

Original research article

## The Diagnostic Accuracy Of Strain Elastography Using Color Mapping In Differentiation Of Benign And Malignant Thyroid Nodules

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### Abstract

Although ultrasound has a high sensitivity for detecting thyroid nodules, its diagnostic performance for differentiating between benign and malignant nodules is quite poor. There is no one feature or combination of features in conventional ultrasonography that is sufficiently sensitive or specific to identify all malignant nodules. After obtaining approval and clearance from the institutional ethics committee, the patients fulfilling the inclusion criteria were enrolled for the study. On strain elastography color scoring among 21 malignant nodules, 16 nodules had an elasticity score  $>3$  and remaining 5 nodules had a score of  $<3$  on elastography color scoring. However, among 39 benign nodules all of them showed soft elasticity, that is score of  $<3$  but 5 of the malignant lesions also showed score of  $<3$ . On strain elastography on strain ratio 19 (32% of total patients) patients were suspicious of malignancy which had a ratio of more than 2.8. The rest 41 (68%) were categorized as benign which had a ratio of less than 2.8.

**Keywords:** Strain elastography, color mapping, thyroid nodules

### Introduction

According to reports, 33% of unselected adults between the ages of 18 and 65 and 50% of those over the age of 65 have thyroid nodules. Although benign thyroid nodules predominate, 5%-15% of thyroid nodules are malignant. Although ultrasound has a high sensitivity for detecting thyroid nodules, its diagnostic performance for differentiating between benign and malignant nodules is quite poor. There is no one feature or combination of features in conventional ultrasonography that is sufficiently sensitive or specific to identify all malignant nodules <sup>[1]</sup>.

In order to evaluate thyroid localised lesions, ultrasonography and fine-needle aspiration biopsy (FNAB) are now the two methods most frequently utilised. While ultrasonography has a high sensitivity for finding thyroid nodules, it performs poorly as a diagnostic tool for identifying benign from malignant nodules. The proficiency and

expertise of the operators and cytopathologists determine how well the FNAB performs. For the remaining 25-35% of instances, repeated FNAB is advised, which raises the risk of consequences like bleeding, infections, and discomfort. Even in expert centres, FNAB is only reliable in 65-75% of cases. Therefore, it is necessary to improve and perfect non-invasive techniques for demonstrating malignancy [2].

**Methodology**

**Source of Data**

Patients presenting with thyroid nodules to Department of Radiodiagnosis referred from hospitals attached to Bangalore Medical College and Research Institute.

**Study Design:** Cross sectional Study.

**Inclusion Criteria**

1. Adult 18 years of age and above.
2. All patients with either nodular thyroid disease or solitary thyroid nodule.
3. Patient willing to informed consent.

**Exclusion Criteria**

1. Nodules that reveal cystic changes on ultrasound.
2. Nodules that show presence of calcified shell on ultrasound.
3. Patient with no FNAC/histopathology diagnosis.

**Methodology for Data Collection**

After obtaining approval and clearance from the institutional ethics committee, the patients fulfilling the inclusion criteria were enrolled for the study.

**Results**

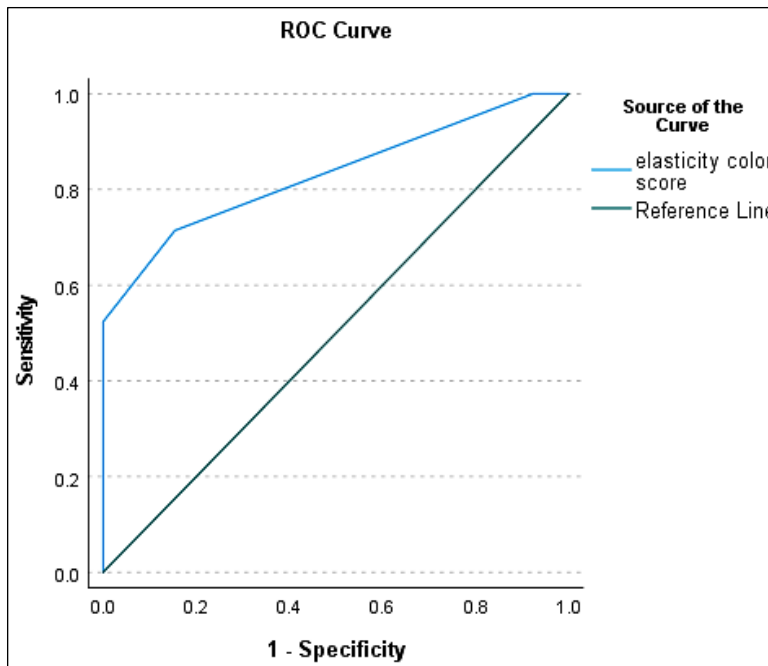
**Table 1:** Age Distribution of Thyroid Nodules

Age	Number of participants	Percentage
20-29	9	15.0
30-39	19	31.7
40-49	19	31.7
50-59	13	21.7
Total	60	100.0

They were aged between 20 and 60 years with mean age of 41.13 years. Majority (38) patients were in the age group 30 to 50 years.

**Table 2:** Strain Elastography Color Mapping of Thyroid Nodules

Elastography color scoring	No. of participants	Percentage
Positive for malignancy (Score of 4-5)	16	27
Negative Score of (1-3)	44	73
Total	60	100.0

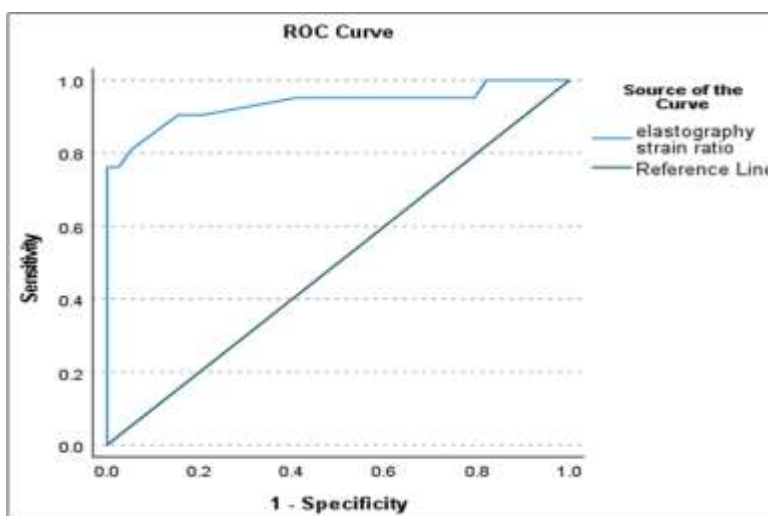


**Fig 1:** ROC curve for Elastography color scoring of thyroid nodules

On strain elastography on strain ratio 19 (32% of total patients) patients were suspicious of malignancy which had a ratio of more than 2.8. The rest 41 (68%) were categorized as benign which had a ratio of less than 2.8.

**Table 3:** Strain Ratio of Thyroid Nodules

Elastography strain ratio	No. of participants	Percentage
Positive for malignancy	19	32
Negative	41	68
Total	60	100.0



**Fig 2:** ROC curve for strain ratio of thyroid nodules

## On Bethesda Classification of FNAC

### Discussion

On strain elastography color scoring among 21 malignant nodules, 16 nodules had an elasticity score  $>3$  and remaining 5 nodules had a score of  $<3$  on elastography color scoring. However, among 39 benign nodules all of them showed soft elasticity, that is score of  $<3$  but 5 of the malignant lesions also showed score of  $<3$ . The sensitivity, specificity, PPV, NPV and accuracy of strain elastography color scoring was 76%, 100%, 100%, 89% and 92% respectively. This observation is comparable to study of Rago T *et al.* in which scores 1 and 2 were found in 49 cases, all benign lesions; score 3 in 13 cases, one carcinoma and 12 benign lesions; and scores 4 and 5 in 30 cases, all carcinomas<sup>[3]</sup>.

The elasticity score of 4 was highly predictive of malignancy ( $P < 0.001$ ), with a sensitivity of 98%, a specificity of 100%, a positive predictive value of 100%, and a negative predictive value of 98%. This finding was similar to the study by Yang *et al.* (2017)<sup>[65]</sup>, where in 86 (86%) benign thyroid nodules were classified as score I and II, and 45 (90%) malignant thyroid nodules were classified as score III and IV, also found that the sensitivity and specificity of USE score of  $\geq$  III for detecting malignant nodules were 90% and 86% respectively.

A prospective cross-sectional study conducted by Muthiah nachiappan *et al.* (n=65) published in 2018, showed elastography has proven to be a good adjunct tool in assisting USG in the diagnosis and differentiation of benign versus malignant nodules. The elastography score malignancy was seen in 81.3% of malignant nodules with over all sensitivity of 92.86% and specificity of 94.12%, PPV of 81.25% and NPV of 97.96%. Thus, concluded that elastography safe, simple and repeatable test without radiation exposure to the patient, it is worthy of being included in the routine diagnostic work up. It also helps in the choice of nodule/s for FNA/Biopsy and reduces the number of FNA procedure<sup>[4]</sup>.

On strain elastography strain ratio among 21 malignant nodules, 19 nodules had ratio of  $>2.8$  and remaining 2 nodules had a ratio of  $<2.8$ . However, among 39 benign nodules all of them showed ratio of  $<2.8$  but 2 of the malignant lesions also showed ratio of  $<2.8$ . The sensitivity, specificity, PPV, NPV and accuracy of strain elastography color scoring was 90%, 100%, 100%, 95% and 96% respectively.

Overall combination of grey scale ultrasound, color Doppler, elasticity color scoring and mean strain ratio gives higher accuracy in differentiating benign and malignant thyroid nodules and hence reduces the number of fine needle aspirations needed.

### Conclusion

When evaluating thyroid nodules, combining elastography with ultrasonography is a rapid and simple way to get extra data to distinguish between benign and malignant aetiologies.

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