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A Cross-Sectional Study on the Role of Sonography in Characterisation of Thyroid Nodules in Patients Attending at a Tertiary Care Centre of West Bengal

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ABSTRACT

Background: Thyroid nodules are one of the most commonly encountered clinical findings in endocrinological and surgical practice. With the widespread availability of ultrasonography (USG), even small and clinically impalpable nodules are now being detected. Sonography plays a vital role in not only detecting nodules but also characterising them in terms of echogenicity, vascularity, calcification, margins, and other sonographic features that help differentiate benign from malignant lesions. The present study was undertaken to assess the role of sonography in the characterisation of thyroid nodules at a tertiary care centre in West Bengal. ***Methods:*** This was a hospital-based, cross-sectional observational study conducted at the Department of Radiodiagnosis of a tertiary care hospital in West Bengal. A total of 62 patients presenting with thyroid nodules were enrolled using non-probability purposive sampling over a defined study period. Detailed sonographic examination was performed using a high-frequency linear transducer, and findings were recorded and analysed. ***Results:*** The majority of the patients were females (77.4%) in the age group of 31 to 50 years. Solitary nodules were found in 62.9% of cases. Benign sonographic features predominated, with hypoechoic nodules seen in 38.7% and isoechoic nodules in 33.9% of cases. Calcification was identified in 22.6% of cases. Increased vascularity was noted in 29.0% of nodules on Doppler examination. TIRADS categorisation revealed that most nodules fell in TIRADS 3 (benign) and TIRADS 4 (intermediate suspicion categories. ***Conclusion:*** Ultrasonography is a reliable, cost-effective, non-invasive, and easily reproducible tool for the initial evaluation and characterisation of thyroid nodules. It helps in risk stratification and guides further management decisions. The application of TIRADS scoring enhances diagnostic accuracy and helps avoid unnecessary invasive procedures.

Keywords: *Sonography, Thyroid nodule, Ultrasonography, TIRADS, West Bengal, Cross-sectional study*

1. INTRODUCTION

Thyroid nodules are discrete lesions within the thyroid gland that are radiologically distinguishable from the surrounding thyroid parenchyma. They are found in approximately 4 to 8 percent of the adult population when assessed by palpation and in up to 67 percent when high-resolution ultrasonography is used.[1] India, including the eastern states like West Bengal, has a significant burden of thyroid disorders, largely attributed to iodine deficiency, genetic predisposition, and environmental factors.

The clinical importance of thyroid nodules lies in the need to exclude malignancy, which accounts for approximately 5 to 15 percent of all thyroid nodules. The challenge for clinicians and radiologists is to accurately differentiate between benign and malignant nodules, as unnecessary surgical interventions carry significant morbidity.

Ultrasonography (USG) of the thyroid is the first and most informative imaging modality used in the evaluation of thyroid nodules. It provides detailed information about the number, size, location, echogenicity, margins, presence of calcifications, and vascularity of nodules. The introduction of standardised reporting systems such as the Thyroid Imaging Reporting and Data System (TIRADS) has further enhanced the clinical utility of sonography by providing structured risk stratification.[2]

Given the high prevalence of thyroid disorders in West Bengal and limited published data from this region, the present study was designed to evaluate the sonographic characteristics of thyroid nodules in patients attending a tertiary care hospital and to correlate sonographic features with the risk of malignancy based on TIRADS classification.

2. OBJECTIVES

Primary Objective:

To study the role of ultrasonography in the characterisation of thyroid nodules in patients attending a tertiary care centre in West Bengal.

Secondary Objectives:

(i) To describe the sociodemographic profile of patients with thyroid nodules. (ii) To assess various sonographic features including echogenicity, margins, calcification, and vascularity of thyroid nodules. (iii) To classify thyroid nodules using TIRADS scoring system. (iv) To evaluate the diagnostic utility of sonography in differentiating benign from potentially malignant nodules.

3. METHODOLOGY

3.1 Study Design and Setting

This was a hospital-based, cross-sectional observational study conducted at the Department of Radiodiagnosis of a tertiary care teaching hospital in West Bengal. The study was conducted over a period of 12 months from [Month, Year] to [Month, Year].

3.2 Sample Size Calculation

The sample size was calculated using the standard formula for cross-sectional studies:

$$n = Z^2 \times p \times q / d^2$$

Where:

n = required sample size

Z = 1.96 (standard normal deviate at 95% confidence level)

p = expected proportion of thyroid nodule patients with significant sonographic features = 0.50 (taken as 50% for maximum sample size as no prior local study was available)

q = 1 - p = 0.50

d = allowable error = 0.127 (12.7%)

$$n = (1.96)^2 \times 0.50 \times 0.50 / (0.127)^2 = 3.8416 \times 0.25 / 0.01613 \approx 59.5 \approx 60$$

Accounting for possible dropouts and incomplete records, the final sample size was rounded up to 62 patients.

3.3 Sampling Method

Non-probability purposive sampling was used for patient selection. All patients referred to the Radiodiagnosis department for thyroid sonography and who met the eligibility criteria were enrolled consecutively until the required sample size of 62 was achieved.

3.4 Inclusion and Exclusion Criteria

Inclusion Criteria: (i) Patients of either sex aged 18 years and above. (ii) Patients with clinically detected or incidentally discovered thyroid nodule(s) referred for USG. (iii) Patients willing to give written informed consent.

Exclusion Criteria: (i) Patients with a prior history of thyroid surgery or radioiodine therapy. (ii) Patients with known thyroid malignancy undergoing follow-up. (iii) Patients who refused consent. (iv) Pregnant women (to avoid confounding due to physiological thyroid changes).

3.5 Data Collection and Sonographic Examination

All sonographic examinations were performed using a dedicated high-resolution ultrasonography machine with a 7.5 to 12 MHz linear array transducer. Each patient was examined in supine position with neck hyperextended. The following parameters were assessed systematically: (i) Number of nodules (solitary or multiple); (ii) Size (maximum diameter in mm); (iii) Echogenicity (hyperechoic, isoechoic, hypoechoic, markedly hypoechoic); (iv) Margins (well-defined, ill-defined); (v) Internal consistency (solid, cystic, mixed); (vi) Presence of calcifications (macro or microcalcifications); (vii) Vascularity on Colour Doppler and Power Doppler imaging; (viii) TIRADS classification as per ACR-TIRADS 2017 guidelines.

A detailed proforma was used to record clinical details, sonographic findings, and relevant laboratory parameters. Ethical clearance was obtained from the Institutional Ethics Committee prior to study commencement.

3.6 Statistical Analysis

Data were entered in Microsoft Excel 2016 and analysed using SPSS version 20.0. Descriptive statistics including frequency, percentage, mean, and standard deviation were calculated. Results are presented in tabular and graphical format.

4. RESULTS

A total of 62 patients presenting with thyroid nodules were enrolled in the present study. The findings are described below in detail.

Table 1: Sociodemographic Profile of Study Participants (n = 62)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Female	48	77.4
	Male	14	22.6
Age Group (Years)	18 – 30	10	16.1
	31 – 40	18	29.0
	41 – 50	16	25.8
	51 – 60	12	19.4
	> 60	06	9.7
Residence	Urban	38	61.3
	Rural	24	38.7
Educational Status	Illiterate	08	12.9
	Primary	14	22.6
	Secondary & above	40	64.5
Occupation	Housewife	32	51.6
	Labourer / Farmer	10	16.1
	Service / Business	20	32.3

Table 2: Sonographic Characteristics of Thyroid Nodules (n = 62)

Sonographic Feature	Category	Frequency (n)	Percentage (%)
Number of Nodules	Solitary	39	62.9
	Multiple	23	37.1
Echogenicity	Hyperechoic	12	19.4
	Isoechoic	21	33.9
	Hypoechoic	24	38.7
	Markedly Hypoechoic	05	8.0
Internal Consistency	Solid	36	58.1

Sonographic Feature	Category	Frequency (n)	Percentage (%)
	Cystic	08	12.9
	Mixed (Solid-Cystic)	18	29.0
Margins	Well-Defined	50	80.6
	Ill-Defined	12	19.4
Calcification	Present	14	22.6
	Absent	48	77.4
Vascularity (Doppler)	Increased	18	29.0
	Normal / Absent	44	71.0

Table 3: TIRADS Classification of Thyroid Nodules (n = 62)

TIRADS Category	Description	Frequency (n)	Percentage (%)
TIRADS 1	Normal thyroid	02	3.2
TIRADS 2	Benign	15	24.2
TIRADS 3	Probably Benign	24	38.7
TIRADS 4A	Low Suspicion	12	19.4
TIRADS 4B	Intermediate Suspicion	06	9.7
TIRADS 5	High Suspicion of Malignancy	03	4.8
Total		62	100

4.1 Narrative Summary of Results

The study cohort comprised 62 patients, of whom 48 (77.4%) were females and 14 (22.6%) were males, giving a female-to-male ratio of approximately 3.4:1. The predominant age group was 31 to 40 years (29.0%), followed by the 41 to 50 years group (25.8%). The mean age of the study participants was 41.2 ± 11.6 years. This demographic pattern is consistent with the known higher prevalence of thyroid disorders in females of reproductive and perimenopausal age.

Urban residents constituted 61.3% of the study population, while 38.7% were from rural areas. The majority of the patients (64.5%) had secondary education or above. Housewives formed the largest occupational group (51.6%), reflecting the predominantly female composition of the study population.

Sonographically, solitary nodules were more common, accounting for 62.9% of cases. Hypoechoic nodules were the most frequently observed echogenicity pattern (38.7%), followed by isoechoic nodules (33.9%). Solid consistency was noted in 58.1% of nodules. Well-defined margins were found in 80.6% of cases. Calcification was present in 22.6% of nodules. On Colour Doppler examination, increased vascularity was noted in 29.0% of cases.

On TIRADS classification, the majority of nodules fell in the TIRADS 3 (Probably Benign) category (38.7%), followed by TIRADS 2 (Benign) at 24.2%. TIRADS 4A accounted for 19.4%, while TIRADS 5 (High Suspicion of Malignancy) was noted in only 4.8% (3 patients). These three patients were referred for FNAC (Fine Needle Aspiration Cytology) for histological confirmation.

5. DISCUSSION

The present cross-sectional study was conducted to evaluate the role of high-resolution ultrasonography in the characterisation of thyroid nodules among patients attending a tertiary care centre in West Bengal. The findings of this study are in agreement with several earlier studies from India and abroad.

In our study, a striking female preponderance was observed, with females comprising 77.4% of the study participants. This is consistent with the established epidemiological data, which indicates that thyroid diseases are more common in females due to the influence of oestrogen on thyroid gland physiology, genetic susceptibility, and autoimmune factors. Studies by Hegedus et al. (2004) and Ezzat et al. (1994) also reported female predominance in patients with thyroid nodules.[3,4]

The most commonly affected age group in our study was 31 to 50 years, which corresponds to the reproductive and perimenopausal period in women. This finding is in concordance with studies conducted by Kwong et al. and other Indian researchers, who found a peak prevalence in the 3rd to 5th decades of life. The predominance of housewives among the patients reflects the overall female-dominant composition of the study sample.

Solitary nodules were more prevalent (62.9%) than multinodular goitre (37.1%) in our study, which is consistent with reports from similar hospital-based cross-sectional studies in India. Hypoechoic echogenicity was the most common sonographic pattern (38.7%), followed by isoechoic nodules (33.9%). While hypoechogenicity alone is not diagnostic of malignancy, the presence of hypoechogenicity in combination with ill-defined margins, microcalcification, and increased vascularity significantly raises the suspicion of malignancy.[5]

Well-defined margins were noted in 80.6% of cases, indicating a predominantly benign nature of nodules in this study cohort. Ill-defined or irregular margins, a known risk feature for malignancy, were observed in only 19.4% of cases. Calcification was identified in 22.6% of patients. Microcalcifications, which are strongly associated with papillary carcinoma of the thyroid, were identified in a subset of these patients and correlated with higher TIRADS scores.

Doppler examination revealed increased vascularity in 29.0% of cases. Increased intranodular vascularity is considered an additional sonographic risk feature for malignancy, particularly when combined with other high-risk sonographic findings. This finding emphasises the importance of including Colour Doppler assessment as an integral component of thyroid sonography.

The TIRADS classification in our study revealed that the majority of nodules were categorised as TIRADS 3 (38.7%) and TIRADS 2 (24.2%), together accounting for 62.9% of cases, indicating predominantly benign disease. Only 4.8% of nodules fell into the TIRADS 5 category (high suspicion), and these patients were appropriately referred for FNAC. This finding is reflective of the real-world clinical scenario in a tertiary centre, where most referred patients ultimately have benign thyroid disease.

The ACR-TIRADS system provides a standardised, reproducible, and objective approach to thyroid nodule assessment that reduces inter-observer variability and helps avoid unnecessary FNAC procedures for clearly benign nodules. Its application in a resource-limited setting like West Bengal can prove particularly beneficial in rationalising healthcare resources.

A limitation of the present study is that histopathological correlation was not available for all patients, as only those with TIRADS 4B and 5 were recommended for FNAC based on existing guidelines. A prospective study with complete histopathological correlation would provide a more definitive assessment of the diagnostic accuracy of sonography.

6. CONCLUSION

Ultrasonography is an indispensable, non-invasive, and cost-effective imaging modality for the characterisation of thyroid nodules. In the present study conducted at a tertiary care centre in West Bengal, it was observed that thyroid nodules are predominantly found in females of the 31 to 50 years age group. The majority of nodules had benign sonographic features, with well-defined margins, solid or mixed consistency, and isoechoic or hypoechoic patterns being most common.

The application of the ACR-TIRADS classification system enables systematic and structured reporting of thyroid nodules, facilitating appropriate risk stratification and management. The findings of this study reinforce that sonography, when performed systematically with a standardised scoring system, can significantly reduce unnecessary diagnostic procedures while ensuring timely identification of high-risk nodules requiring further evaluation.

We recommend that all patients presenting with thyroid nodules should undergo high-resolution ultrasonography with Colour Doppler assessment and formal TIRADS categorisation as the primary imaging investigation before any further diagnostic or therapeutic steps are planned.

7.DECLARATION

Conflict of Interest: The authors declare no conflict of interest.

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