

CORRELATION OF ULTRASOUND CRITERIA OF THYROID NODULES ACCORDING TO THE NEW CLASSIFICATION OF AMERICAN COLLEGE OF RADIOLOGY TIRADS AND FINE NEEDLE ASPIRATION FINDINGS

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ABSTRACT

In recent times, high-resolution ultrasound thyroid imaging has paved the way for significant transformation in clinical approach to thyroid nodule. There are several risk stratification systems in thyroid imaging, developed with an aim, not only to reduce the inter-observer variability but also to establish an effective communication system. Thyroid image reporting and data system (TIRADS) classification system, is the most useful of all. Since there are few research articles published on this subject in Syria, in this research we studied thyroid nodules using high-resolution ultrasound in an attempt to adopt the Thyroid Image Reporting And Data System By American College of Radiology (ACR-TIRADS classification) as a daily examination in the evaluation of these nodules. **Materials and Methods:** This is a cross-sectional Prospective study, which includes 90 patients (100 nodules) who presented with thyroid nodules over 12 months. Patients underwent complete clinical examination, ultrasound, and Fine Needle Aspiration (FNA). **Results:** A significant association was found between the ACR-TIRADS system and Bethesda classification, with a significant statistical significance P value < 0.001. 32 nodules classified as TI-RADS 2 had only a 6.25% risk of malignancy with a statistical significance P value of 0.01. The nodules classified with TIRADS 3 were 20, and the risk ratio for the presence of malignancy was only 5% with a statistical significance of P value 0.02, while the risk ratio for the presence of malignancy was in the 25 nodules classified with TIRADS 4, and the 23 nodules classified with TIRADS 5, 32% and 65.2%, respectively, with statistical significance P value 0.0001. **Conclusion:** The ACR-TIRADS is appropriate to assess thyroid nodules and avoid unnecessary fine needle aspiration, as well as to assist in making a decision about when this procedure should be performed.

KEYWORDS: Thyroid nodule/ACR-TIRADS classification/fine-needle aspiration /ultrasonography / Thyroid gland / histopathology.

I. INTRODUCTION

Thyroid nodules diseases are widespread, estimated about 68% around the world^[3] where one third of adults population are found to have thyroid nodules by ultrasound imaging, and only (4-6.5)% of these nodules are malignant^[5]

FNA examination is considered the basic examination in determining the type of nodules and determining the treatment strategy whether it is surgical or conservative therapy. And since the FNA is considered an expensive and mildly traumatic examination, it was necessary to develop a system based on ultrasound imaging aimed to classify thyroid nodules according to echogenic features

into benign and suspected of malignancy nodules, and thus identifying the nodules that need a FNA procedure and thus avoiding an unnecessary FNA examination, therefore THE AMERICAN COLLEGE OF RADIOLOGY, relying on the success of the BI-RADS system which its main purpose is to evaluate breast lesions based on their echogenic features and determining the type and nature of these lesions (benign or malignant) and as a result determining the best way for treatment and provide a great communication between surgeons and radiologists, has developed the ACR-TIRADS system which consist of five categories divided according to echogenic features to : composition,

shape, margins, echogenicity and punctate hyperechoic foci.^[3]

In our study we evaluate the patients with nodular thyroid diseases based on their echogenic features and classify the nodules according to ACR-TIRADS system and also evaluate the nodules based on their histopathologic feature which were obtained by doing the FNA examination for each nodule and classify the nodules according to BETHESDA system.

The aim of our study is to correlate between the ACR – TIRADS system and the BETHESDA system in order to evaluate the efficacy of the ACR-TIRADS system in determining the type of the thyroid nodules and differentiate the benign nodules from suspicious nodules, and therefore relying on the ACR-TIRADS system as an initial examination in determining the type of thyroid nodules and identifying the nodules that need an FNA procedure.

II. MATERIALS AND METHODS

Study design

Prospective study design.

Duration of study: 1 year (February 2021 – February 2022).

Inclusion criteria

Patients referred to the Department of Radiology at Tishreen University Hospital who were diagnosed with thyroid nodules and agreed to perform FNA.

Exclusion criteria

1. Small thyroid nodules less than 1 cm.
2. Completely cystic thyroid nodules that contain thyroid colloid and are classified as TIRADS1.
3. Nodules whose cytological analysis showed insufficiency of cells "Bethesda I" or atypia BETHESDAIII.
4. Patients who are in danger of bleeding due to for example (a history of taking colliquative, a history of blood diseases such as thrombocytopenia.....).

Materials

High-resolution B-mode ultrasound done using SIEMENS ACUSON NX2 with high-frequency linear probe (5-10 MHz). FNAC reports (follow-up).

Sample size

A total of 90 patients 100 (nodules) were included in the final study.

Sampling method

The study included all the study subjects, who satisfied the inclusion and exclusion criteria, hence no sampling was done.

Procedure

The patient is made to lie supine. The ultrasound

examination starts with B-mode to image the thyroid and the neck. The thyroid nodules, if present, are staged according to ACR-TIRADS. The neck is assessed for suspicious lymph nodes. Then FNA results are followed up for the Bethesda staging.

Data collection methods

Data were collected for the study, using a structure case report form. The data were gathered from the history, clinical examination, and the investigation reports of the study participants.

III. RESULTS

A total of 90 patients 100 (nodules) were included in this study, out of which 76 were females. These thyroid nodules are predominantly found in and around third–sixth decade of life. The patients in this age group amount to 63 patients, approximately 70% of our study population.

In our study, 100 thyroid nodules which were scheduled to get an FNA done were initially assessed using ultrasound and ACR-TIRADS scoring was given for each case. Out of the 100 nodules, 30 were categorized under TIRADS 2, 45 were classified under TIRADS 3, 25 were classified under TIRADS 4, and 23 were classified under TIRADS 5. The nodules classified as Bethesda II were considered benign, and those nodules classified as Bethesda V–VI were considered malignant. Out of the 30 TIRADS 2 nodules, 2 nodules turned out to be under Bethesda V or higher, which means these nodules turned out to be malignant or suspicious of malignancy. Among the 20 nodules labeled as TIRADS 3, only one nodule was suspicious of malignancy. The proportion of malignant nodules classified as TIRADS 2, TIRADS 3, TIRADS 4, and TIRADS 5 were (6.25, 5.32 and 65.2)% respectively.

Sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV), and accuracy were also calculated based on histopathological results. TIRADS scores 4 and 5 were considered positive for malignancy, while scores 2 and 3 were considered negative for malignancy. Data were analyzed by Chi-square test or Fisher's exact test for categorical variables of benign and malignant nodules ($P < 0.001$).

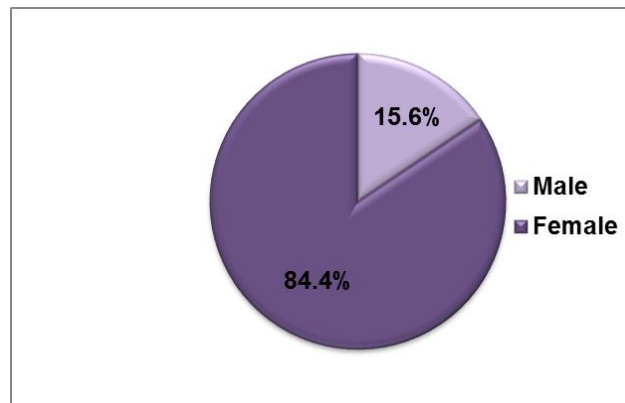


Figure (1): Graphical representation for the Distribution of the research sample by gender.

Table (1): Distribution of the research sample by age groups.

Age	Number of nodules	Percentage
<30	14	15.6%
30-60	63	70%
>60	13	14.4%
Total	90	100%

Table (2): distribution of the research sample according to the histopathological results.

Histopathological results	Number of nodules	percentage
suspicious of malignancy BETHESDA 5,6	26	26%
Benign BETHESDA 2	74	74%
Total	100	100%

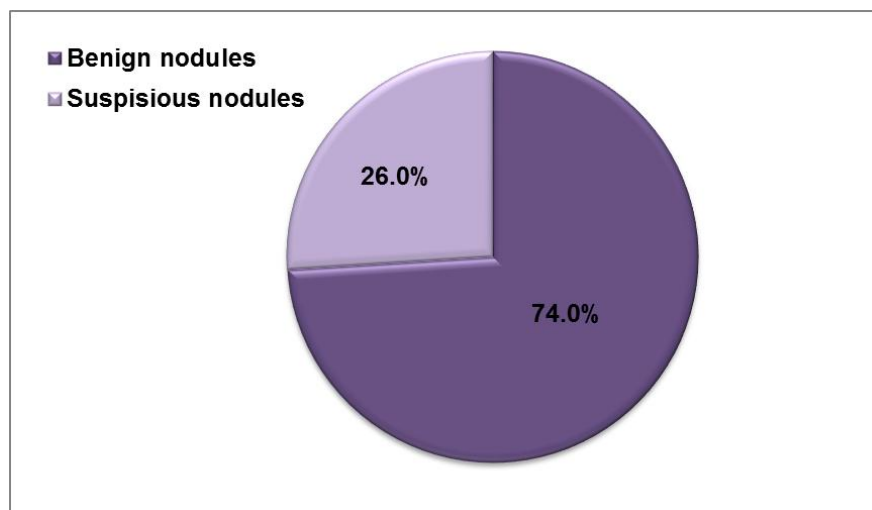


Figure (2): Graphical representation of the research sample according to histopathology result.

Table (3): Distribution of the research sample according to the level of TIRADS.

TIRADS level	Number of nodules	percentage
TR1	0	0%
TR2	32	32%
TR3	20	20%
TR4	25	25%
TR5	23	23%
Total	100	100%

Table (4): Shows the relationship between histopathological findings and TIRADS and the risk of malignancy at each level.

TIRADS level	Total	Histopathological results		Risk of malignancy	P-value
		Benign BETHESDA2	Suspicious BETHESDA5,6		
TR1	0	0	0	———	———
TR2	32	30	2	6.25%	0.01
TR3	20	19	1	5%	0.02
TR4	25	17	8	32%	0.0001
TR5	23	8	15	65.2%	0.0001

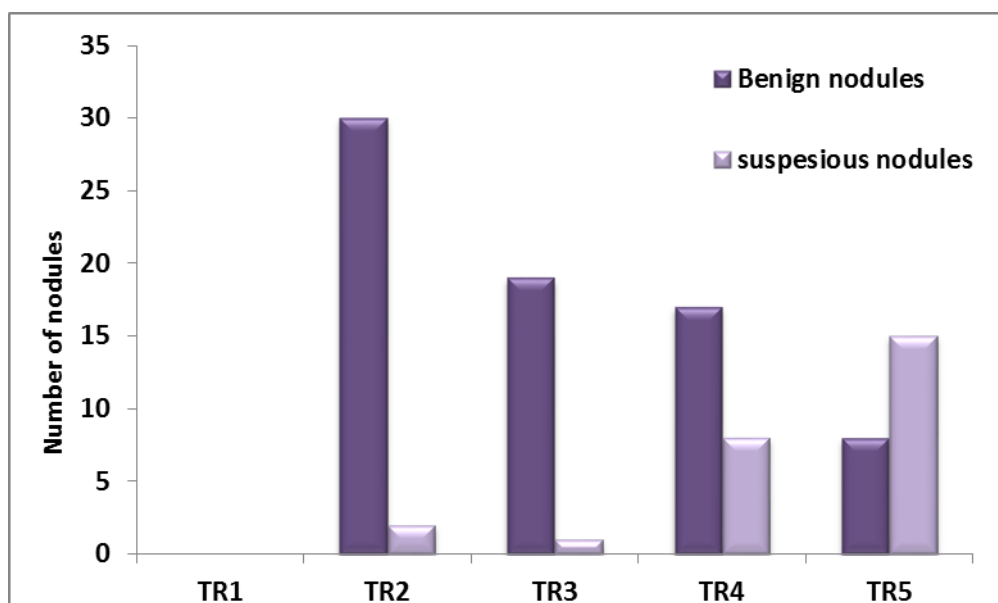


Figure 3: Graphical representation of the relationship between histopathological findings and TIRADS and malignancy risk at each level.

IV. DISCUSSION

There are many classifications that have been developed based on ultrasound imaging in order to try to determine the need for an FNA examination, so in our study we have adopted the ACR-TIRADS classification system in order to classify the nodules from benign to mildly suspicious, and even highly suspected nodules, and try to correlate the echogenic findings with Histopathological findings. Our study sample included 100 thyroid nodules in 90 patients, the number of female patients was 76, or 84.4%, compared to 14 males, or 15.6%, so the prevalence of thyroid diseases Nodular is higher in females than in males. This can be explained by the fact that in females and during menstruation, there is an overlap between female hormones and thyroid hormones⁽⁶⁾, which predisposes to nodular thyroid disease, and also in females during pregnancy there is an increase in estrogen levels, and an increase in estrogen receptor levels in the Thyroid cells, which is considered a predisposing factor for nodular thyroid disease^[6], and there are some studies that found a relationship between the occurrence of iron deficiency and an increased risk of nodular thyroid disease^[6], and as it is known that females, during menstruation, and pregnancy may Commonly have iron deficiency. In our study, we

divided the sample into three age groups as following: less than 30 years old, between 30 and 60 years old, and older than 60 years old. We found in our study that 70% of patients who had thyroid nodules were between 30 and 60 years old, compared to 15.6% in patients less than 30 years old, and 14.4% in patients over 60 years old. And Since the largest proportion of patients are females, we may attribute the reason for the dominance of the age group, which ranges between 30 and 60, to the fact that in this age females are exposed to the hormonal changes that we talked about earlier (menstruation and pregnancy). Nodular thyroid disease is common, affecting about 68% of the population around the world,^[3] but fortunately, most of these nodules are benign.^[1,2,7] and this is consistent with our study where The number of benign nodules was 74, or 74%, compared to 26 suspicious nodules, representing 26% of the total sample. We also found that there is no statistically significant relationship between sex and the increased incidence of malignancy in nodular thyroid diseases, where the number of malignant nodules in males was 2 with a rate of 14.3%, compared to 22 malignant nodules in females at a rate of 28.9% with a P-value of 0.2, so despite the greater prevalence of thyroid nodules in females compared to males, no gender differences were observed for thyroid nodules suspected

of malignancy. The main objective of our study was to compare the ACR-TIRADS and BETHESDA systems, and by comparing the echogenic findings with the histopathological findings, we found a statistically significant relationship between the high level of TIRADS and the increased risk of malignancy. We had 32 nodules with TIRADS2 classification, and the number of healthy nodules was 30 against 2 suspected nodules with a statistical significance P-value of 0.01 and a risk of malignancy of 6.25% with a sensitivity of 40% and specificity of 92.3%, and a positive predictive value of safety 93.75%. We also had 20 nodules with TIRADS3 classification and the number of healthy nodules was 19 versus only one suspected nodule with a statistical significance P-value of 0.02 and a risk ratio of 5% for malignancy with a sensitivity of 25.67%, specificity of 96.15%, and a positive predictive value of safety 95%. From the previous values, we note that the specificity and positive predictive values of safety for TIRADS2 and TIRADS3 are high. We also had 25 nodules with TIRADS4 classification and the number of healthy nodules was 17 versus 8 suspected nodules with a statistical significance of P-value 0.0001 and a risk ratio

of 32% for the presence of malignancy with a sensitivity of 30.76%, specificity of 77.02%, and a negative predictive value of 76%. And we had 23 nodules with TIRADS5 classification and the number of healthy nodules was 8 versus 15 suspected nodules with a statistical significance P-value of 0.0001 and a risk ratio of 65.2% for the presence of malignancy with a sensitivity of 57.69%, specificity of 59.18%, and a negative predictive value of 85.71%. From the previous values, we note that the specificity and negative predictive values of malignancy for TIRADS4 and TIRADS5 are high. Based on all the previous results, we were able to confirm the reliability of the ACR-TIRADS system, and confirm its importance in classifying thyroid nodules, and relying on it to identify suspected nodules that need FNA, benign nodules, and nodules that need monitoring. We found by studying the risk of malignancy according to the number of total points that the thyroid nodules take based on echogenic appearance according to the ACR-TIRADS system, that The higher the number of points, the higher the percentage of malignancy with a statistical significance of P-value 0.0001.

Table 5: Study comparison.

TIRADS5	TIRADS4	TIRADS 3	TIRADS 2	Sample size	
%65	%32	%5	%6.25	90 patients (100 nodules)	Our study 2022
%77	%38	%2	%0.2	184 patients	GokulakrishnanPeriakaruppan2018
%100	%11	% 0.7	% 0.5	1466 patients	Kevin Berbaum2016
%91	%76	%31	%9	3414 patients	Jin Young Kwak2011
%91	%43	% 1.7	%0.8	906 patients	Antonio Rahal Junior 2016
%100	%76	%31	%1.8	2679 patients	Ji-Young Park 2009
% 89	%45	%14	%0	1959 nodules	Eleonora Horvath 2009

V. CONCLUSION

There was a statistical significance of P-value 0.0001 when studying the risk of malignancy according to the number of total points based on the echogenic appearance of the thyroid nodules according to the ACR-TIRADS system. There was a statistical significance ranging from P-value 0.02 to 0.0001 according to the degree of TIRADS when studying the relationship between echogenic findings and histopathological findings, so the ACR-TIRADS system can be considered as the appropriate system for filtering thyroid nodules that need or do not need FNA procedure, Thus avoiding unnecessary FNA. The ACR-TIRADS classification system is practical, and rather easy, as it relies on the characteristics of the B-MODE only, thus reducing errors that may result from the inexperience of the examiner. The higher the ACR-TIRADS classification, the higher the incidence of malignancy, and the higher the number of points according to echocardiographic findings, the higher the malignancy rate, with a statistical significance of P-value 0.0001. It was concluded that there are certain echogenic characteristics that suggest malignancy more than others, such as Punctate Echogenic Foci, the nodule being severely hypoechoic, its extension out of the

thyroid, the increase in the anterior-posterior diameter more than the transverse, the higher the number of points, the higher the ratio Presence of malignancy with statistical significance P-value 0.0001. It was concluded that there are certain echogenic characteristics that suggest benign nodules more than others, such as: defined clear edges, cystic content, presence of large comet tail artifact, presence of large rough calcifications, the fewer points, the higher the safety ratio with a statistical significance of 0.0001 P -value.

VI. REFERENCES

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