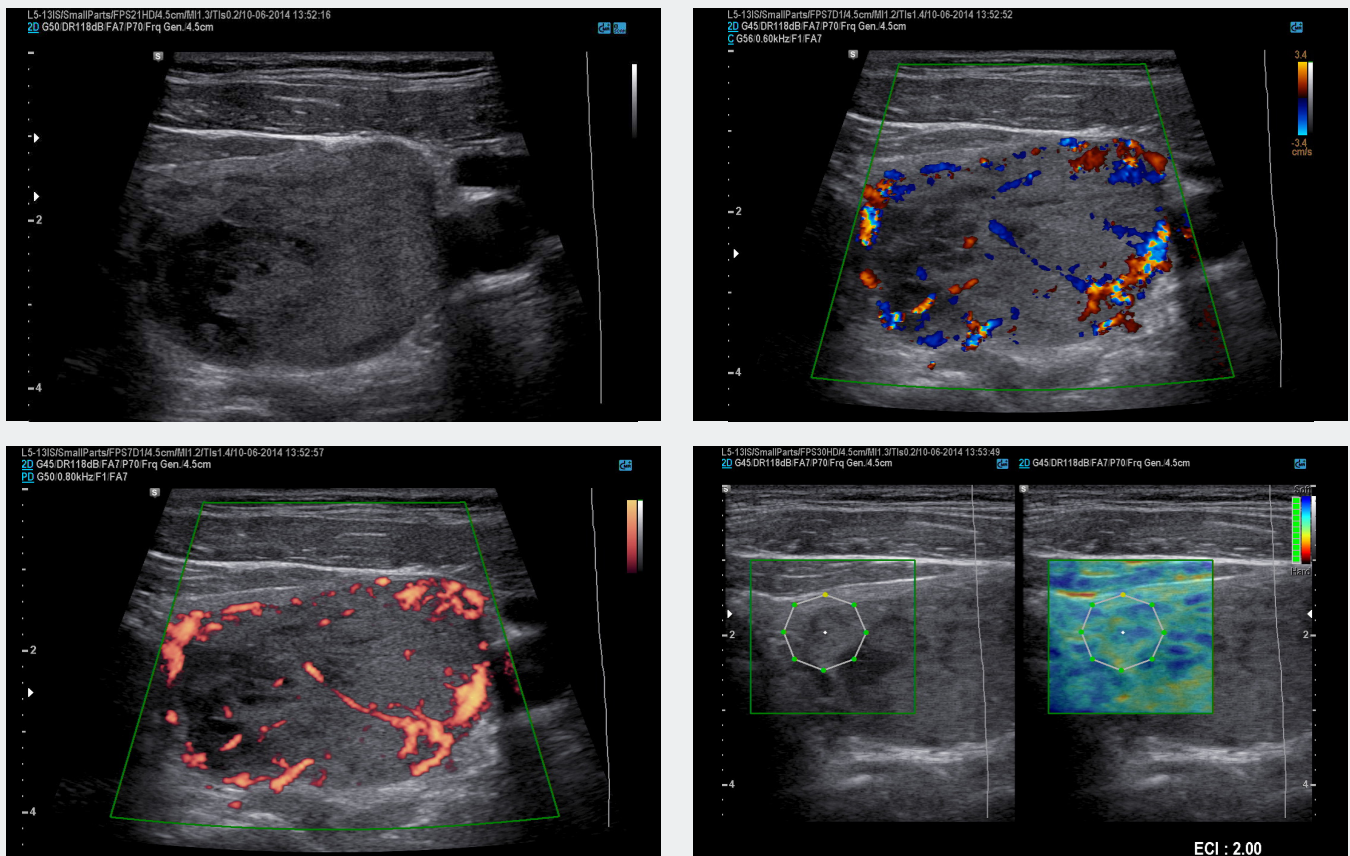

Figure 1. The images show an iso-ipoechoic, well marginated and oval shaped nodule localized in the left middle lobe of the thyroid gland, with a type III vascular pattern at Color Doppler US. The axial peri-intranodular ECI was 2.00.
Histology confirmed the diagnosis of benign nodular hyperplasia.

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In the preliminary experience reported in the press-study "Diagnostic Accuracy and Interobserver Agreement of Quasistatic Ultrasound Elastography in the Diagnosis of Thyroid Nodules" by Cantisani et al.[5], patients were evaluated with E-Thyroid on the Accuvix A30 system, by an expert radiologist who was blinded to clinical, cytological or histological characteristics. The protocol of the study contemplated both axial and longitudinal scans, in order to compare them, and furthermore the Region of Interest (ROI) was positioned first only in the nodule and afterwards in the nodule and parenchyma around it.

The patient was asked to suspend breathing for two to three seconds until the color bar indicating the quality of elastography examination turned green. The obtained images included an elastographic box showing stiff tissue(or area) as red and soft tissue(or area) as blue. A color scale with stiffness indication was found in the upper right side of the screen. Subsequently, an E-Thyroid ROI was positioned and the computed ECI value appeared on the screen[3].

According to our experience, for a correct evaluation, the elastographic box can include thyroid parenchyma and nodules, but a distance of a few millimeters should be kept from the carotid artery, because its direct pulsation may alter the relative stiffness assessment inside the elastographic box. Our study results showed that in most cases it was more accurate and easier to achieve the proper elastographic evaluation in the axial plane. However, our suggestion is to try evaluating in different planes depending on the position and type of nodules as well as on patient's neck.

Statistical analysis based on ROC Curve showed that the most accurate cut-off value for ECI index was 3; the median value of malignant nodules was 3.99, and it was 1.99 in benign lesions (Figure 1, 2).
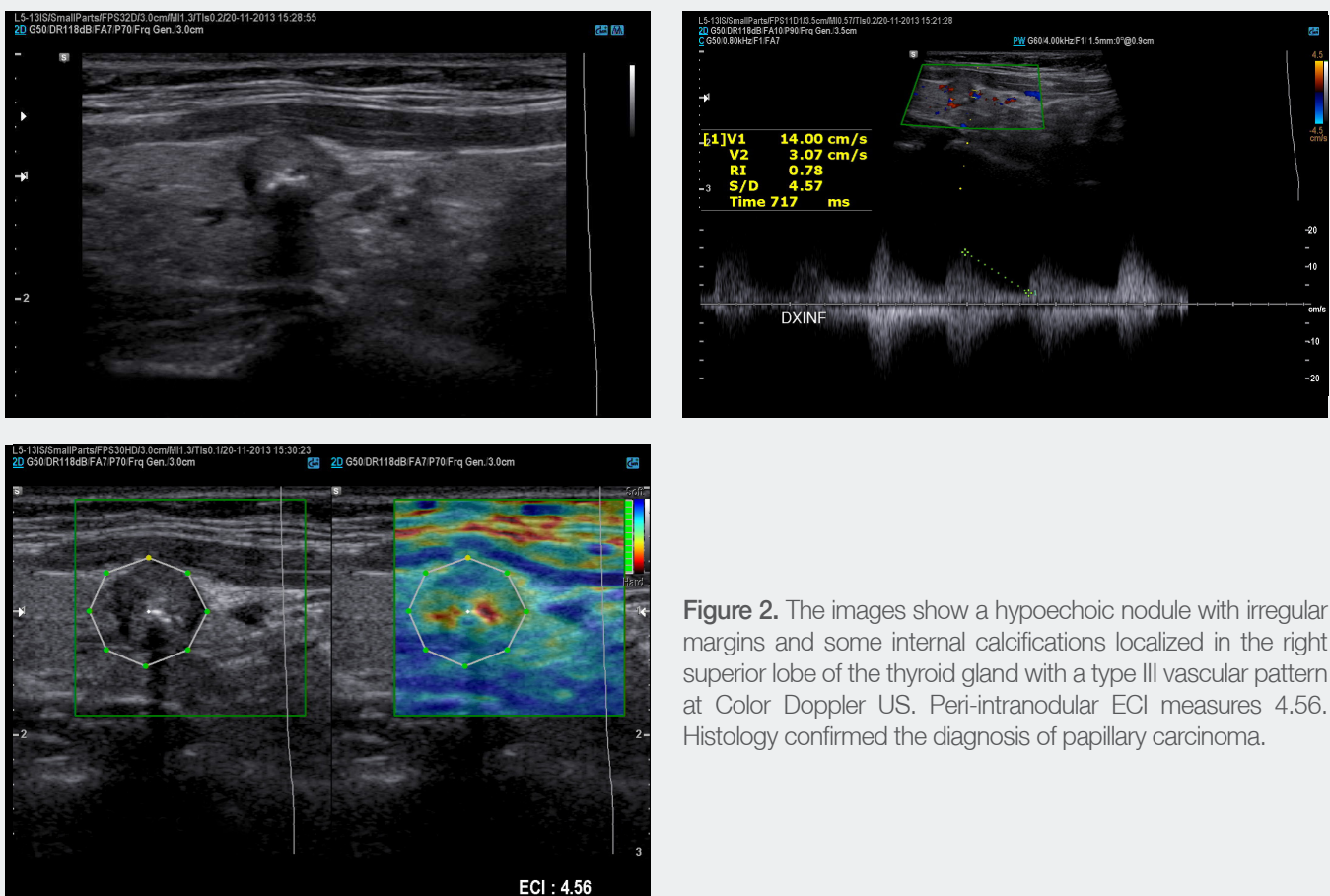

Figure 2. The images show a hypoechoic nodule with irregular margins and some internal calcifications localized in the right superior lobe of the thyroid gland with a type III vascular pattern at Color Doppler US. Peri-intranodular ECI measures 4.56. Histology confirmed the diagnosis of papillary carcinoma.

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Discussion

In the assessment of thyroid nodules, our results suggest that Quasistatic Ultrasound Elastography with the E-Thyroid method may achieve good accuracy and low inter-observer variability.

The low inter-observer variability could be due to variability in images that were selected for measurement with E-Thyroid and to the variability related to the ROI positioning. For this reason, training is mandatory to reduce it.

As a potential limitation, we found that differences related to carotid artery pulsation depending on age, atherosclerosis and hypertension could affect ECI results. Another possible limitation is an isthmic nodule position, away from the carotid. The degree of the operator's hand compression can also influence the ECI result; further testing to better evaluate this variable is warranted.

Keep in mind that gross calcifications within the nodules can provide false positive results, as also reported by the EFSUMB Guidelines 2013[4].

Conclusion

According to EFSUMB 2013 guidelines, USE techniques including E-Thyroid can be considered as an additional tool for differentiating thyroid nodules. Moreover, its high sensitivity, specificity, negative and positive predictive values could be of relevant clinical utility in the pre-surgical selection of patients with indeterminate cytology and in guiding follow up of lesions negative for malignancy at FNA[4]. Training is warranted to achieve good and reproducible results[2].

Supported Systems

(1) RS80A

(2) WS80A

(3) Accuvix A30

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