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Original Research Article

SONOGRAPHIC AND HISTOPATHOLOGICAL EVALUATION OF THYROID NODULES IN AUTOIMMUNE THYROIDITIS

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ABSTRACT

Background: Thyroid nodules are a typical symptom of autoimmune thyroiditis (AIT), which is more often known as Hashimoto's thyroiditis. This inflammatory disorder affects the thyroid gland. Because sonographic characteristics of benign and malignant nodules in AIT overlap, clinically differentiating between the two is difficult. The purpose of this study is to enhance diagnosis accuracy and suggest proper care by correlating sonographic characteristics of thyroid nodules with histological findings in patients diagnosed with AIT.

Materials and Methods: A prospective investigation was performed on 60 patients identified with autoimmune thyroiditis using clinical, serological, and sonographic criteria. This study was conducted at the Department of Pathology, Government Medical College Mancherial, Telangana, India from April 2024 to December 2024. All patients had high-resolution thyroid ultrasonography to assess nodule features, including echogenicity, margins, calcifications, vascularity, and morphology. Fine-needle aspiration cytology (FNAC) or surgical biopsy was conducted for histological verification. Sonographic observations were evaluated against histological diagnoses to determine sensitivity, specificity, and predictive value for malignancy.

Results: Nodules were found in 60 of the patients. The sonography of twenty-four nodules revealed characteristics that could indicate cancer, including hypoechogenicity, microcalcifications, uneven borders, a form that was taller than wide, and intranodular vascularity. Of the nodules examined, histopathology revealed that ten (12.2%) were cancerous, with papillary thyroid carcinoma being the most common type. Microcalcifications and uneven margins were the two sonographic findings that were most predictive of cancer. Ultrasonography had a sensitivity of 90% and a specificity of 78.3% when it came to identifying tumors. There was a definite relationship between sonographic suspicion and histological diagnosis.

Conclusion: One important non-invasive method for evaluating thyroid nodules in autoimmune thyroiditis patients is sonographic examination. There are a number of sonographic characteristics that can accurately indicate cancer and help determine if FNAC or surgery is necessary. On the other hand, a conclusive diagnosis can only be made with histological confirmation.

Keywords: Autoimmune thyroiditis, Hashimoto's thyroiditis, thyroid nodules, ultrasonography, histopathology, fine-needle aspiration cytology.

INTRODUCTION

The most common autoimmune endocrine ailment in the world is autoimmune thyroiditis (AIT), which primarily shows up as Hashimoto's thyroiditis. It's a chronic inflammatory disorder of the thyroid gland. Progressive thyroid failure caused by immune-mediated destruction of thyroid follicles is the hallmark of this condition, which mostly affects women in their 30s and 40s. Diffuse lymphocytic

infiltration, germinal center development, Hurthle cell alterations, and fibrosis of varied degrees are histopathological hallmarks of AIT.[1-3]

Serological testing can confirm the diagnosis if there are increased levels of antibodies against thyroid peroxidase (anti-TPO) and thyroglobulin. Thyroid nodules, found in a large percentage of patients by palpation or by chance on ultrasonography, are one of the clinical obstacles in AIT. Although most of these nodules are harmless, patients with AIT have a slightly increased risk of cancer, specifically papillary thyroid carcinoma, when compared to the general population. Immune dysregulation and genetic changes brought on by chronic inflammation may provide the pathophysiological basis of this connection, although this is yet not fully understood.[4-6]

The initial imaging method for evaluating thyroid morphology and identifying nodules is high-resolution ultrasonography. Hypoechogenicity, microcalcifications, an abnormally taller-than-wide form, enhanced intranodular vascularity, and ill-defined or irregular borders are sonographic characteristics that can indicate cancer. Nevertheless, these characteristics can be more difficult to interpret and diagnose with precision due to background echotexture alterations in AIT, such as widespread hypoechogenicity and pseudonodular patterns.[5-7]

The gold standard for cytological examination of thyroid nodules is fine-needle aspiration cytology (FNAC), which is guided by ultrasound. While benign lymphocytic thyroiditis and malignant alterations share many characteristics, AIT might make cytological assessment difficult. Histopathological analysis and surgical excision may be required to reach a final diagnosis in certain instances.[6-8]

This study aimed to examine the sonographic features of thyroid nodules in AIT patients and compare them with histological results, taking into consideration the complexity of these diagnoses. We aim to improve clinical decision-making regarding biopsy or surgical intervention by identifying specific ultrasonography markers that may consistently predict malignancy in the context of autoimmune thyroid inflammation.[9-11]

MATERIALS AND METHODS

This prospective observational study was carried out at the Department of Pathology, Government Medical College Mancherial, Telangana, India from April 2024 to December 2024. 60 patients diagnosed with autoimmune thyroiditis (AIT) and exhibiting thyroid nodules were enrolled following the acquisition of informed permission. The diagnosis of AIT was confirmed through clinical evaluation, biochemical thyroid assessment, increased levels of anti-thyroid peroxidase (anti-TPO) antibodies, and distinctive ultrasonographic characteristics. All patients had comprehensive thyroid ultrasonography utilizing a high-frequency linear probe (7–12 MHz). Characteristics of the nodule, such as size, echogenicity, borders, presence of calcifications, form, and internal vascularity, were documented. Suspicious nodules underwent additional assessment using ultrasound-guided fine-needle aspiration cytology (FNAC). Surgical specimens, when accessible, underwent histological analysis for validation. The sonographic data were evaluated against histological results to ascertain the diagnostic efficacy of ultrasound in distinguishing benign from malignant nodules in patients with AIT.

Inclusion Criteria:

- Patients aged 18 years and above.
- Clinically and biochemically diagnosed cases of autoimmune thyroiditis.
- Presence of one or more thyroid nodules (>1 cm in size) on ultrasonography.
- Patients who underwent FNAC or surgical excision for histopathological correlation.
- Willingness to participate and provide informed consent.

Exclusion Criteria:

- Patients with previously diagnosed thyroid malignancy.
- Patients on thyroid cancer therapy or post-thyroidectomy cases.
- Nodules <1 cm in size without suspicious features on ultrasound.
- Inadequate FNAC samples or non-diagnostic cytology.
- Pregnant women or those with contraindications to FNAC.
- Patients lost to follow-up before histopathological confirmation.

RESULTS

We examined 60 patients who had been diagnosed with autoimmune thyroiditis (AIT) and thyroid nodules. The patients had an average age of 42.8 ± 11.6 years, and the majority were female. For every suspicious nodule, ultrasonographic characteristics were documented and histopathological correlation was carried out.

Table 1: Demographic and clinical characteristics of the study population

Parameter	Value
Mean Age (years)	42.8 ± 11.6
Gender (Male/Female)	8 (13.3%) / 52 (86.7%)
Mean TSH level (µIU/mL)	6.1 ± 2.4
Anti-TPO Antibody Positive	60 (100%)
Presenting Symptom	Goiter (65%), Neck discomfort (20%), Incidental (15%)

A large majority of the participants in the study were female (86.7%). Goitre was most commonly seen in these patients. Autoimmune thyroiditis was confirmed in all patients who tested positive for anti-TPO.

Table 2: Distribution and number of thyroid nodules detected on ultrasonography

Number of Nodules per Patient	Patients (n)	Total Nodules
Single Nodule	34	34
Two Nodules	16	32
Three or More Nodules	10	30
Total	60	96

Results showed that out of 60 patients, 96 thyroid nodules were detected. Of the individuals examined, 34 had a single nodule, whereas the other cases had numerous nodules.

Table 3: Ultrasonographic features of thyroid nodules

Feature	Frequency (n)	Percentage (%)
Hypoechogenicity	58	60.4%
Irregular Margins	36	37.5%
Microcalcifications	28	29.2%
Taller-than-wide Shape	21	21.9%
Intranodular Vascularity	33	34.4%
Solid Composition	70	72.9%

There were mostly solid nodules that were hypoechoic. Many of the nodules had concerning characteristics, such as intranodular vascularity, microcalcifications, and uneven borders.

Table 4: Histopathological diagnosis of evaluated nodules

Diagnosis	Frequency (n)	Percentage (%)
Papillary Thyroid Carcinoma	12	12.5%
Follicular Variant of PTC	3	3.1%
Hurthle Cell Neoplasm	2	2.1%
Colloid Nodule	41	42.7%
Hashimoto’s Nodule	26	27.1%
Follicular Adenoma	12	12.5%

The majority of the 96 nodules were papillary thyroid carcinomas (PTCs), with 15 (or 15.6%) being malignant. Nodules such as Hashimoto's and colloid nodules were considered benign.

Table 5: Correlation between ultrasonographic features and malignancy

Sonographic Feature	Malignant (n = 15)	Benign (n = 81)	p-value
Hypoechogenicity	13	45	0.012 *
Irregular Margins	11	25	0.003 *
Microcalcifications	10	18	0.001 *
Taller-than-wide Shape	8	13	0.014 *
Intranodular Vascularity	9	24	0.025 *

There was a statistically significant link between malignancy and suspicious characteristics such as microcalcifications, uneven edges, and a taller-than-wide form ($p < 0.05$).

Table 6: Diagnostic performance of ultrasonography for predicting malignancy

Parameter	Value (%)
Sensitivity	86.7
Specificity	80.2
Positive Predictive Value (PPV)	44.1
Negative Predictive Value (NPV)	96.2
Diagnostic Accuracy	81.2

Despite some shared characteristics with benign nodules, ultrasonography showed excellent sensitivity and NPV in identifying malignant nodules, making it a dependable screening technique in AIT patients. However, the positive predictive value (PPV) remained moderate.

DISCUSSION

Inflammatory alterations in the thyroid parenchyma can mimic or obfuscate characteristics of cancer, making the examination of thyroid nodules in the context of autoimmune thyroiditis (AIT), especially Hashimoto's thyroiditis, a diagnostic challenge in and of itself. This study aims to establish the diagnostic accuracy of ultrasonography in identifying malignant nodules by correlating sonographic features with

histological results. It involved 60 patients with AIT and 96 thyroid nodules.[12-14]

Our results, which revealed that middle-aged women had a higher prevalence of AIT, corroborated earlier research showing that females accounted for 86.7% of patients and that the average patient age was 42.8 years. Typically seen in both benign and malignant nodules, especially in the context of thyroiditis, ultrasonography showed that most nodules were solid (72.9%) and hypoechoic (60.4%). Notably, papillary thyroid carcinoma (PTC) was the most common kind of malignancy, proven histopathologically in 15.6% of nodules.[15-17] This is in line with research that has shown an elevated incidence of PTC in AIT patients, while the specific causative link is still up for discussion. There was a statistically significant link between malignancy and suspicious sonographic characteristics like microcalcifications, uneven edges, and a taller-than-wide form ($p < 0.05$). The strongest correlation between microcalcifications and papillary cancer was supported by their high positive predictive value (66.7%). These findings corroborate prior research that found that the two most accurate sonographic markers of thyroid nodule malignancy are microcalcifications and uneven edges.[18-20]

In our investigation, ultrasonography demonstrated remarkable diagnostic performance, with an NPV of 96.2% and a sensitivity of 86.7%. Ultrasonography is a powerful tool for detecting and ruling out cancer in nodules that do not exhibit any worrisome characteristics. Since benign inflammatory nodules and malignant ones in AIT share some sonographic characteristics, the moderate positive predictive value (PPV) of 44.1% is understandable. Thus, although ultrasonography is a great first step, it is not a replacement for histological confirmation, particularly in cases where the ultrasonography results are unclear or cause suspicion.[21-23]

Malignant lesions were just one part of the histopathological spectrum that also comprised follicular adenomas, colloid nodules, and Hashimoto's nodules. Diagnostic challenges on cytology may arise from the presence of Hurthle cell alterations and lymphoid aggregates, which are characteristic of AIT. This highlights the necessity for meticulous FNAC interpretation or surgical biopsy when necessary. Patients with AIT who have thyroid nodules should be managed optimally by a multidisciplinary team that includes clinical assessment, serology, sonographic characteristics, and cytological/histopathological confirmation.[24,25] It may be helpful to monitor the course of nodules and look for changes that could indicate cancer by doing serial imaging at regular intervals. The results may not be applicable to a broader population because this study only used data from one location and had a small sample size. Another potential issue with cytology-based diagnoses is that not all nodules were surgically removed. To confirm these results, larger cohorts and longer follow-up periods are required in future multicentre trials.[26,27]

CONCLUSION

Autoimmune thyroiditis is associated with an increased risk of thyroid nodules, and it can be difficult to tell benign nodules from malignant ones when sonographic characteristics coincide. In order to identify nodules that need more investigation, this study shows that specific ultrasonographic features—like microcalcifications, uneven edges, hypoechogenicity, and a taller-than-wide shape—are strongly linked to cancer. For the initial evaluation of thyroid nodules in autoimmune thyroiditis, ultrasonography is still a reliable, painless, and easily accessible option. Nevertheless, for a conclusive diagnosis, particularly in nodules exhibiting worrisome characteristics, histological confirmation by FNAC or surgical biopsy is necessary, as the inflammatory background could lead to false positives. To accurately diagnose and promptly treat thyroid nodules in autoimmune thyroiditis, a multidisciplinary approach is required that incorporates clinical, serological, sonographic, and histological results. Particularly for patients with occult cancers, patient outcomes can be greatly improved with early identification and effective care.

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