Original Research Article

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

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Abstract

Background: A firm and hard thyroid nodule on palpation is associated with an increased risk of malignancy .Palpation is subjective. Elastography has been introduced to evaluate the tissue hardness objectively and to augment the diagnostic accuracy of gray-scale ultrasonography (US).
Aim and objectives: To evaluate the diagnostic utility of gray-scale ultrasonography (US) and elastography in differentiating benign and malignant thyroid nodules.
Materials and methods: A retrospective analysis of 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. Diagnostic performances of gray scale US, Elastography with Rago and Asteria criteria, and Odd's ratios (ORs) with 95% confidence intervals for predicting thyroid malignancy were compared with gold standard FNAC using generalized estimating equation.
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

A firm and hard thyroid nodule on palpation is associated with an increased risk of malignancy [1]. Palpation is subjective [2, 3, 4]. Elastography has been introduced to evaluate the tissue hardness objectively and to augment the diagnostic accuracy of gray-scale ultrasonography (US) [5, 6]. The stiffness of thyroid nodules is dependent on the composition and cellularity of the nodule [7].

The basic concept of US elastography is that compression applied to the thyroid tissue produces the strain (tissue displacement in longitudinal direction) within the tissue, and the amount of strain is less in harder tissues than in softer ones [8].

Elastography is useful in differentiating malignant from benign thyroid nodules as malignant nodules are harder than the surrounding adjacent parenchyma [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: January to June, 2019
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.

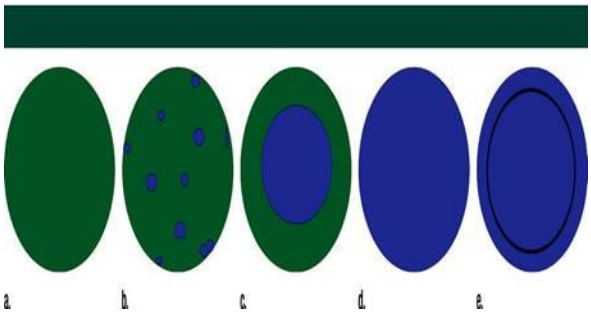
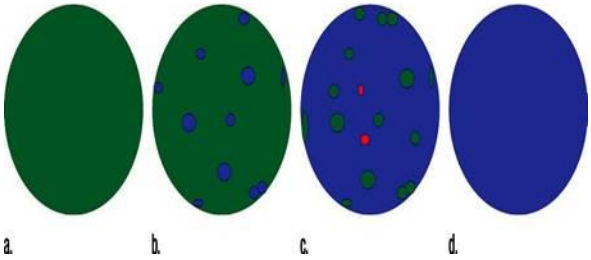


Photo – 2: ASTERIA criteria.



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 of patients 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

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**).

Photo – 3: Gray-scale US.

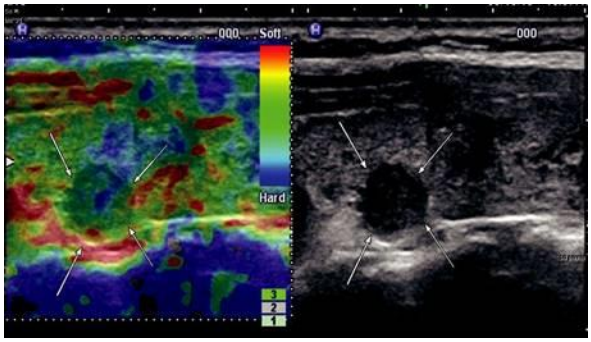
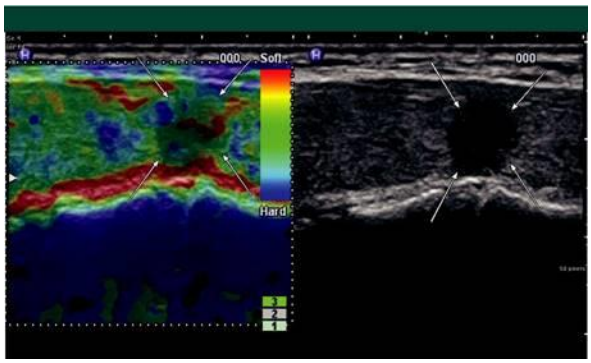


Photo – 4: Gray-scale US.



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.

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**).

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.

Limitations

- Reference standard used was – cytology: 48 nodules in 33, histopathology: 22 nodules in 17, No surgical confirmation was done for all nodules. False-negative cytologic results may have existed.
- Cystic nodules were excluded.
- Most of 21 malignancies are papillary thyroid carcinomas and their variant form. There is debate in nodules with indeterminate cytology.

References

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