Efficacy of Sonoelastography Images in Solitary Cold Thyroid Nodule and Compared with Fine Needle Aspiration Cytology Findings (FNAC)

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ABSTRACT

Objective: **To evaluate the validity of sonoelastography of cold thyroid nodule in diagnosis of malignant nodule with fine needle aspiration cytology analysis as the reference standard.**

Patients and Methods: **This cross sectional study was conducted in the Institute of Nuclear Medicine & Allied Sciences (INMAS), Sir Salimullah Medical College (SMC) & Mitford Hospital campus, Dhaka, from July 2015 to June 2016 in 85 patients with solitary solid cold nodule. Eighty five nodules in these patients were examined by conventional ultrasound, ultrasound elastography and radionuclidescan. The final diagnosis was obtained from cytological findings. Tissue stiffness on ultrasound elastography was scored from 1 (low stiffness over the entire nodule) to 4 (high stiffness over the entire nodule).**

Results: **The mean age was found 33.8±10.1 years with range from 12 to 58 years and male to female ratio was 1:5.1. The mean size of nodules was found 2.0±0.6 cm. Most (40.0%) of the patients were found in elastography score 2, 22(25.9%) score 1, 17(20.0%) score 4 and 12(14.1%) score 3. The validity of elastography scores had sensitivity 77.8%, specificity 86.2%, accuracy 83.5%, positive predictive values 72.4% and negative predictive values 89.3% for prediction of thyroid nodule.**

Conclusion: **Considering the validity parameter the elastography may be effective diagnostic modality for evaluation of thyroid nodule.**

Key word: **Elastography, Thyroid Nodule, Radionuclide Scan.**

INTRODUCTION

Thyroid nodule is an abnormal growth of cells within thyroid gland. Thyroid nodules are very common and are found in 4% to 8% of adults by palpation, 41% by ultrasound, and 50% by pathologic examination at autopsy (1, 2). Most nodules are benign, with less than 5% of them being malignant (3).

Ultrasound (US) elastography has recently been introduced in the clinical work up of thyroid nodules. The US Elastography evaluates the tissue stiffness by measuring its deformation degree in response to stress (4, 5, 6). US elastography applied to distinguish the hardness or elasticity of nodules to differentiate benign from malignant. In a study Rago et al. (2007) reported that the predictivity of ultrasound elastrographic measurement was independent of the nodular size with sensitivity of 100% and specificity 100% (7). In other study, Yurong et al. (2009) showed the sensitivity of elastogram predicted malignancy was 88% with specificity 93% (8). This present study was undertaken to evaluate the efficacy of elastography in solitary cold thyroid nodule correlating with FNAC findings.

PATIENTS AND METHODS

Between July 2015 and June 2016, a prospective evaluation was performed in 85 patients with thyroid nodules referred to ultrasound division at the INMAS, SSMC, Mitford Hospital Campus. The patients who were examined for conventional ultrasound and real-time elastography, radionuclide Scan and the final diagnosis was based on the results of cytological evaluation. Ethical approval from the Medical Research Ethics committee, National Institute of Nuclear Medicine and Allied Sciences and informed

consent were obtained from all patients. Thyroid scan was performed by Dual Head SPECT Gama camera using low energy parallel hole collimator. Thyroid US and US elastography was performed using a real time instrument (Medison, Accuvex A30) with a linear transducer using high frequency from 7-11 MHz.

The patient lied in a supine position with his neck slightly extended. The ultrasound examination started with B mode imaging to assess nodular size and presence of sufficient surrounding reference tissue. The region of interest (ROI) was centered on the lesion, including sufficient surrounding thyroid tissue. The deformity was represented by color scale over the B-mode image that ranged from blue (i.e. softest components with the greatest elastic strain) to red (i.e. hardest component with no strain). Each nodule was assigned an elastography score based on a four-point scale according to the classification proposed by (Itoh et al. 2006) Score 1: Low stiffness over the entire nodule (entirely blue). Score 2: Low stiffness over most of the nodule (almost blue with green spots).Score 3: High stiffness over the most of the nodule (almost red with green spots). Score 4:High stiffness over the entire nodule (entirely red) (9). Score 1 and score 2 considered as benign, score 3 and score 4 considered as malignant. Patients with solitary cold thyroid nodule, solid nodule and nodular size larger than 1 cm were included. Patients with cystic nodule, calcified egg shell nodule, previous history of surgery, toxic nodule, known case of hyper and hypothyroidism were excluded.

RESULTS

According to the age group of the study subjects, it was observed that majority (38.8%) patients belonged to age 31-40 years. The mean age was found 33.8±10.1 years with range from 12 to 58 years. Majority (83.5%) of patients was female and 14(16.5%) patients were male. Male female ratio was 1:5.1. Regarding the consistency of nodules out of 85, majority 48(56.5%) had firm in consistency followed by soft 28(32.9%) and hard 9(10.6%). Elastography score of the study subjects, it was observed that majority (40.0%) patients belong to in elastography score 2, followed by 22(25.9%) score 1, 17(20.0%) score 4 and 12(14.1%) score 3.

Table 1: Distribution of nodular pattern according to elastography findings (n=85)

Elastography findings	Number of subjects	Percentage
Benign (score 1 & 2)	56	65.9
Malignant (score 3 & 4)	29	34.1

Table 1 shows elastographic pattern of the nodules: It was observed that 56(65.9%) patient had benign feature while rest 29(34.1%) had malignant features.

Table 2: Distribution of the study subjects according to FNAC diagnosis (n=85)

FNAC diagnosis	Number of subjects	Percentage
Benign	58	68.2
Malignant	27	31.8

Table 2 shows FNAC diagnosis of the patients. It was observed that 58(68.2%) patients had benign and 27(31.8%) had malignant thyroid nodule.

Table 3: Comparison between elastography scores and FNAC for evaluation of thyroid nodule (n=85)

Elastography scores	FNAC diagnosis	
	Positive (malignant) (n=27)	Negative (benign) (n=58)
Malignant Score 3 & score4 (n=29))	21 (True positive)	8 (False positive)
Benign Score 1 & score 2 (n=56)	6 (False negative)	50 (True negative)

It was found that elastographically 29 positive cases 21 found true positive and rest 8 was false positive. On the other hand, elastography out of 56 negative cases 50 were true negative and rest 6 was false negative in identification of malignancy by FNAC diagnosis.

The validity of elastography scores evaluation for thyroid nodule was correlated by calculating sensitivity (77.8%), specificity (86.2%), accuracy (83.5%), positive predictive values (72.4%) and negative predictive value (89.3%).

DISCUSSION

This cross sectional type of study was carried out with an aim to prove the potentiality of US elastography as an adjunctive tool in case of cold nodule and to evaluate the predictive value of real time US elastography in differentiating benign from malignant nodule and also to reduce the rate of thyroid biopsy as because elasticity is being highly associated with benign cytology that is diagnosed by elastography. This study is performed to find the diagnostic accuracy of new technique and correlate with FNAC and Elastoscan seems to have the potential to be an effective and valuable tool as it provides the elastic evaluation of thyroid nodule with low inter observer variability.

According to elastography score in this study it was observed that majority (40.0%) patients was found in elastography score 2, 25.9% score 1 , 20.0% score 4 and 14.1% score 3 .Gietka-Czernel et al. (2010) found elasticity score 1 was found 6(11.3%), elasticity score 2 was found 17(32.1%), elasticity score 3 was found 10(18.9%) and elasticity score 4 was found 13(24.5%) and elasticity score 5 was found 7(13.2%) of malignant thyroid nodule (10), which is comparable with the current study.

In this present study it was observed that elastography scores evaluation for thyroid nodule, true positive 21 cases, false positive 8 cases, false negative 6 cases and true negative 50 cases in identification of malignancy by FNAC diagnosis. EL-Hariri et al. (2014) study supported the opinion as the score 3–4 was achieved in 21 of 25 malignant nodules 84.0% compared to 9 of 59 benign nodules 15.3%. While the score 1–2 was detected in 50 of 59 benign nodules 84.7% compared to only 4 of 25 malignant nodules 16.0%(11). So the scores of 1 and 2 with Itoh criteria were significantly seen in benign nodules, whereas, scores of 3 and 4 were significantly seen in malignant nodules ($p<0.05$). Regarding the validity of elastography scores had sensitivity 77.8%, specificity 86.2%, accuracy 83.5%, positive predictive values 72.4% and negative predictive values 89.3% for prediction of thyroid nodule. EL-Hariri et al. (2014) found the elastography score of benign and malignant lesions had some overlap and the sensitivity of the elastography score was 84.0%, while the specificity was 84.7%, the PPV was 70%, the NPV was 92.6% and the accuracy was 84.5% (11). Similarly, Wang et al. (2012) found the sensitivity and specificity of the ES for thyroid cancer diagnosis was 78% and 80%, respectively (12).

CONCLUSION

The sensitivity and positive predictive value (PPV) of elastography in diagnosis of malignant lesion in this study was comparatively low however specificity, accuracy and negative predictive value were quite high. This is a preliminary study and considering the validity parameter it can be concluded that elastography scan may be effective diagnostic modality for the evaluation of thyroid nodule.

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