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Original Research Article

Evaluation of Ultrasound Parameters and Cytological Finding Correlation of the Diagnosis of thyroid Swelling

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Abstract:

Background: After diabetes mellitus, thyroid gland disorders are the most prevalent endocrine conditions found in clinical settings. The ability to distinguish between benign and malignant thyroid nodules is aided by ultrasound parameters and their lives with cytology findings. The purpose of this study is to assess thyroid nodules by correlating ultrasound results with fine needle aspiration cytology.

Methods: From July 2020 to December 2020, the Pathology Department at NMCH, Patna, Bihar, collaborated with the Radiology Department to perform this prospective observational study. Forty more patients were sent to the pathology department for fine needle aspiration. These patients had their thyroid swelling examined with ultrasonography.

Results: Of the forty patients with thyroid lesions, the largest number, or 25 percent, is in the age range of 31 to 40 years old, and the majority, or 77.5%, are female. 52.5% of the lesions had a single nodule, while 47.5% had several nodules. Consequently, it was discovered that there was a strong correlation between malignancy and internal vascularity, whether or not peripheral vascularity existed. It was discovered that malignancy and hypoechogenicity had a strong correlation. A noteworthy correlation was also discovered between malignancy and a solid or primarily solid component.

Conclusion: When analyzing thyroid nodules, the combination of all imaging features on USG has a substantial association with FNAC and has a high correlation with sensitivity of 85.71% and specificity of 90.91% with 95% confidence interval for identifying malignancy. Therefore, in skilled hands, the combination of USG findings can identify whether the thyroid nodule is malignant. This straightforward, risk-free, and economical study's accuracy can be compared to FNAC, which is saved for unclear lesions.

Keywords: Thyroid malignancy, Ultrasound parameters, Cytology.

Introduction

Thyroid gland problems rank second globally in terms of endocrine dysfunction, after diabetes. They frequently come in with a thyroid swelling to see an endocrine surgeon. The identifying technique determines how common these swellings are. The prevalence as determined only by palpation falls between 4 and 7% [1], while the adult population's ultrasonography (USG) detection rate ranges from 20 to 76%. [2,3] The high-resolution USG is the gold standard test for nodule detection. [4] These nodules' likelihood of being malignant cannot be predicted by a single USG characteristic alone. [5] Therefore, a number of guidelines have been developed to allow USG imaging to be used for the detection and classification of nodules based on their risk of malignancy (ROM). Based on current multi-institutional data and expert opinion, the American College of Radiology (ACR)-Thyroid Imaging and Reporting Data System (TIRADS) is designed and validated. [6] Each of the six thyroid nodule features is assessed in this approach, and a unique score is assigned to each category. The total score is the sum of the individual scores. After that, the nodule is categorized into five groups based on its overall score: normal, benign, probably benign, suspicious, and malignant. Greater is the score, greater is ROM. Cytological assessment of thyroid swellings is a quick, simple, and affordable diagnostic process. Yet, The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) was introduced in 2007 and later upgraded in 2017 in order to facilitate pathologist-clinician communication and address the lack of consistency

in the reporting systems utilized globally. [7,8] All thyroid aspirates are categorized into six groups by the TBSRTC, and each group has a corresponding range of motion and therapeutic recommendations. The patient experiences worry at the mere diagnosis of a thyroid nodule, and they want to know the lesion's ROM and future course of treatment. It will be easier to stop needless thyroidectomies for benign, asymptomatic thyroid nodules and to prevent the malignancy from progressing if we can confidently diagnose benign or malignant nodules before surgery. Numerous studies have validated the TIRADS [9–11] and TBSRTC systems [2,12,13], each of which shows excellent specificity and sensitivity. While fine needle aspiration (FNAC) diagnosis is used in the majority of studies to validate USG results, it is not considered the gold standard. [11,14] There aren't many studies like this on the Indian people. A small number of authors have assessed how well the two methods agree with one another when histology is used as the definitive diagnosis. [15]

Material and Methods

From July 2020 to December 2020, the Pathology Department at Nalanda Medical College and Hospital, Patna, Bihar, collaborated with the Radiology Department to perform this prospective observational study. Forty more patients were sent to the pathology department for fine needle aspiration. These patients had their thyroid swelling checked with ultrasonography. This study included patients who had palpably felt thyroid nodules that were symptomatic, incidentally noticed asymptomatic but suspicious thyroid nodules, and who voluntarily provided written informed consent to participate.

Patients with thyroid swelling who do not receive FNAC or who do not provide informed consent were not included in this Study.

Data gathered and organized into an MS Excel sheet. Version 20.0 of the SPSS software is used to analyze data. Qualitative information tallied as a percentage and frequency. Quantitative information that has been summarized using the mean and standard deviation. The statistical significance has been tested using the t test and the chi-square test.

Results

The age range of 31 to 40 accounts for the largest number of patients out of 40 with thyroid lesions, with a frequency of 10 (25%). A second-highest frequency of 9 (22.5%) is observed in the age group < 30.There were 8 (20%), 5 (12.5 %), 5 (12.5 %), and 3 (7.5 %) of patients in the age groups 41 to 50, 51 to 60, 61 to 70, and 71 to 80, respectively. Thirty-one patients, or 77.5 percent, are female, and the remaining nine patients, or 22.5%, are male. (Table 1).

Table 1: Distribution of cases according to Demographic profile of patients

Particular		No. of cases [n=40]	Percentage
Age (Years)	≤30	9	22.5%
	31 to 40	10	25%
	41 to 50	8	20%
	51 to 60	5	12.5%
	61 to 70	5	12.5%
	71 to 80	3	7.5%
Gender	Male	9	22.5%
	Female	31	77.5%

Twenty-one (52.5%) of the forty individuals with thyroid lesions had solitary nodules, while nineteen (47.5%) had multiple nodules. 38 (95%) cases had wider nodules than tall ones, while 2 (5%) cases had taller nodules than wide ones. (Table 2)

Table 2: Distribution of cases according to Number of Nodules

		No. of cases	Percentage
Number of Nodules	Solitary	21	52.5%
	Multiple	19	47.5%
Shape of Nodule	Taller than Wide	2	5%
	Wider than Tall	38	95%

Of the 40 patients, 2 (5%) had malignant nodules that were taller than wide, and 1 (2.5%) had malignant nodules that were wider than tall, while 33 (82.5%) had benign nodules and 4 (10%) had nodules that were suspicious of malignancy. (Table 3)

Table 3: Distribution according to shape of Nodule

Shape of Nodule	Benign		Suspicious for Malignancy		Malignant		Total
	Number	Percentage	Number	Percentage	Number	Percentage	
Taller than Wide	0	0%	0	0%	2	5%	2(5%)
Wider than Tall	33	82.5%	4	10%	1	2.5%	38(95%)
Total	33	82.5%	4	10%	3	7.5%	40(100%)
$\chi 2$=25.96, P-Value0.00001							

Three cases (7.5%) with an irregular margin have two (5%) malignant cases and one (2.5%) suspicious for malignancy. Thirty-three (82.5%) of the 37 (92.5%) cases with a regular margin are benign, one (2.5%) is malignant, and three (7.5%) are suspicious for malignancy. (Table 4)

Table 4: Distribution according to Margin and FNAC

Margin	Benign		Suspicious for Malignancy		Malignant		Total
	Number	Percentage	Number	Percentage	Number	Percentage	
Irregular	0	0%	1	2.5%	2	5%	3(7.5%)
Regular	33	82.5%	3	7.5%	1	2.5%	37(92.5%)
Total	33	82.5%	4	10%	3	7.5%	40(100%)
$\chi 2$=14.269, P-Value0.0002							

Of the forty patients, one (2.5%) had malignant cases that were little, one (2.5%) had coarse, and one (2.5%) had missing calcification. 27 (67.5%) cases had no calcification, 3 (7.5%) cases had little calcification, and 3 (7.5%) cases had coarse calcification. One (2.5%) case exhibited no calcification, while three (7.5%) cases were suspicious for malignancy. (Table 5).

Table 5: Distribution of calcification according to FNAC

Calcification	Benign		Suspicious for Malignancy		Malignant		Total
	Number	Percentage	Number	Percentage	Number	Percentage	
Coarse	3	7.5%	0	0%	1	2.5%	4(10%)
Tiny	3	7.5%	3	7.5%	1	2.5%	6(15%)
Absent	27	67.5%	1	2.5%	1	2.5%	30(75%)
Total	33	82.5%	4	10%	3	7.5%	40(100%)
$\chi 2$=13.655, P-Value=0.0084							

Eleven (27.5%) of the 40 patients are predominantly solid; five have benign diagnoses, three are suspicious for malignancy, and three have malignant diagnoses based on FNAC. Five (12.5%) are solid; four have benign diagnoses, one is suspicious for malignancy, and none have a malignant FNAC. 18 (45%) of the cases are Predominant Cystic, of which 18 are benign, 0 are suspicious for malignancy, and 0 are malignant based on FNAC screening. Six (15%) of the cysts are benign, 0 are suspicious for malignancy, and 0 are malignant based on FNAC. (Table 6)

Table 6: Distribution of Composition according to FNAC

Calcification	Benign		Suspicious for Malignancy		Malignant		Total
	Number	Percentage	Number	Percentage	Number	Percentage	
Predominant Solid	5	12.5 %	3	7.5 %	3	7.5 %	11(27.5%)
Solid	4	10 %	1	2.5 %	0	0 %	5(12.5 %)
Predominant Cystic	18	45 %	0	0 %	0	0 %	18(45 %)
Cystic	6	15 %	0	0 %	0	0 %	6(15 %)
Total	33	82.5 %	4	10 %	3	7.5 %	40(100 %)
$\chi 2$ =16.815, P-value= 0.00998							

Three (7.5%) malignant cases out of 40 patients had hypoechoicecogenicity. Six cases (15%) were classified as benign; 1 case (2.5%) as hypoechoic; 17 cases (42.5%) as isoechoic; and 9 cases (22.5%) as hyperechoic. Four (10%) cases of suspicious malignancy exhibited hypoechoicechogenicity. (Table 7)

Table 7: Distribution of Echogenicity according to FNAC

Echogenicity	Benign		Suspicious for Malignancy		Malignant		Total
	Number	Percentage	Number	Percentage	Number	Percentage	
Anechoic	6	15%	0	0%	0	0%	6(15%)
Hypoechoic	1	2.5%	4	10%	3	7.5%	8(20%)
Isoechoic	17	42.5%	0	0%	0	0%	17(42.5%)
Hyperechoic	9	22.5%	0	0%	0	0%	9(22.5%)
Total	33	82.5%	4	10%	3	7.5%	40(100%)
χ^2 =33.9394pValue0.00001							

Three malignant patients (7.5%) exhibited internal vascularity. Six (15%) of the benign patients had peripheral vascularity, four (10%) had internal vascularity, and twenty-three (57.5%) had non-existent vascularity. One case (2.5%) that was suspicious for malignancy had peripheral vascularity, two cases (5%) had internal vascularity, and one case (2.5%) had absent vascularity. (Table 8)

Table 8: Distribution of Vascularity according to FNAC

Vascularity	Benign		Suspicious for Malignancy		Malignant		Total
	Number	Percentage	Number	Percentage	Number	Percentage	
Peripheral	6	15%	1	2.5%	0	0%	7(17.5%)
Internal	4	10%	2	5%	3	7.5%	9(22.5%)
Absent	23	57.5%	1	2.5%	0	0%	24(60%)

Thirty three benign thyroid lesion in total, of which fourteen (42.42%) are cases of Colloid Nodular Goiter. These are followed by five cases (15.15%) of Multinodular Goiter, two cases (6.06%) of Hyperplastic Lesion, eleven cases (33.33%) of Colloid Goiter with Cystic Degeneration, and one case (3.03%) of Hashimoto Thyroiditis. (Table 9)

Table 9: Distribution of Benign cases on FNAC

Benign	No. of cases	Percentage
Colloid Nodular Goiter	14	42.42%
Multinodular Goiter	5	15.15%
Hyperplastic Nodule	2	6.06%
Colloid goiter with cystic degeneration	11	33.33%
Hashimoto Thyroiditis	1	3.03%
Total	33	100%

Six (15%) of the patients have malignant lesions that are confirmed by FNAC after a USG diagnosis. 30 patients, or 75% of the total, had a benign lesion identified by USG and confirmed by cytology. On the other hand, 1 (2.5%) patient who had a USG diagnosis of a benign lesion was subsequently found to be suspicious of malignancy on FNAC, whereas 3 (7.5%) patients who received a USG diagnosis of a malignant lesion were later found to be benign. (Table 10)

Table10: Correlation of USG and FNAC Finding

USG Finding	FNAC Finding		Total	Sensitivity	Specificity
	Benign	Suspicious for Malignancy			
Benign	30(75%)	1(2.5%)	31(77.5%)	85.71%	90.91%
Suspicious for Malignancy	3(7.5%)	6(15%)	9(22.5%)		
Total	33(82.5%)	7(17.5%)	40(100%)		
Positive Predictive Value (PPV) = 66.67%		Negative Predictive Value (NPV)= 96.77%			

Discussion

The age group of 31 to 40 years old comprised 10 (25%) of the patients in our study, whereas the age group of <30 years old included 9 (22.5%). Patients with thyroid nodules, ranging in age from 17 to 72 years old with a mean age of 41.77±12.31 years, were included in Alam et al. study[16]. Within the age range of 15–62 years, Popli et al. study [17] examined. The mean age was 54.7±13.7 years, according to Hatada et al. [18] review of ultrasound guided fine needle aspiration biopsy for thyroid nodules. In a research by Ram et al. [19], the patients' ages ranged from 15 to 73 years old, with a mean of 43±13 years. The range of 15–82 years with a mean age of 52.8±13.8 years was reported by Koike et al. [20].

In the current study, there were nine (22.5%) male patients and 31 (77.5%) female patients. The results of Hatada et al.[25] revealed that 85.36% of the population was female. 1:3 male to female ratio and 76% female population were noted by Alam et al. [16].279 (90.29%) of the patients in a research by Koike et al. [21] were female. Ram et al. [22] also observed that 81 (80%) of the study's participants were female. A popular imaging technique for assessing the morphological characteristics of thyroid nodules is USG. Due to its low cost, safety, and non-invasive nature, USG is favoured over other imaging modalities such as computed tomography, magnetic resonance imaging, and radioactive thyroid scan[21].

In the current study, the majority of thyroid nodules, or 31, or 77.5 percent, were found to be benign, while the remainder 09, or 22.5%, were found to be suggestive for malignancy upon USG examination. To determine the number of benign and malignant nodules, our study was compared to several earlier investigations.

In their investigation on the predictive power of thyroid nodules 'ultrasonographic characteristics for malignancy, Mamere et al. [23] identified 142 (88.2%) lesions as benign and 19 (11.8%) as malignant nodules. With the aid of USG, Bhuyar et al. [24] examined 50 instances in all; 45 (90%) of them were determined to be benign, 1 (2%) to be suspicious, and 4 (8%) to be malignant. In a study by Brkljacić B et al. [20], a total of 426 thyroid nodules were included for evaluation of benign and malignant nodules based on USG echogenicity. They discovered that 356 nodules (83.6%) were benign and 70 nodules (16.4%) were malignant.

In our study, 21 (52.5%) of the patients had a single nodule when they first arrived. On the other hand, 19 people (47.5%) had several nodules. Although multinodular goitres are typically thought to be benign, cancerous nodules can occasionally be present. According to Koike et al.[21], there were 17.8% multiple nodules and 82.2% single nodules. On the other hand, Jena et al. [25] discovered that while 27.4% of patients had numerous nodules, 72.6% of patients had solitary lesions.

In the current study, 33 (82.5%) Benign and 4 (10%) Suspicious for Malignancy patients exhibited wider than Tall nodule, while 2 (5%) Malignant cases and 1 (2.5%) Malignant cases showed Taller than Wide nodule. To investigate the relationship between taller than wide shape and malignancy, our study was compared with several other studies that had been conducted.

Three of the lesions in our FNAC investigation were malignant, and one lesion (2.5%) had microcalcification on USG. One malignant lesion (2.5%) exhibited coarse calcification. 33 of the lesions on the FNAC were benign; 3 (7.5%) of them had coarse calcification, 3 (7.5%) had small calcification, and the remaining 27 had no calcification. Microcalcifications showed a strong correlation with FNAC cases suggestive for cancer and malignancy. (P = 0.0084) Our research revealed a statistically significant correlation between microcalcifications and cancer, which is consistent with the majority of previous investigations, including those conducted by Iannuccilli et al.[26] and Kovacevic et al.[27].

The USG exhibited a sensitivity of 85.7% and a specificity of 90.91% with a 95% confidence interval for identifying malignant thyroid nodules. It was discovered that while determining if thyroid nodules were malignant, there was a strong correlation between the results of FNAC and ultrasonography.

In their study, Popli et al. [17] looked at 240 thyroid nodules using USG and found that, for the ultrasound diagnosis of benign and malignant thyroid nodules, the corresponding values for overall sensitivity, specificity, positive, and negative predictive values were 81.8%, 87.2%, 59.0%, and 95.5%. Thyroid cancer was found to have a sensitivity of 83.3% and a specificity of 94.9% for nodules 1 cm, according to Ozel et al. study [28].

In the assessment of malignant thyroid nodules, Sanaullah et al. [29] reported 93.3% diagnostic accuracy, 94.12% specificity, and 90.3% sensitivity for ultrasonography findings.

Conclusion

Thyroid nodule ultrasonography combined with fine needle aspiration cytology is the most effective screening test for cancer in the outpatient department. Several ultrasonography characteristics are used to assist classify lesions and manage them. This study identifies associations between the following ultrasonography features: microcalcification in conjunction with enhanced internal vascularity, solitary nodules with malignancy on cytology, AT ratio more than 1, predominant solid lesion, hyperechoic lesion, and uneven margin.

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