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Evaluation of malignant risk potential of thyroid nodules using ultrasound thyroid imaging reporting and data system (Tirads) criteria and correlating with fine needle aspiration cytology (FNAC)

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Abstract

Background: Thyroid gland is one of the major endocrine gland in our body which can be affected by various congenital anomalies, inflammatory diseases and various tumors which can present as thyroid nodules. Thyroid nodules can include both benign and malignant nodules. Ultrasonography is the best available tool for initial work-up of thyroid nodules using ACR-TIRADS lexicon. The ACR-TIRADS along with a Thyroid Ultrasound Reporting Lexicon developed in order to provide a protocol for risk stratification & management of thyroid nodules.

Aims and objectives: To evaluate the ultrasound characteristics of thyroid nodules & categorize them using the ACR-TIRADS category based on suspicious ultrasound findings. To correlate the suspicious ultrasound features with the pathological (FNAC)

findings. To assess the malignancy risk of suspicious thyroid nodules.

Materials and methods: This study is a cross-sectional study conducted on 50 patients using PHILIPS Affinity 50 Ultrasonography MACHINE with linear probe of 6-12MHzin department of radio-diagnosis in Alluri Sitarama Raju Academy of Medical Sciences referred for ultrasound (US) evaluation of thyroid nodules over a period of 12 months (1st October 2020 to 30th September 2021).

Results: Out of 50 cases studied, patients with TIRADS 3 criteria (n=36), all were benign. Among patients with TIRADS 4 criteria (n=10), 8/10 (80%) were benign and 2/10 (20%) were malignant. Among patients with TIRADS 5 criteria (n=4), all were malignant. The association between them was statistically significant.

Conclusion: ACR TIRADS scoring is a simple, applicable, and potentially cost-effective approach of classifying thyroid nodules on ultrasound, which determines the probability of malignancy risk with certain level of confidence & thus helps in deciding the further management & avoiding unnecessary FNAC and surgeries.

Keywords: Thyroid, ACR-TIRADS, Nodules, Risk stratification, Benign, Malignant

Introduction

Thyroid gland is one of the major endocrine gland in our body. It can be affected by various congenital anomalies, inflammatory diseases and various tumors which can present as thyroid nodules. Thyroid nodules can include both benign and malignant nodules. Nodules in thyroid gland are very common with a reported prevalence of up to 68% in adult population. Ultrasonography is the modality of choice for initial characterization of thyroid nodules because of its widespread availability, low cost and lack of ionising radiation. But ultrasonography is not a confirmatory method to differentiate between benign and malignant nodules. The investigation procedure for confirmation is fine needle aspiration cytology. FNAC is an invasive and painful procedure. It also carries risk of introducing infection. To avoid unnecessary FNAC in all cases, thyroid nodules were classified into TIrads (thyroid imaging reporting and data system) category based on suspicious ultrasound findings[1]. The ACR-TIRADS[2]along with a Thyroid Ultrasound Reporting Lexicon[3] developed in order to provide a protocol for risk stratification & management of thyroid nodules. ACR TI-RADS provides points in 5 categories (TR1 to TR5) on the basis of sonographic features of thyroid nodules which include composition, echogenicity, shape, margin &echogenic foci[2].The sum of all points corresponds to a risk level of malignancy which is ranging from TR1 (benign) to TR5 (highly suspicious), which in conjunction with maximal dimension of the nodule, used to guide for management of the nodules[4].

Aims and objectives

To evaluate the ultrasound characteristics of thyroid nodules & categorize them using the ACR-TIRADS category based on suspicious ultrasound findings.To correlate the suspicious ultrasound features with the pathological (FNAC) findings. To assess the malignancy risk of suspicious thyroid nodules.

Materials & Methods

A total number of 50 patients referred for ultrasound (US) evaluation of thyroid nodules were imaged with PHILIPS Affinity 50 Ultra sonography machine with linear probe of 6-12MHzin department of radio-diagnosis in Alluri Sitarama Raju Academy of Medical Sciencesin the department of radio-diagnosis over a period of 12 months (1st October 2020 to 30th September

2021). It was ancross-sectional study and a total of 50 patients fulfilling the selection criteria were studied.

Source of data

Patients who got referred to the Radiology department for ultrasound (US) evaluation of thyroid nodules

Selection criteria

Inclusion criteria

Patients referred to the radiology department for ultrasonographic evaluation of thyroid nodules and are scheduled to get an FNAC done are included in this study.

Exclusion criteria

- Patients who refused to give consent for participating in the study.
- Systemic or CNS related secondary thyroid involvement - Patients with secondary thyroid related disorders like drug/radiation induced hypo/ hyperthyroidism

Results

A total of 50 referred for ultrasound (US) evaluation of thyroid nodules were imaged.

Majority of the patients belonged to 31-40 years age group. Males were 20% and females were 80%.

Figure 1: Distribution of patients based on the age group.

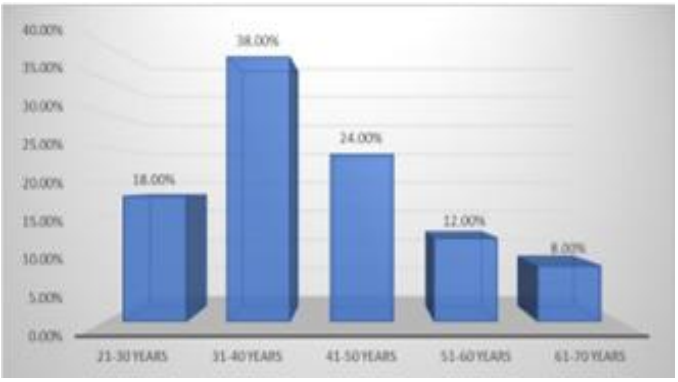
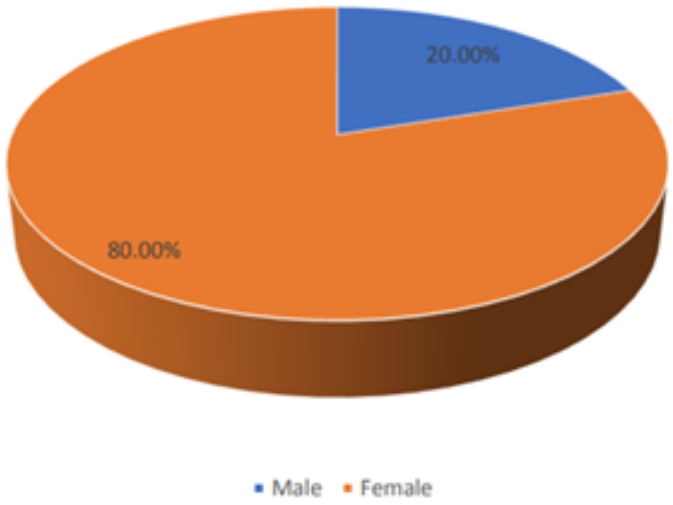


Figure 2: Distribution of patients according to the sexes.



Clinical findings were neck swelling (100%), single nodule (88%), pain (68%), dysphagia (14%), multiple nodule (12%) and change of voice (8%).

Based on USG findings, shape was taller than wider in 4% patients and wider than taller in 96% patients; echogenicity showed hypo echogenicity in 22% patients, hyper/ is echogenicity in 70% patients and markedly hypo echogenicity in 8% patients; Content was mixed in 52% patients and solid in 48% patients; calcification showed macrocalcification in 42% patients and micro calcification in 6% patients; margins were micro lobulated in 4% patients and smooth in 86% patients.

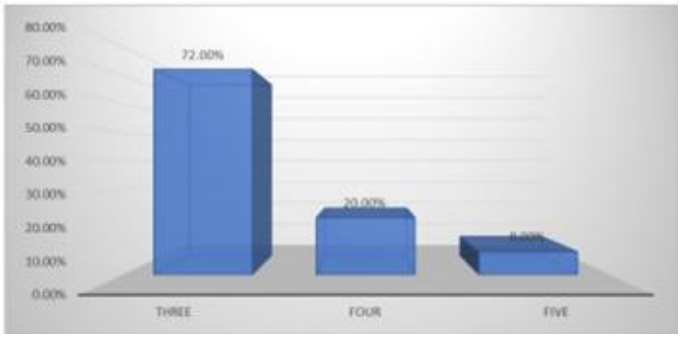
According to TIRADS criteria, 72% belonged to TIRADS 3 criteria, 20% belonged to TIRADS 4 criteria and 8% belonged to TIRADS 5 criteria.

Among patients with TIRADS 3 criteria (n=36), all were benign. Among patients with TIRADS 4 criteria (n=10), 8/10 (80%) were benign and 2/10 (20%) were malignant. Among patients with TIRADS 5 criteria (n=4), all were malignant. The association between them was considered to be statistically significant.

Table 1: Distribution of patients based on the TIRADS criteria.

		Frequency	Percent
TIRADS	3	36	72.0%
	4	10	20.0%
	5	4	8.0%
	Total	50	100.0%

Figure 3: Distribution of patients on the basis of TIRADS criteria



Findings in FNAC report were cystic degeneration of colloid goiter (2%), cystic degeneration of nodular colloid goiter (10%), cystic degeneration of nodular goiter (10%), colloid goiter (10%), follicular thyroid carcinoma (2%), follicular variant of papillary cancer (2%), lymphoma (2%), nodular colloid goiter (22%), nodular goiter (34%) & papillary thyroid carcinoma (6%)

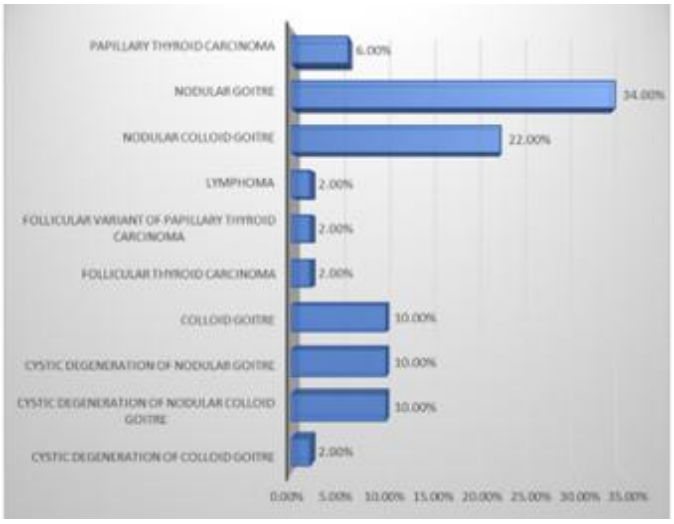


Figure 4: Distribution of patients on the basis of FNAC report

Among patients with TIRADS 3 criteria (n=36), all were benign. Among patients with TIRADS 4 criteria (n=10), 8/10 (80%) were benign and 2/10 (20%) were malignant. Among patients with TIRADS 5 criteria (n=4), all were malignant. The association between them was statistically significant.

Table 2: Patients distribution on the basis of TIRADS criteria and malignancy.

		Benign	Malignant	Total
TIRADS	3	36 (100%)	0 (0%)	36 (100%)
	4	8 (80%)	2 (20%)	10 (100%)
	5	0 (0%)	4 (100%)	4 (100%)
	Total	44 (88%)	6 (12%)	50 (100%)

Figure 5: TIRADS score-3 nodule with FNAC report as colloid goiter.

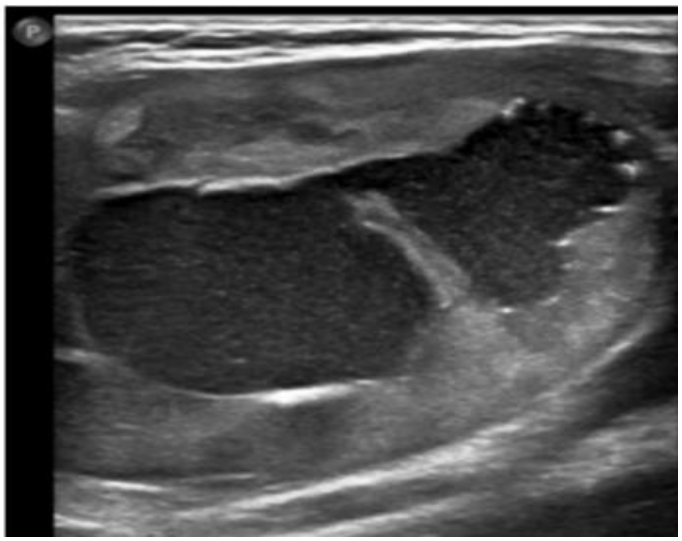


Figure 6: TIRADS score-3 nodule with FNAC report as nodular goiter.

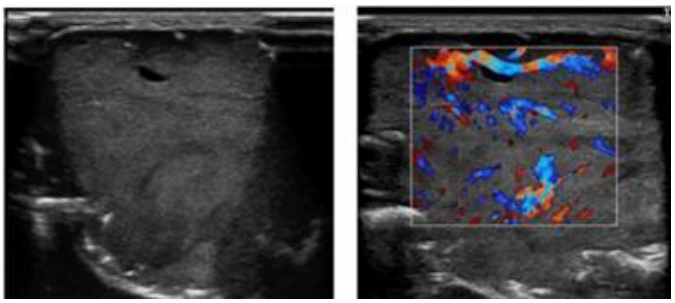


Figure 7: TIRADS score-4 nodule with FNAC report as nodular colloid goiter

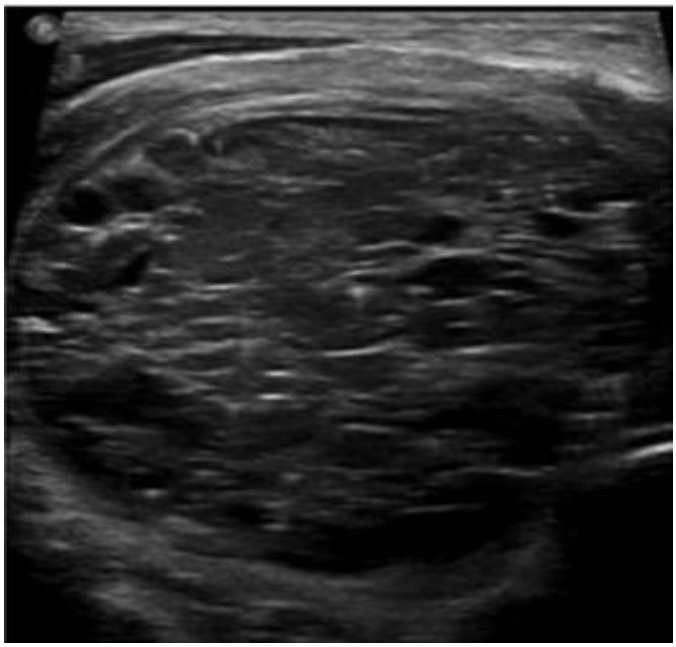


Figure 8: TIRADS score-5 nodule with FNAC report as Papillary thyroid carcinoma.

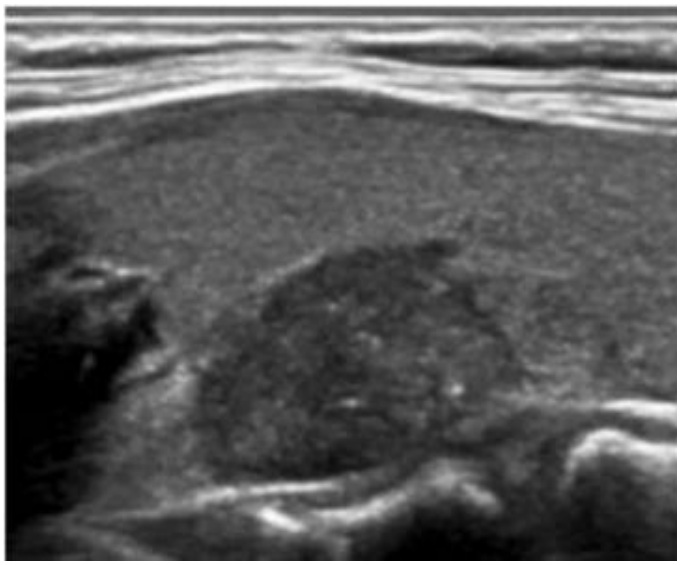
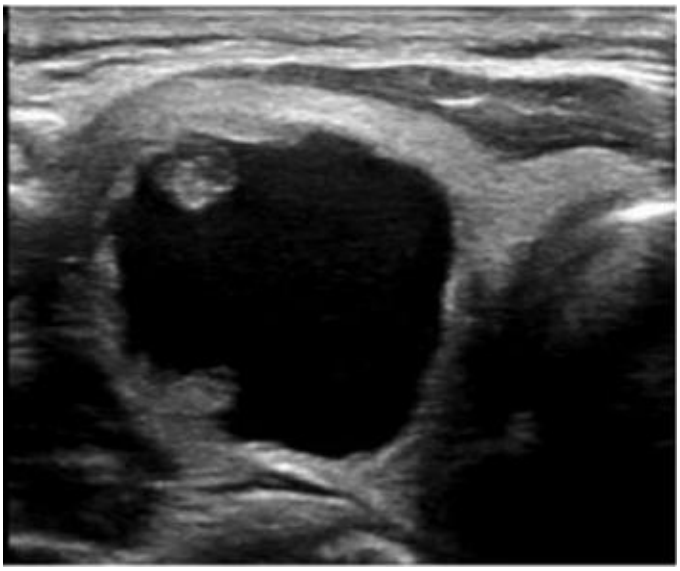


Figure 9: TIRADS score-3 nodule with FNAC report as cystic degeneration of nodular colloid goiter.



Discussion

- According to Richman DM et al., (2020)[5]conducted a study to estimate the performance of ACR TI-RADS criteria for guiding on whether to biopsy nodules of thyroid in children. Total of 314 cases were studied. Among the 314 cases, nodules scored were 404, of which 19.1% (77 of 404) were malignant. Most common malignant nodules were PTC (68 [88.3%] of 77).
- Periakaruppan G et al., (2018)[6] conducted a study to evaluate the correlation between TIRADS & Bethesda system for reporting thyroid - cytopathology at a tertiary care center in India. In their study, out of 117 TIRADS 2 nodules, none of them are Bethesda IV or higher, which means none of the nodules are malignant. The risk of malignancy for TIRADS 2, TIRADS 3, TIRADS 4 & TIRADS 5 was 0%,2%,38%&77% respectively and concluded that the probability of a particular nodule being malignant can be effectively inferred from USG-TIRADS system with confidence.
- Singapore Walla RM etal., (2017)[7]compared TIRADS of nodules on USG with the findings on FNAC reported using the Bethesda System. Of the 100 cases,

74 were considered benign or probably benign, 20 were suspicious for malignancy, and 6 were indeterminate on ultrasound. Overall 54 concordance rate with FNAC was 83% with sensitivity 70.6% & specificity 90.4%. The NPV was 93.8%

Conclusion

ACR TIRADS scoring is a simple, applicable, and potentially cost-effective approach of classifying thyroid nodules on ultrasound, which determines the probability of malignancy risk with certain level of confidence & thus helps in deciding the further management & avoiding unnecessary FNAC and surgeries. The ACR TI-RADS risk-stratification system allows clinicians to decide which thyroid nodules require biopsy, follow-up, or no further action based on their ultrasound features.

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