Shear Wave Elastography: A Non-Invasive Diagnosis for Thyroid Nodules

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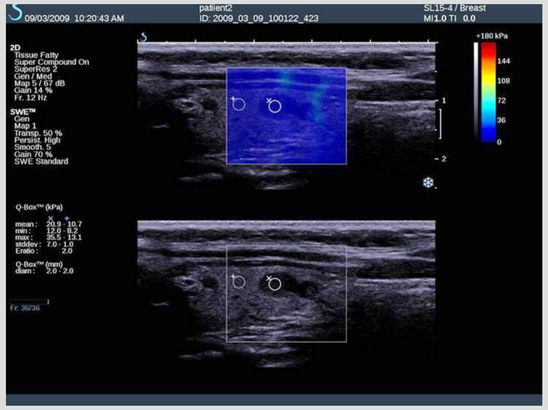
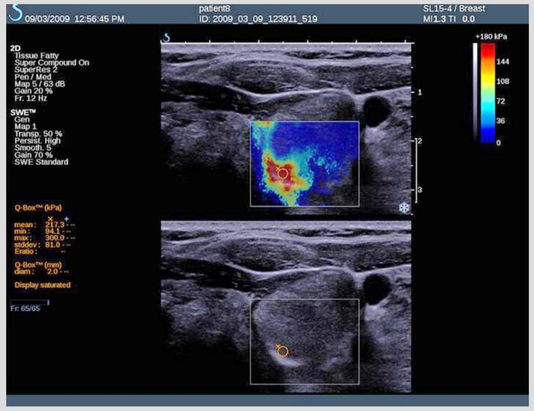
Introduction

Thyroid nodules are a common occurrence in adults and usually are harmless. However, over the past few decades there has been a dramatic increase in the detection of thyroid nodules.[1] This is due to the increased utilization of medical imaging in present day, especially ultrasound. Ultrasound is the primary modality used for detecting nodules. Technology has become more enhanced and increased sensitivity is able to identify smaller thyroid nodules. Shear wave elastography is a new ultrasound technique that is being utilized to diagnose nodules as benign or malignant. This is being considered over the more invasive fine needle aspiration procedure.[2]

Detection and Diagnosis

Ultrasound is one of the main imaging modalities used to detect thyroid nodules and diagnose them as benign or malignant. This is due to the many sonographic features that are present with thyroid nodules. Some of these features consist of microcalcifications, hypoechogenicity (soundwaves penetrability decreases resulting in a darker area), intranodular vasculature, or irregular margins.[2] Another characteristic that has been used to differentiate between benign or malignant is the “taller-than-wide” sign. This is the difference between the anteroposterior measurement and the transverse measurement. If this difference is greater than or equal to 1, the nodule is considered malignant. Ultrasound images were compared to computed tomography images to check the reliability of this finding. The compression of the ultrasound probe could result in incorrect measurements leading to a misdiagnosis.[3]





FIGURES 1 & 2: *The two ultrasound images above utilized shear wave elastography. The image to the left represents a benign finding noted by the blue shade. The image to the right represents a malignant nodule which is noted by the red-colored area.*[2]

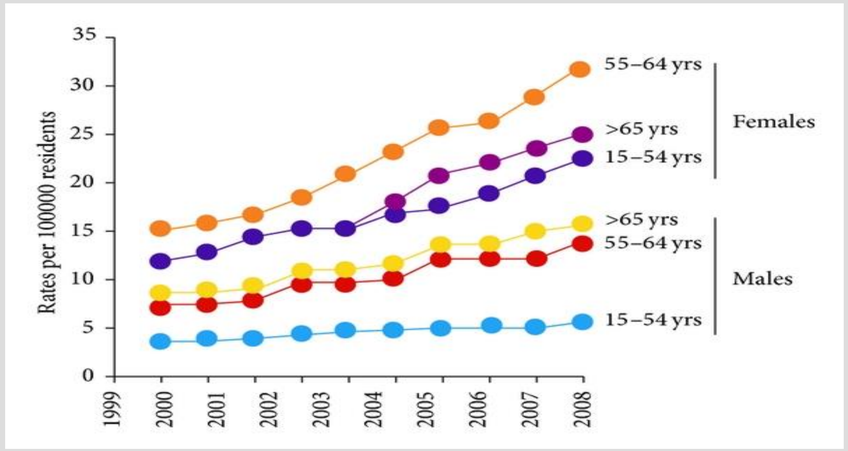


FIGURE 3: *The figure above represents the increase in incidence of thyroid cancer in North America.*[4]

Shear Wave Elastography

The current preferred procedure for nodule diagnosis is fine-needle aspiration. This is an invasive procedure that has been found to be unreliable. There may be inconclusive results that lead to another more invasive procedure involving surgical removal. A new ultrasound technique has been created to decrease the use of invasive techniques and provide accurate diagnoses. Shear wave elastography works in real time to measure the stiffness and elasticity of nodules. Typically, malignant nodules are stiffer than benign nodules so this would help differentiate between the two. Ultra-sonic beams are used to penetrate the thyroid and the machine uses an equation to quantify tissue stiffness. When the image is acquired, blue represents softer tissue and red represents tissue that is stiffer (See Figures 1 & 2). The elasticity index is used to determine whether or not the nodule may be malignant.[2]

Conclusion

In conclusion, shear wave elastography could become one of the first-line procedures for the diagnosis of thyroid nodules. There is still much research that must be conducted in order to prove it is a reliable method. There are many advantages to shear wave elastography that could improve the accuracy of thyroid nodule diagnosis for future cases. This is important because of the increasing incidence of malignant thyroid nodules (See Figure 3).

References

1. American Cancer Society. About Thyroid Cancer. Cancer.org. https://www.cancer.org/cancer/thyroid-cancer/about/what-is-thyroid-cancer.html. Updated April 15, 2016. Accessed October 18, 2017.
2. Sebag F, Vaillant-Lombard J, Berbis J, et al. Shear Wave Elastography: A New Ultrasound Imaging Mode for Diagnosis of Benign and Malignant Tumors. *The Journal of Clinical Endocrinology & Metabolism.* 2010;95(12), 5281-5288.
3. Yoon SJ, Yoon DY, Chang SK, et al. “Taller-Than-Wide Sign” of Thyroid Malignancy: Comparison Between Ultrasound and CT. *American Journal of Reontgenology.* 2010;194, W420-W424.
4. Davies L, Welch HG. Current Thyroid Cancer Trends in the United States. *JAMA Otolaryngology-Head & Neck Surgery.* 2014;140(4), 317-322