# Role of Ultrasonography in the Diagnosis of Carcinoma of Thyroid gland with Histopathological Correlation

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The study was aimed to evaluate the usefulness and accuracy of ultrasonography for the diagnosis of the thyroid gland carcinoma. This cross sectional study was carried out in the Department of Radiology and Imaging, Mymensingh Medical College Hospital, in collaboration with outpatient and inpatient department of Otolaryngology and Surgery of Mymensingh Medical College Hospital enrolling 52 patients of 15 to 60 years of age range who were referred to Department of Radiology and Imaging, Mymensingh Medical College Hospital, prior to operation for discrimination of benign and malignant thyroid nodule by ultrasonography during the period of January 2008 to December 2009. In this study, mean age was 32.26 ± 9.01 (mean±SD) years. Highest age incidence 67.3% was found in 25-45 years age group. Among the patients male and female were 21.2% and 78.8% respectively. Among the 52 cases, 45 (86.5%) cases presented with single nodule and rest of the 7 (13.5%) were with multiple nodule. Most of the nodules of the patients occupied the right lobe (59.6%), left lobe and both lobe contained nodules in 32.7% and 7.7 % cases respectively. 67.3% cases showed well defined margin of the nodules and other 32.7 % cases showed poorly defined margin in ultrasound examination. Most of the patients (40.4%) presented with complex mass followed by solid masses in 36.5% cases. 3 (5.8%) patients showed cervical lymphadenopathy and 2 (3.8%) involved the adjacent organ. Among the cases 15 (28.8%) were of malignant thyroid nodule and rest 37 (71.2%) cases were of benign thyroid nodule as diagnosed by ultrasonography. Considering histopathological diagnosis as gold standard test sensitivity, specificity, positive predictive value, negative predictive value and accuracy of ultrasonography in the diagnosis of the carcinoma of thyroid gland were 90.9%, 87.8%, 66.7%, 97.5% and 88.5%, respectively. In most of the cases, ultrsonographic findings of the present study correlated well with histopathological findings. It can therefore be concluded that ultrasonography is a useful modality in the evaluation of carcinoma of thyroid gland

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**Key words:** Ultrasonography, Carcinoma, Thyroid gland

## Introduction

Thyroid is an endocrine gland, situated in the lower part of the front and side of the neck. It regulates basal metabolic rate, stimulates somatic and psychic growths and plays important role in calcium metabolism.[1] Thyroid nodules are very common, found by palpation in 4% to 7% of the asymptomatic population, in 17% to 27% of cases on ultrasonography and in 50% of cases at autopsy. Although, most thyroid nodules are benign, approximately 4% to 14% of such nodules are malignant. Thus, it is important to identify which nodules are more likely to be malignant. Several

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ultrasonographic characteristics that have been studied as potential predictors of thyroid malignancy include irregular margins, hypoechogenicity, the absence of a halo, a predominately solid composition, intranodular vascularity and the presence of calcification.[2] Vani[3] reported 15.5% of solitary thyroid nodules are malignant, with female preponderance and a mean age of 35 years. Thyroid carcinoma annual incidence is 1-2 per 100000 population, which accounts for 90% of the malignancies of the entire endocrine system, 1% of the total human malignancies and 0.5% of total deaths from malignancies.[4]

All patients who present with a thyroid nodule should undergo ultrasound evaluation of the nodule, thyroid gland and cervical lymph nodes, if indicated. Ultrasound is an inexpensive, readily available and non invasive investigation. The superiority of ultrasound examination of thyroid over clinical examination has been described with one study showing ultrasonography leading to a change in management of 44% of patients who had been referred for a solitary nodule on physical examination. Patients with multiple thyroid nodules have the same risk for malignancy as those with solitary thyroid nodules or even diffuse goiters and it is recommended that all patients who have a nodular thyroid undergo ultrasound evaluation. To date, no single feature carries a high sensitivity and high positive predictive value for thyroid cancer. However, there are a number of ultrasound qualities that, when they occur in combination, are associated with a higher risk of malignancy.[5]

## Methods

The present cross sectional study was conducted in the Department of Radiology and Imaging of Mymensingh Medical College Hospital to evaluate the usefulness and accuracy of ultrasonography for the diagnosis of the thyroid gland carcinoma enrolling 60 patients who were referred by department of Otolaryngology and Surgery of Mymensingh Medical College Hospital, for ultrasonography to discriminate benign and malignant nodules before surgical intervention, of 15 to 60 years of age range during the period of January 2008 to December 2009. Exclusion criteria were patients who refused to do surgery and non-availability of histopathological report. Ultrasonography was performed in all patients and after operation histopathological diagnosis was done. Histopathological reports were collected and correlated with ultrasonography findings. However, 8 patients were excluded from the study as dropout case or refused to co-operate further with the study. Finally histopathology reports were collected from 52 patients and they were considered as study sample. After taking informed written consent, data was collected in a preformed questionnaire by taking history, the findings and interpretations of the ultrasound and histopathological reports. Histopathological diagnosis was considered as gold standard of diagnostic criteria.

*Ethical consideration*

Prior to commencement of study the respective authority approved the research protocol. Proper permission was taken from the department and institution concerned for the study. All the patients included in this study were informed about the nature, risk and benefit of the study. Informed written consent was taken from each patient. No participant was identified in any report or publication under the study.

*Diagnostic criteria*
Ultrasound diagnostic criteria: Any mass lesion with – ill defined margin, irregular shape, absence of halo sign and or cystic lesion, internal calcification, adjacent organ involvement, hypoechogenicity, heterogenicity, cervical lymphadenopathy.[6]

*Data analysis*
After informing all the necessary information regarding the research study, data were collected in a predesigned structured data collection sheets. Record of clinical, ultrasound and histopathological findings were kept and compared. Data were entered into computer package SPSS version 12 for statistical analysis. The data was expressed as frequency, percentage, mean (±SD) and range. For the validity of the study outcome sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated for ultrasonography using the 2x2 table.

**Result:**
*Demographic characteristic of the study subjects:*
Among 52 study subjects the age ranged between 15 to 60 years. The mean age was 32.26 ± 9.01 ( mean ±SD) years. Highest age incidence, 67.3% was found in 25-45 years age group. Among the subjects 78.8 % (41) were female and 21.25% (11) were male.

*Sonographic features of the study subjects:*
Among 52 cases, 15 (28.8%) of them were with malignant nodule and rest 37 (71.2%) were with benign nodule as diagnosed by ultrasonography. Most of the nodules of the patients occupied the right lobe (59.6%), left lobe and both lobe contained nodules in 32.7% and 7.7 % cases respectively. Regarding number of nodule, single nodule found in all 11 cases (100%) of malignant thyroid nodule and 7 (17.1%) cases were with multiple nodule who all were benign. Among the cases with benign nodule 35 (85.4%) had regular margin and 6 (14.6%) had irregular margin. The entire malignant nodule had irregular margin. Among the benign cases 17 (41.5%) were solid, 2 (4.9%) were cystic, 16 (39.0%) were complex mass, 6 (14.6%) cases had both solid and cystic changes. Among the malignant cases 2 (18.2%) were solid, 5 (45.5%) were complex mass and 4 (36.4%) were hypoechoeic and all hypoechoeic lesions are malignant. Calcification was present in 32 (59.3%) cases and absent in 20 (40.7 %) cases. Among the benign cases halo sign was present in 34 (79.1%) cases and absent in 7 (20.9%) cases. Among malignant cases, halo sign was present in 1(9.1%) case and absent in 10 (90.9%) cases. Only three patients (5.8%) had cervical lymphadenopathy who all were malignant cases. Two patients (3.8%) was ultrasonographicaly detected with adjacent organ involvement.

*Evaluation of ultrasound diagnosis on the basis of histopathology as gold standard test for diagnosis of carcinoma of thyroid gland:*
Out of 52 study subjects, 15 were diagnosed as malignant thyroid nodule by ultrasonography and among them 10 were confirmed by histopathological evaluation. They were true positive. 05 cases were diagnosed as malignant thyroid nodule by ultrasonography but not confirmed by histopathology findings. They were false positive. Out of 37 cases of benign thyroid nodule which were confirmed by ultrasonography, 1 was confirmed as malignant thyroid nodule and 36 were benign nodule by histopathology findings. They were false negative and true negative respectively.

Considering histopathological diagnosis as gold standard test sensitivity, specificity, positive predictive value, negative predictive value and accuracy of ultrasonography in the diagnosis of the thyroid gland carcinoma were

90.9%, 87.8%, 66.7%, 97.3% and 88.5% respectively.

Table I: Comparison between histopathological diagnosis and sonographic diagnosis

| USG diagnosis | Histopathological diagnosis | | Total |
|---|---|---|---|
| | Malignant | Benign | |
| Malignant | 10 (TP)(90.9%) | 5 (FP)(12.2%) | 15 (28.8%) |
| Benign | 01 (FN)(9.1%) | 36 (TN)(87.8%) | 37 (71.2%) |
| Total | 11(100%) | 41 (100%) | 52(100%) |

Table I shows the comparison between histopathology test and ultrasonography. Out of 52 cases 15 were diagnosed as malignant thyroid nodule by ultrasonography and among them 10 were confirmed by histopathological evaluation. They were true positive. 05 cases were diagnosed as malignant thyroid nodule by ultrasonography but not confirmed by histopathology findings. They were false positive. Out of 37 cases of benign thyroid nodule which were confirmed by ultrasonography, 1 was confirmed as malignant thyroid nodule and 36 were benign nodule by histopathology findings. They were false negative and true negative respectively.

Table II: The Validity test results for ultrasonography in thyroid gland carcinoma

| Validity Test | Estimated Value (%) | Significance level at 95% CI |
|---|---|---|
| Sensitivity | 90.9 | 67.4-98.3 |
| Specificity | 87.8 | 81.5-89.8 |
| PPV | 66.7 | 49.4-72.1 |
| NPV | 97.3 | 90.3-99.5 |
| Accuracy | 88.5 | 78.5-91.6 |

Table II shows the validity test results. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of ultrasonography in the diagnosis of thyroid gland carcinoma were 90.9%, 87.8%, 66.7%, 97.3% and 88.5% respectively.

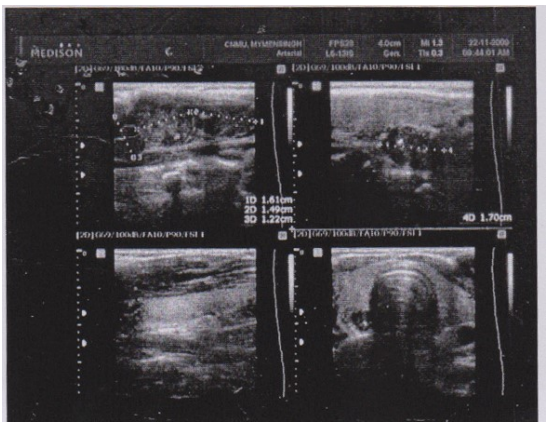


Fig 1. Ultrasonography showing thyroid nodules (papillary carcinoma of thyroid)

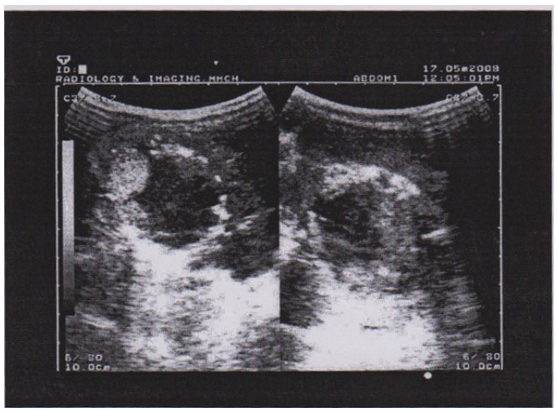

Fig 2. Ultrasonography showing thyroid nodules (papillary carcinoma of thyroid)

**Discussion**

Ultrasonography is the imaging study of choice for thyroid nodules. It can identify nodules too small to be palpated, the presence of multiple nodules, central or lateral neck lymphadenopathy and provides accurate measurements of nodule diameter for interval monitoring. Additionally, it allows characterization of nodules by sonographic features which suggest malignancy.[7] Histopathology is used as a gold standard for

the diagnosis of carcinoma of thyroid gland. It acts as a reference in assessing other diagnostic tools. Here, the usefulness and accuracy of ultrasonography in the evaluation of thyroid gland carcinoma was compared with histopathology.

The present cross sectional study was conducted in the Department of Radiology and Imaging of Mymensingh Medical College Hospital to evaluate the usefulness and accuracy of ultrasonography for the diagnosis of the thyroid gland carcinoma enrolling 52 patients who were referred by department of Otolaryngology and Surgery of Mymensingh Medical College Hospital for ultrasonography to discriminate benign and malignant nodules before surgical intervention during the period of January 2008 to December 2009. The age of the patients ranged from 15 to 60 years. The mean age was 32.26 ± 9.01 (mean ±SD) years. Highest age incidence 67.3% was found in 25-45 years age group. Among the subjects 78.8 % (41) were female and 21.25% (11) were male. Among the 52 cases, with benign nodule 35 (85.4%) had regular margin and 6 (14.6%) had irregular margin. All the malignant nodule had irregular margin. Among the benign cases 17 (41.5%) were solid, 2 (4.9%) were cystic, 16 (39.0%) were complex mass, 6 (14.6%) cases had both solid and cystic changes. Among the malignant cases 2 (18.2%) were solid, 5 (45.5%) were complex mass and 4 (36.4%) were hypoechoic and all hypoechoic lesions are malignant. Calcification was present in 32 (59.3%) cases and absent in 20 (40.7 %) cases. Only three (5.7%) patient had cervical lymphadenopathy who all were malignant cases. Two patient (3.8%) was ultrasonographically detected with adjacent organ involvement.

Cappelli[8] evaluated whether ultrasonographic features of thyroid nodules are associated with histological malignancy and to identify useful criteria for clinical decision -making. Histological type and local aggressiveness were largely independent of nodule size. Microcalcifications (72.7% vs. 28.7%; $p<0.001$), blurred margin (52.8% vs. 18.8%; $p<0.001$), solid hypoechoic appearance (80.6% vs. 52.4%; $p<0.001$) and intranodular vascular pattern type 2 (61.6% vs. 49.7%; $p<0.001$) were all significantly more frequent in malignant than benign nodules.

Out of 52 study subjects, 15 were diagnosed as malignant thyroid nodule by ultrasonography and among them 10 were confirmed by histopathological evaluation. They were true positive. 05 cases were diagnosed as malignant thyroid nodule by ultrasonography but not confirmed by histopathology findings. They were false positive. Out of 37 cases of benign thyroid nodule which were confirmed by ultrasonography, 1 was confirmed as malignant thyroid nodule and 36 were benign nodule by histopathology findings. They were false negative and true negative respectively. Considering histopathological diagnosis as gold standard test sensitivity, specificity, positive predictive value, negative predictive value and accuracy of ultrasonography in the diagnosis of the thyroid gland carcinoma were 90.9%, 87.8%, 66.7%, 97.3% and 88.5% respectively.

Authors[9] reported in a study to evaluate the diagnostic accuracy of a new ultrasound classification system for differentiating between benign and malignant solid thyroid nodules, the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of ultrasonogram was 86%, 95%, 91%, 92%, 92% respectively. Some other Authors[10] studied to evaluate the role of ultrasound in the management of thyroid nodules with a fine needle aspiration biopsy reading suspicious for papillary carcinoma. Sensitivity, specificity, positive predictive

value, negative predictive value and accuracy of ultrasonogram was 96.4%, 74.5%, 92.7%, 94.9%, 80.9% respectively, in nodules read as suspicious for papillary thyroid carcinoma. Thapa[11] reported ultrasound is 91% sensitive and 100% specific with positive predictive value of 100% and negative predictive value of 97% for the diagnosis of the malignant thyroid nodule. High sensitivity, specificity and accuracy of ultrasound in the diagnosis of thyroid gland carcinoma confirm that ultrasonography is a useful diagnostic modality for thyroid carcinoma.

*Conclusion*

In most of the cases, ultrasonography findings of the present study correlated well with histopathological findings. It can therefore be concluded that ultrasonography is a useful modality in the evaluation of thyroid gland carcinoma.

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