

Role of Ultrasonography in Thyroid Nodules with Pathological Correlation

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ABSTRACT

Introduction: Thyroid nodules are commonly detected pathology. Ultrasound has emerged as the most useful imaging modality for evaluation of these lesions. The purpose of this study was to identify the accuracy of various imaging features in thyroid nodules that are associated with benignity and malignancy and the overall accuracy of ultrasound in determining malignant nodules.

Material and methods: Fifty seven patients who were referred to our department for ultrasound assessment of thyroid nodules and their pathological findings were available were included in the study.

Results: Out of the 57 seven patients, 25 patients had malignant nodules and 32 patients had benign nodules. Nodules were assessed on the basis of echogenicity, central vascularity, calcification, cystic areas, background thyroid changes and lymphadenopathy.

Conclusion: Ultrasound is a sensitive and specific modality in assessment of thyroid nodules with good overall accuracy. The most sensitive parameter in suspecting malignancy is hypo echogenicity of the nodule, the most specific features are lymphadenopathy and micro calcification.

Keywords: Ultrasound, thyroid, accuracy, micro calcification, sensitivity, specificity.

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of various ultrasound parameters were assessed in detecting malignant thyroid nodules.

The nodules were assessed on the basis of echogenicity, calcification, internal vascularity, cystic areas, lymphadenopathy and background thyroid changes.

The nodules were classified as hypoechoic when they were of lower echogenicity when compared to the thyroid gland, hyperechoic when nodule was more echogenic when compared to background thyroid parenchyma.

The calcification was classified into microcalcification (for tiny calcification without shadowing and measuring about 1mm) and macrocalcification (calcification with shadowing measuring more than 1mm, including coarse and curvilinear calcification). Presence of internal vascularity on Doppler, and cystic areas was documented. Lymphadenopathy was diagnosed when nodes were enlarged by more than 1 cm in their short axis or had microcalcification or cystic areas (irrespective of size) and architectural distortion. The architecture of rest of the thyroid was assessed for presence of adenomatous hyperplasia, colloid nodules and Hashimoto's thyroiditis.

The final ultrasound diagnosis based on these findings was correlated with FNAC and histologic assessment on post thyroidectomy specimen when available.

STATISTICAL ANALYSIS

Descriptive statistics was used to infer results. Microsoft excel was used to generate tables.

RESULTS

In our study ten male patients presented with nodules out of which 40% were malignant and 47 female patients had nodules out of which malignancy was reported in 44.6% of patients. The nodules assessed in our study ranged from 5mm to 5 cms.

In our study 51% (29) nodules were hypoechoic, 49% (28) nodules were hyper echoic. Central vascularity was present in 68.4% (39) patients and no significant central vascularity was seen in 31.5% (18) patients. No calcification was iden-

INTRODUCTION

Thyroid nodules are commonly detected pathology. It is found in 4-8% of patients by palpation and 10-41%¹ by ultrasound. Ultrasound has emerged as the most useful imaging modality for evaluation of these lesions² as it is easily available, has superior resolution, helps classify lesions, detects non palpable nodules and guides for fine needle aspiration of suspicious nodules.

The purpose of this study was to identify the accuracy of various imaging features in thyroid nodules that are associated with benignity and malignancy and the overall accuracy of ultrasound in determining malignant nodules.

MATERIAL AND METHODS

The retrospective study was done for a period of one year in a tertiary cancer referral hospital. We analyzed 57 patients who had thyroid nodules on imaging.

Inclusion and exclusion criteria: Patients who were referred to our department for assessment of thyroid nodules and their pathological work up was done. The nodules that were not evaluated were excluded from the study. Ethical clearance was obtained from the institution and informed consent was obtained from the patient.

The high resolution ultrasound findings were correlated with fine needle aspiration cytology (FNAC) report and the histopathological report (HPE) whenever available.

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tified in 54.3% (31) patients, macro calcification was seen in 26.3% (15) patients, micro calcification was seen in 17.5% (10) patients and one patient had mixed macro calcification and micro calcification(1.7%). Cystic areas were identified in 23% patients, two patients had honeycombing and 56.1% (32) patients had no cystic areas. Four patients had significant nodes two of these patients had micro calcification in the nodes and other two had no calcification. Normal thyroid background was present in 67% (38)patients; colloid/adenomatous hyperplasia changes were seen in background thyroid in 29.8% (17) patients, Hashimoto's thyroiditis was seen in 2 patients.

The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of each feature were calculated and are given in table 1. The sensitivity of hypoechogenicity, central vascularity, calcification, microcalcification, lymphadenopathy was 84%, 74%, 64%, 29% and 16% respectively. The specificity of hypoechogenicity, central vascularity, calcification, microcalcification, lymphadenopathy was 75%, 48%, 65%, 94%, and 100% respectively in diagnosing malignant nodules.

DISCUSSION

In our study an average of 42.2% malignant nodules were reported. The higher incidence of malignancy reported in our study is due to the fact that our center is a tertiary referral center.

The sensitivity of hypoechogenicity in predicting malignancy was 84%, the specificity was 75% and the accuracy was 78.9%. According to a study by Papini et al, the sensitivity

of hypoechoic nodules in predicting malignancy was 87%, which is similar to our study. Benign nodules were hypoechoic in 55% of cases.³

Central vascularity had a sensitivity of 74.1%, specificity of 48% and accuracy of 78.9% in predicting malignancy in our study. Intrinsic hyper vascularity is a feature of malignant nodules and is defined as flow that is higher in the central part of nodule than in the surrounding thyroid parenchyma. It occurs in 69 to 74% of thyroid malignancies according to a study by Hoang et al.² Benign nodules showed central vascularity in 50% of patients according to a study by Frates et al.⁴ The sensitivity of any type of calcification to predict malignancy was 64%, the specificity was 65.6 % and the accuracy was 64.9% according to our study. In our study malignancy was associated with 70% of patients with micro calcifications and 60% of patients with macro calcifications. The sensitivity of microcalcifications in detecting malignancy was 29.1%, specificity was 93.9%, and accuracy was 66.6%. Micro calcification is a feature in papillary carcinoma and is seen due to the psammoma bodies. Coarse calcification is seen in medullary carcinoma and in adenomatous nodules. Micro calcification was seen in 43% of patients, macrocalcifications was seen in 17% of patients with papillary carcinoma and in a study by Chan et al.⁵

The two patients who had honey combing (spongiform configuration) in our study had colloid nodules. In a study by Ginat et al honey combing was associated with nodular hyperplasia with specificity of 100%⁶ similar finding were observed by Bonavita et al.⁷ There were 12.2% (7) patients who had cystic areas with echogenic debris and comet tail arti-

Feature	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	Accuracy (%)
Hypoechogenicity	84	75	72	85	78.9
Central vascularity	74	48	58.9	72.4	78.9
Calcification	64	65.6	59.2	70	64.9
Microcalcification	29.1	93.9	77.7	64.5	66.6
Lymphadenopathy	16	100	100	59	61.4
Overall ultrasound	88.4	73.3	74	88	80.3

Table-1: The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of each ultrasound feature in predicting malignancy.

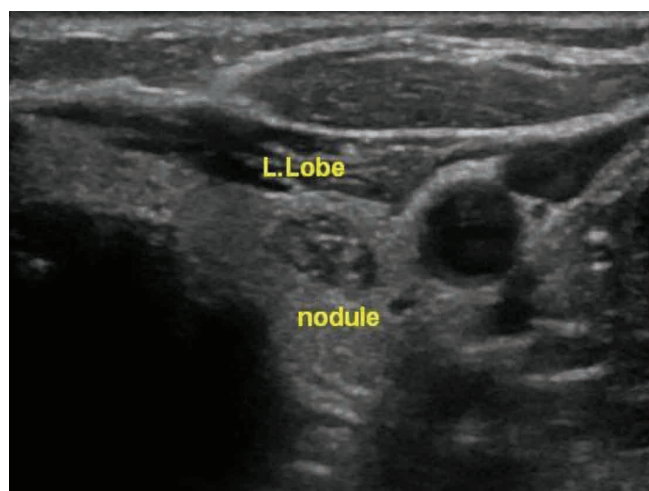


Figure-1: Hypo echoic lesion in left lobe of thyroid with microcalcification

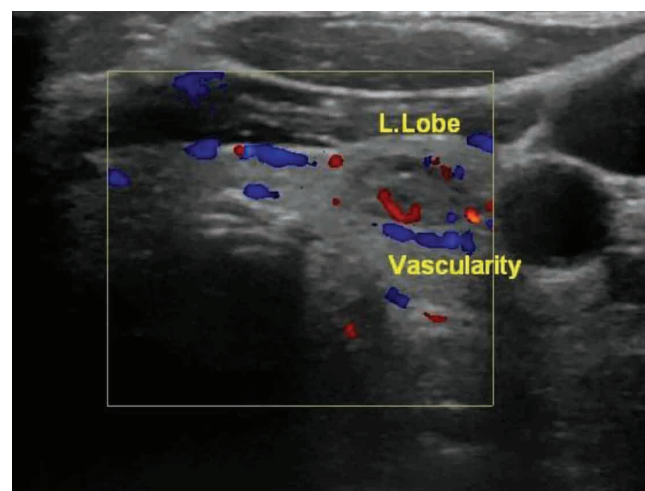


Figure-2: Significant internal vascularity is seen in the nodule. Pathologically proven to be Papillary carcinoma.

fact, out of which 6 patients had adenomatous hyperplasia (85%). One patient had papillary carcinoma. At ultrasound colloid nodules may depict internal echogenic foci due to presence of inspissated calcifications they are identified by presence of comet tail artifact.⁸

Out of other 16 patients who had cystic areas without debris 25% (4) nodules were malignant but all these nodules had micro or macro calcification. The other 75% (12) nodules were benign and had no calcification. Cystic changes are seen in 13 to 26% of papillary carcinomas according to a study by Hatabu et al. The presence of internal solid components with vascularity, solid excrescences protruding into the lumen and micro calcifications help to identify malignant nodules.⁹

Presence of lymphadenopathy had a sensitivity of 16% and a specificity of 100% in predicting malignancy in our study. Lymphadenopathy is a highly specific feature of malignancy.¹⁰ Metastatic regional lymphadenopathy is reported in 19.7% of thyroid malignancies in a study by Papiniet al.³

Nineteen patients had malignant nodules in a background of normal thyroid parenchyma (approximately half of nodules in a background of normal thyroid parenchyma were malignant), in a background of adenomatous hyperplasia 13 patients had benign nodules and 6 patients had malignant nodules (approximately one third of nodules in a background of adenomatous hyperplasia were malignant). Two benign nodules were seen in background of Hashimoto's thyroiditis. In another study malignancy was identified in 9.2% of patients with solitary thyroid nodule and 6.3% of patients in a background of adenomatous hyperplasia.³ Hence just presence of multiple nodules must not be dismissed as due to benign etiology and a suspicious nodule must be further evaluated. In a case of multiple thyroid nodules FNAC may be performed in upto four nodules, which have suspicious features.¹¹

The sensitivity of ultrasound in detecting malignant nodules was 88.4%, specificity was 73.3% and the overall accuracy was 80.3% in our study. In a study by Koike et al the sensitivity of ultrasound in diagnosis of nonfollicular neoplasms was 86.5% and for follicular neoplasms was 18.2%, the specificity was 92.3% and 88.7% respectively.¹⁰ Some of our cases had undergone ultrasound, FNAC and HPE in them it was seen that ultrasound diagnosed nodules as malignant when FNAC was negative in four cases, similarly FNAC had rightly diagnosed 8 cases of malignancy which was not detected on ultrasound, both ultrasound and FNAC had missed three cases of malignancy detected on HPE. Thus the ultrasound features suggesting malignant nodules are hypoechoogenicity, internal vascularity, microcalcification and solid composition.¹²

CONCLUSION

Ultrasound is a sensitive and specific modality in assessment of thyroid nodules with good overall accuracy. The most sensitive parameter in suspecting malignancy is hypo echogenicity of the nodule; the most specific features are lymphadenopathy followed by microcalcification. Significant number of the cases with background adenomatous multinodular changes in thyroid had a malignant nodule, hence FNAC is warranted in suspicious thyroid nodules and they cannot be ignored as adenomatous changes.

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