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Diagnostic utility of gray scale ultrasound and elastography in solitary thyroid nodules

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Abstract

Background*: An elevated risk of cancer is linked to a firm and hard thyroid nodule upon palpation. Palpation is a personal experience. Elastography was developed to objectively assess tissue hardness and improve gray-scale ultrasonography's (US) diagnostic precision.*

Goals: *To assess the diagnostic value of elastography and gray-scale ultrasonography (US) in distinguishing between benign and malignant thyroid nodules.*

Materials and methods: *Our Dhiraj General Hospital conducted a six-month retrospective examination of the Gray scale US and elastography of 70 solid thyroid nodules in 50 patients. Using a generalized estimating equation, the diagnostic performance of grayscale US, Elastography with Rago and Asteria criteria, and Odd's ratios (ORs) with 95% CIs for predicting thyroid cancer were compared with the gold standard FNAC.*

Results: *70 solid thyroid nodules in 50 patients were evaluated. 21 were malignant and 49 were benign. Sensitivity, negative predictive value (NPV), and Odd's ratio(OR) of gray-scale US for the 70 nodules were 91.6%, 94.5% and 22.2 respectively, and these values were higher than the 15.6% and 65.3% sensitivity, 71.6% and 79.2% NPV and 3.6 and 2.7 ORs found for elastography with Rago and Asteria criteria, respectively.*

Conclusion: *Elastography alone as well as the combination of elastography and gray-scale US showed inferior performance in the differentiation of malignant and benign thyroid nodules compared with gray-scale US features. Hence elastography is not a useful tool in recommending FNAC.*

Key words: *Gray scale US imaging, Elastography, FNAC, Thyroid nodule.*

INTRODUCTION

An elevated risk of cancer is linked to a firm and hard thyroid nodule upon palpation [1]. It is subjective to palpate [2, 3, 4]. In order to improve the diagnostic precision of gray-scale ultrasonography (US) and to objectively assess tissue hardness, elastography was developed [5, 6]. The cellularity and content of thyroid nodules determine their rigidity [7].

The fundamental idea behind US elastography is that when the thyroid tissue is compressed, strain (longitudinal displacement of the tissue) is created inside the tissue; the strain is less in harder tissues than in softer ones [8].

Since malignant thyroid nodules are harder than the surrounding adjacent parenchyma, elastography can be used to distinguish between them [2, 3, 7, 9].

Elastography has been evaluated :

- Without comparison with gray-scale US features
- With each gray scale US feature
- With combinations of a few suspicious gray-scale US features [2, 3, 9].

Aim and Objectives

- To evaluate the diagnostic utility of gray-scale US and elastography in differentiating benign and malignant thyroid nodules.
- To evaluate the diagnostic utility of elastography either as an adjunctive diagnostic tool to gray-scale US or as a separate diagnostic tool.

MATERIALS AND METHODS

A retrospective analysis using Gray scale US and Elastography of 70 solid thyroid nodules in 50 patients was done in our Dhiraj General Hospital over a 6 month period.

Consent: Institutional review board with waiver of informed consent

Type of study: Retrospective

Study period: June to November, 2024

Sample size: 70 solid thyroid nodules in 50 patients

Gender: 51 Females, 19 Males

Age range: 18-79 years

73 thyroid nodules were imaged at gray-scale US, elastography, and US-guided fine-needle aspiration (FNA) was performed. 3 nodules containing cystic components were excluded.

Diagnostic performances of gray scale US, Elastography with Rago and Asteria criteria (**Photo – 1, 2**), and odds ratios (ORs) with 95% confidence intervals for predicting thyroid malignancy were compared with gold standard FNAC using generalized estimating equation.

Photo – 1: RAGO criteria.

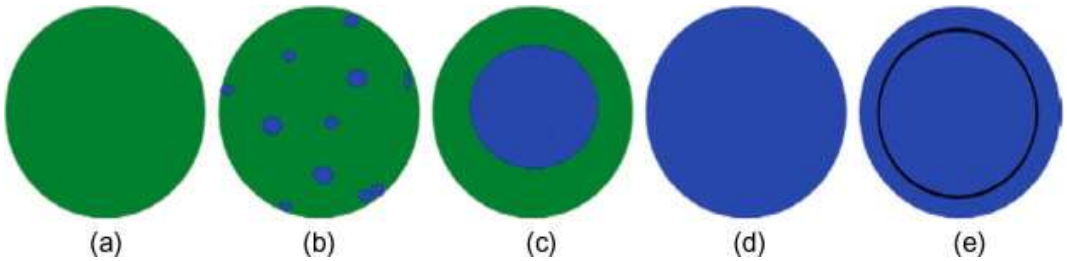
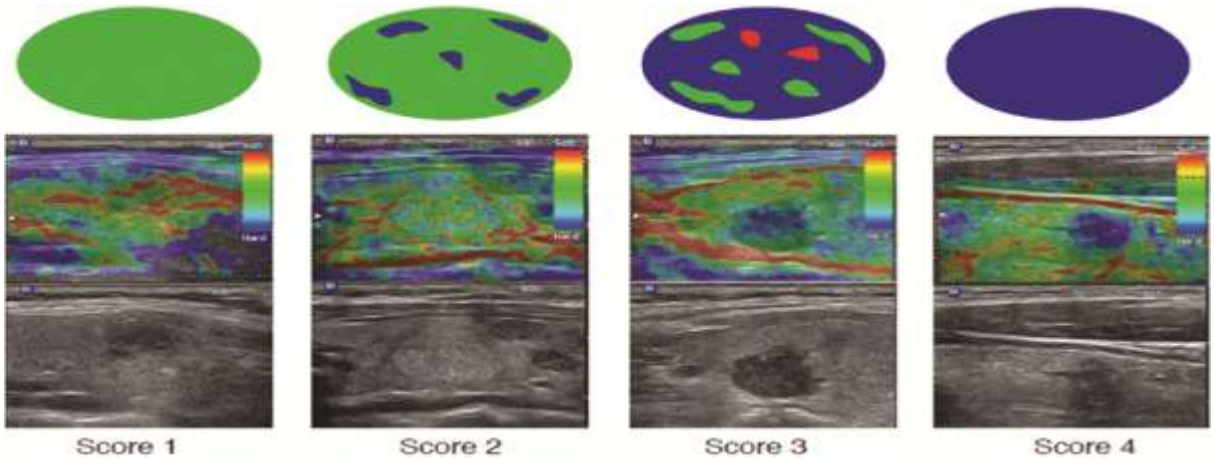


Photo – 2: ASTERIA criteria.



Images were reviewed for the presence of solitary thyroid nodule. If present, the following nodular characteristics were recorded:
Real time gray-scale US using 6-14 MHz linear array transducer
Gray scale features

- Internal component
- Echogenicity
- Margins
- Calcification
- Shape

Findings at elastography were classified according to the

- Rago criteria
- Asteria criteria

Extent of strain: Red: greatest strain (i.e., softest component), to Blue: no strain (i.e., hardest component).

RESULTS AND DISCUSSION

Odd's ratio with 95% Confidence interval was applied (**Table – 1**). Generalized estimating equation analysis was used.

Table – 1: RAGO and Asteria criteria.

	Sensitivity	**Negative predictive value**	**Odd's Ratio**
Gray scale US	91.6%	94.4%	22.2
Rago criteria	15.6%	71.6%	3.6
Asteria criteria	65.3%	79.2%	2.7

Demographic and Pathologic Characteristics Mean age of patients with malignant nodules was younger than that of patients with benign nodules Sex ofpatients was not associated with malignancy.

Each Gray-Scale US and Elastography Feature Associated with Malignancy

Of 70 nodules, 21 were malignant and 49 were benign.

Gray-scale US features of marked hypoechogenicity, poorly defined margin, microcalcifications, a shape that is taller than wide, and suspicious assessment were more significantly seen in malignant nodules than benign nodules.

Scores of 4 and 5 with Rago criteria and scores of 3 and 4 with Asteria criteria were also more significantly seen in malignant nodules than in benign nodules.

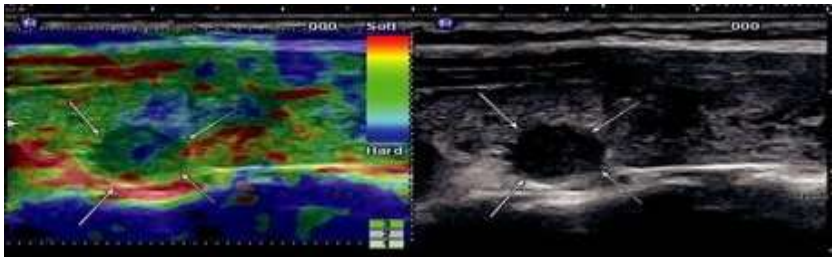
Cases

1) A 43 year old woman who underwent routine checkup.

A 12 mm left thyroid nodule (arrows) with marked hypoechogenicity, poorly defined margins, microcalcifications, and a taller-than- wide shape was found at gray-scale US and assessed as suspicious (**Photo – 3**).

A score of 3 with both Rago and Asteria criteria, was assigned at elastography. This thyroid nodule was diagnosed as papillary thyroid carcinoma at cytologic evaluation.

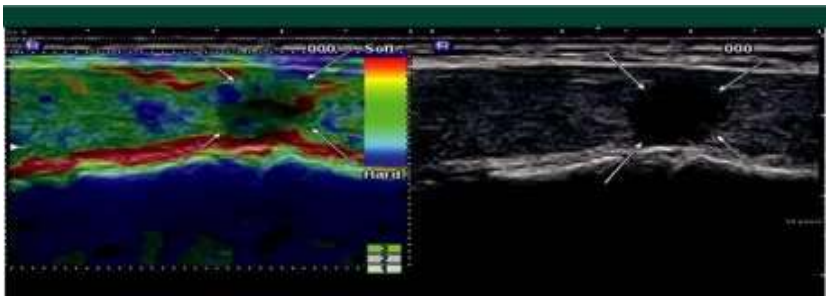
Photo – 3: Gray-scale US.



2) A 47 year old man who underwent routine checkup.

A 9 mm right thyroid nodule (arrows) with hypoechogenicity, poorly margins, and taller- than-wide shape was found at gray-scale US and assessed as suspicious. A score of 3, with both Rago and Asteria criteria, was assigned at elastography. This thyroid nodule was diagnosed as papillary thyroid carcinoma at cytologic evaluation and surgery **(Photo – 4)**.

Photo – 4: Gray-scale US.



CONCLUSION

Elastography alone as well as the combination of elastography and gray- scale US showed inferior performance in the differentiation of malignant and benign thyroid nodules compared with gray-scale US features.

Elastography is not a useful tool in recommending FNAC.

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