Original Research Paper

Volume-9 | Issue-3 | March-2019 | PRINT ISSN - 2249-555X

Radiology

STRAIN USG ELASTOGRAPHY WITH GRAY SCALE AND COLOUR DOPPLER IMAGING OF THYROID NODULES – EFFICACY COMPARED WITH FNAC

A. Karpagavalli	Barnard Institute Of Radiology, Madras Medical College, Chennai.
Dr. E. Manimekala*	Barnard Institute Of Radiology, Madras Medical College, Chennai.*Corresponding Author
Dr.R.Ravi	Barnard Institute Of Radiology, Madras Medical College, Chennai.
Dr. N. Kailasanathan	Barnard Institute Of Radiology, Madras Medical College, Chennai.

ABSTRACT

CONTEXT: Thyroid nodules are very commonly observed on Thyroid USG. Although conventional USG can provide meaningful information in thyroid nodule diagnosis, there has been considerable variation in diagnostic performance. As a consequence, a significant number of patients eventually receive unnecessary invasive thyroid procedures.
Therefore, improvement and refinement of noninvasive methods to depict malignancy are needed. In this context, US Elastography (USE) has recently been introduced in the clinical workup of thyroid nodules.
AIM: The purpose of the study is to compare sonography combined with USE findings of thyroid lesion with the cytological results of fine needle aspiration cytology (FNAC) and determine the accuracy of ultrasound combined USE findings in diagnosis of thyroid lesions.
METHODS AND MATERIAL: This prospective study was carried in Rajiv Gandhi Government General Hospital for a period of 1 year. Patients were screened as per inclusion and exclusion criteria. A total of 100 patients with thyroid nodules underwent High frequency sonographic examinations and free hand elastography using Hitachi Aloka Arietta S70 Machine. Elastographic images were used and modified Asteria scale were assigned for each focal thyroid lesion. These were then correlated with histopathological results. The ability of these various imaging modalities along with HPE to differentiate between benign and malignant focal thyroid lesions was assessed.
STATISTICAL ANALYSIS USED: The collected data were analysed with IBM.SPSS statistics software 23.0 Version.
RESULTS: The sensitivity of grayscale USG in detecting malignant thyroid nodules was 100% but specificity was 91.8% . Some lesions were overlooked compared with FNAC.
US Elastography showed sensitivity of 100% but specificity was 89.7 % . Here also some lesions were overlooked compared with FNAC. Accuracy of gray-scale US features was mostly higher than that of elastography, but it was not statistically significant .
96 benign nodules and 4 probably malignant nodules were detected by using both techniques. Combining USG gray scale and Elastography showed sensitivity of 100% but specificity was 99% .Overall accuracy was 99.5%.
CONCLUSION:96 benign nodules and 4 probably malignant nodules were detected by using both techniques. Combining USG gray scale and Elastography showed sensitivity of 100% but specificity was 99% .Overall accuracy was 99.5%.

KEYWORDS : GRAY SCALE USG , USE, THYROID NODULES , FNAC , BENIGN, MALIGNANT

INTRODUCTION:

Ultrasound elastography is an easily applicable, non contrast enhanced, non invasive and fast imaging method that can be performed during the primary sonographic examination of the patient This study aimed at prospectively evaluating if ultrasound elastography could be an additional useful tool in the characterisation of focal thyroid lesions, thereby aiding in further management.

The Clinical challenge is to distinguish the few clinically significant malignant nodules from the many benign nodules and thus identify patients who need surgical excision.

AIM AND OBJECTIVES:

To compare sonography combined with USE findings of thyroid lesion with the results of fine-needle aspiration cytology and determine the accuracy of ultrasound combined USE findings in the diagnosis of thyroid lesions.

Ultrasonographic and USE evaluation of thyroid lesions and to classify the lesions as benign ,intermediate or malignant.

To compare the accuracy of Ultrasonographic findings with fine needle aspiration cytology (FNAC) in the diagnosis, sensitivity, specificity ,PPV,NPV and overall accuracy.

SUBJECTS:

Patients with focal thyroid lesions referred for routine neck USG were included in this study during the period of 1 year. The patients were selected by the following inclusion & exclusion criteria.

Inclusion Criteria:

- Physical examination suggestive of palpable thyroid swelling in lower neck in midline or on either side.
- Signs and symptoms suggestive of thyroid Disorder (both hypo or hyperthyroidism)

Exclusion Criteria:

- Patient not willing for study
- Patient already diagnosed and treated for thyroid disorder
- Pregnancy
- FNAC showing inadequate aspirated material.

MATERIALS AND METHODS:

Patients with focal liver lesions underwent abdominal sonographic examination and elastography using 3.5MHz convex probe in Hitachi Aloka Arietta S70 machine.

Strain Wave Elastography (SE)

- Patients in the supine position & neck extended with the probe in the neck region with sufficient gel.
- Strain USE detects the local deformation (strain) under slight pressure and displays it as a relative value in comparison to the strain values of the different tissues within the region of interest.
- This results in the elastographic image, also known as elastogram, which is represented as a color coded image superimposed in the B-mode image and displayed next to it on the screen. The quality of the operator's free-hand pressure is visualized on the screen as a sinewave allowing the operator to assess the validity of the compression cycles in real-time.
- This technique allows a qualitative and a semiquantitative assessment of nodule elasticity. The qualitative assessment (elastogram) represents a mapping of the amount of tissue strain at each location .
- Color coding depends on the system and usually blue represents hard, stiff tissue with lowest elastic strain or no strain), red represents soft tissue (with greatest elastic strain), and green or

orange represents intermediate level of stiffness.

A modified Asteria scale is used. It consists of a five-step system :

- Pattern 1: The entire nodule section is diffusely elastic.
- Pattern 2: The formation appears to be largely elastic with the inconstant appearance of anelastic areas during the real time examination.
- Pattern 3: constant presence of large anelastic areas is seen at the periphery(Pattern 3A) or center (Pattern 3B) of the formation.
- Pattern 4: uniformly displayed anelasticity throughout the whole nodule.

Lesions that present Pattern 1 or 2 are classified as probably benign, while Patterns 3 and 4 are indicative of probable malignancy.

RESULTS:

In this evaluation of 100 thyroid nodules, 96 benign nodules and 4 probably malignant nodules were detected by combining USG and USE . Out of 3 cases of carcinoma detected by FNAC , all are detected by combining both techniques . The combination yielded improvement with 99% specificity and 99.5% overall accuracy with a highly significant p value($p < 0.01$). , whereas USG alone had 91.8% specificity and 95.9 % overall accuracy.

CONCLUSION:

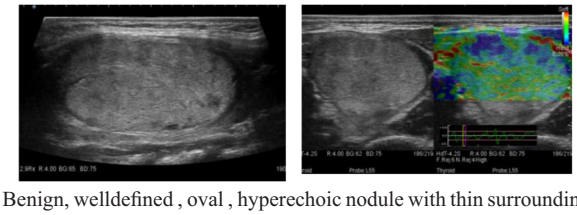
According to this study , it can be concluded that USG in combination with elastography is an cost effective , non invasive and feasible technique to detect malignant thyroid nodule with a high specificity. US Elastography is a useful complement to gray scale US, enhancing its accuracy in detecting malignant thyroid nodules.

Given the high prevalence of thyroid nodules and the substantial costs related to their workup and management, USG in combination with elastography could be a valuable tool for a better selection of patients with thyroid nodules for FNAC or Biopsy .

Gray scale USG in combination with elastography may also be used to guide the follow-up of suspicious lesions negative for malignancy at FNAC

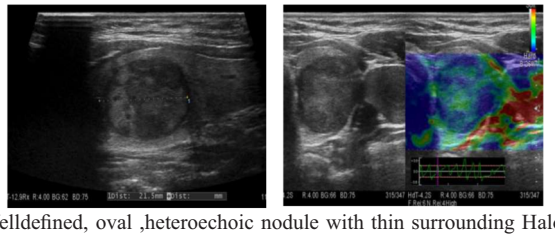
REPRESENTATIVE CASE:

CASE 1 :



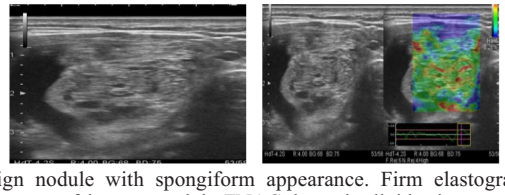
Benign, welldefined , oval , hyperechoic nodule with thin surrounding halo. Predominantly firm elastographic appearance of the same nodule Which was HPE proven hyperplastic nodule.

CASE 2:



Welldefined, oval ,heteroechoic nodule with thin surrounding Halo. Predominantly hard elastographic appearance of the same Nodule. FNAC shows papillary carcinoma

CASE 3:



Benign nodule with spongiform appearance. Firm elastographic appearance of the same nodule. FNAC showed colloid goiter.

TABLES :

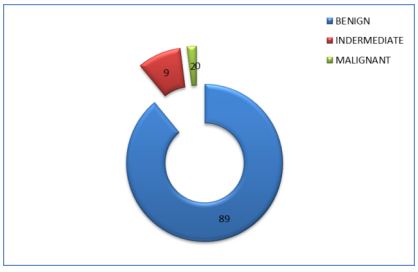
Frequency and characterisation of lesion by gray scale findings

	FREQUENCY	PERCENT
BENIGN	89	89
INDETERMINATE	9	9
MALIGNANT	2	2
TOTAL	100	100

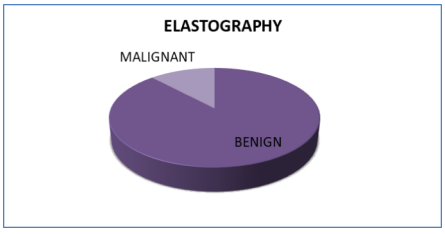
Comparision of grayscale findings and FNAC

GRAY SCALE FINDINGS	FNAC		Total
	Malignant	Benign	
Malignant	3	8	11
Benign	0	89	89
Total	3	97	100

Sensitivity	Specificity	PPV	NPV	OVERALL ACCURACY
100	91.8	27.3	100	95.9



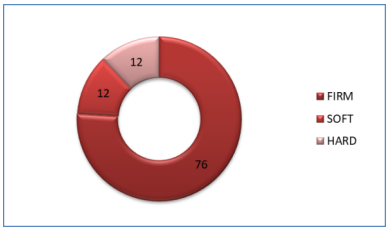
Pie chart of charecterisation of lesion by elastography



Frequency and charecterisation of lesion by elastography

	FREQUENCY	PERCENT
BENIGN	88	88
MALIGNANT	12	12

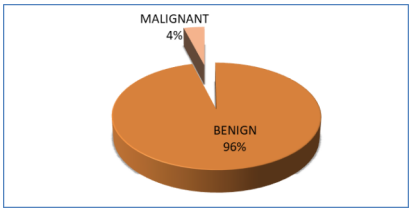
Frequency and characterisation of elastographic findings



Diagnostic performance of elastography in detecting malignant thyroid nodule

Sensitivity	Specificity	PPV	NPV	OVERALL ACCURACY
100	89.7	23.1	100	94.85

Pie chart representing characterisation of lesion by USG –grayscale findings with elastography

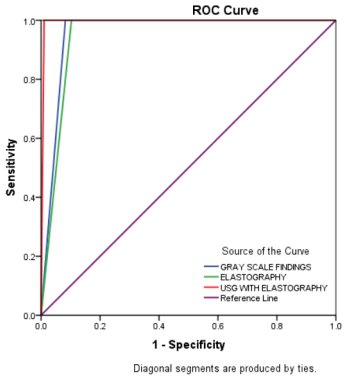


Diagnostic performance of USG grayscale imaging with elastography in detecting malignant thyroid nodule.

Sensitivity	Specificity	PPV	NPV	OVERALL ACCURACY
100	99	75	100	99.5

Frequency and characterisation of lesion by USG –grayscale findings with elastography

	FREQUENCY	PERCENT
BENIGN	96	96
MALIGNANT	4	4



REFERENCE:

1. Solbiati L. La tiroide e le paratiroidi [The thyroid and the parathyroid].In: Rizzatto G, Solbiati L, editors. Anatomia Ecografica: quadri normali, varianti e limiti con il patologico.
2. Milan: Masson; 1992. p. 35-45. Jarlov AE, Hegedus L, Gjorup T, Hansen JE. Accuracy of the clinical assessment of thyroid size. Dan Med Bull 1991;38:87-89.
3. Kerr L. High-resolution thyroid ultrasound: the value of color Doppler. Ultrasound Q 1994;12:21-43.
4. Favus MJ, Schneider AB, Stachura ME, et al. Thyroid cancer occurring as a late consequence of head-and-neck irradiation: evaluation of 1056 patients. N Engl J Med 1976;294:1019-1025.
5. DeGroot LJ, Reilly M, Pinnameneni K, Refetoff S. Retrospective and prospective study of radiation-induced thyroid disease. Am J Med 1983;74:852-862.
6. Grebe SK, Hay ID. Follicular cell–derived thyroid carcinomas. Cancer Treat Res 1997;89:91-140.
7. Solbiati L, Cioffi V, Ballarati E. Ultrasonography of the neck. Radiology.Clin North Am 1992;30:941-954.
8. Muller HW, Schroder S, Schneider C, Seifert G. Sonographic tissue characterisation in thyroid gland diagnosis: a correlation between sonography and histology. Klin Wochenschr 1985;63:706-710.
9. Lagalla R, Caruso G, Midiri M, et al. Echo Doppler-couleur et pathologie thyroidienne. JEMU 1992;13:44-47.
10. Solbiati L, Ballarati E, Cioffi V. Contribution of color-flow mapping to the differential diagnosis of the thyroid nodules. Radiological Society of North America; 1991 [abstract].
11. Solbiati L, Volterrani L, Rizzatto G, et al. The thyroid gland with low uptake lesions: evaluation by ultrasound. Radiology 1985;155: 187-191.
12. Schlumberger MJ, Filetti S, Hay ID. Nontoxic goiter and thyroid neoplasia. In: Larsen PR, Kronenberg HM, Melmed S, et al, editors. Williams textbook of endocrinology. 10th ed. Philadelphia: Saunders; 2003. p. 457-490.
13. Black BM, Kirk Jr TA, Woolner LB. Multicentricity of papillary adenocarcinoma of the thyroid: influence on treatment. J Clin Endocrinol Metab 1960;20:130-135.
14. Wunderbaldinger P, Harisinghani MG, Hahn PF, et al. Cystic lymphnode metastases in papillary thyroid carcinoma. AJR Am J Roentgenol 2002;178:693-697.
15. Pilotti S, Pierotti MA. Classificazione istologica e caratterizzazione molecolare dei tumori dell'epitelio follicolare della tiroide. Argomenti Oncol 1992;13:365-380.