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ORIGINAL ARTICLE

Correlation Between Ultrasonographical and Cytopathological Features of Thyroid Nodules

HUMA KHALIQ[1], SAIMA GULZAR[2], KHURRAM SHEHZAD[3], KOUKAB GULZAR[4], NAGINA KHALIQ[5], SEHRISH AFZAL[6]
[1]*Ex-Consultant Radiologist, Nori Hospital, Islamabad*
[2]*Assistant Professor of Histopathology, Services Hospital, Lahore*
[3]*Assistant Professor of Pathology (Histopathology), Khawaja Muhammad Safdar Medical College, Sialkot*
[4]*Principal Medical Officer, KRL Hospital, Islamabad*
[5]*PMO (Consultant Gynaecologist), PAEC General Hospital, Islamabad*
[6]*Registrar Radiology, Rawalpindi Institute of Cardiology, Rawalpindi*
Correspondence to: Huma Khaliq, E-mail: huma.khaliq@hotmail.com, Cell: 0303-5190008

ABSTRACT

Background: Thyroid nodule is a common presentation in the head neck clinics as well as radiological departments. For the accurate assessment and identification of a thyroid nodule the correlation between ultrasonographical and cytological examination is a preferable protocol.

Objective: To evaluate the correlation between ultrasonographic and cytopathologic features of thyroid nodules.

Methodology: This cross-sectional study was conducted at Department of Radiology, Nori Hospital Islamabad from 1st December 2018 to 30th June 2019. A total of 150 patients from both genders were included in this study. The patients within the age group of 25-60 years were included. Known cases of thyroidal malignancy or other carcinoma, previously treated patients and pediatric patients were excluded. The cytological examination Fine needle aspiration cytology was requested to all these patients in addition to complete ultrasonographical Doppler based imaging. The TIRADS classification for ultrasonographical assessment in correlation with cytological classification through Bethesda was adapted for thyroid nodule identification.

Results: There were 83.3% females and 16.6% males with the mean age of 40.1±6.7 years. Within the various ultrasound related features it was observed that majority of the cases were having higher number of positivity for composition as well as vascularity while there were 142 cases out of 150 cases having negative results for shape overall accuracy revealed that the feature of nodule composition demonstrated the highest sensitivity. In contrast, the shape of the nodule exhibited the highest specificity (96.2%), diagnostic accuracy (88.9%) was seen. 84% cases were benign while 16% were malignant. A significant of benign cases of TIRADS 2 were majorly reported in the TIRADS 5 followed by 4. The majority of the patients were TIRADS 2 and Bethesda 2 classification and benign. There were 24 cases as 16% cases were malignant with highest number of cases within the TIRADS 5 and Bethesda 5 smear. There were 90% of the patients identified with papillary thyroid carcinoma while 10% were suffering from follicular carcinoma.

Conclusion: The application of TIRADS classification based on ultrasongrphical results is highly significant in bringing accuracy to the cytopathological results and also reducing unnecessary fine needle aspiration cytology.

Keywords: Correlation, Ultrasound, Cytopathology, Thyroid nodules, Thyroid Imaging Reporting and Data System (TIRADS)

INTRODUCTION

Thyroid nodules are a frequently encountered condition globally, with a reported prevalence ranging from 4-8%. Most of these nodules are non-cancerous, although the likelihood of malignancy lies between 7% and 15%.[1] Nodular thyroid disorders are considered complex due to the localized, unregulated growth within normal thyroid tissue, which may involve both structural and functional alterations. These nodules may present as isolated entities, unaccompanied by other thyroid-related disorders such as hormonal dysfunction, autoimmune thyroid disease, or cancer.[2,3] Despite being a critical component of assessment, the clinical evaluation of nodule size, morphology, and function lacks precision. Notably, ultrasound (US) often reveals multiple nodules in about half of the patients who are clinically found to have a single palpable nodule. Additionally, US can detect nodules in up to 50% of individuals who present with a clinically normal thyroid on palpation, highlighting the growing reliance on imaging techniques for investigating suspected thyroid conditions.[4,5]

The use of imaging technologies such as computed tomography (CT), magnetic resonance imaging (MRI), and particularly US has markedly increased the identification of thyroid nodules.[6] With advancements in imaging resolution enabling detection of smaller lesions, the incidence rate of thyroid nodules is expected to rise further.[7] The high-resolution imaging reveals at least one small nodule in nearly 70% of the population.[8] However, there is often a mismatch between sonographic features and cytological results, creating challenges and inconsistencies in clinical decision-making.[9,10]

Determining the appropriate indications for fine-needle aspiration cytology (FNAC) remains a contentious issue. Over the last twenty years, debates have persisted regarding which radiological or clinical characteristics reliably suggest malignancy, with no universally accepted classification emerging.[11] The inconsistencies in various classification systems have prompted efforts to align or correlate findings across different diagnostic methods. In this context, Canberk et al[12] investigated the use of the Thyroid Imaging Reporting and Data System (TIRADS) in 2014, proposing it as a complementary tool to FNAC. Although correlations among different classification systems were noted, achieving a unified, standardized approach was deemed unfeasible.

The present study seeks to evaluate our institutional practices in diagnosing and managing thyroid nodules by examining the correlation between sonographic findings and cytological results. Specifically, it focuses on assessing the concordance between suspicious ultrasound characteristics such as solid or mixed echotexture, hypoechogenicity, central vascular flow, a taller-than-wide shape, irregular margins, and signs of extrathyroidal extension and malignant features identified in cytology as classified by the Bethesda system.[13-15]

MATERIALS AND METHODS

This cross-sectional study was conducted at Department of Radiology, Nori Hospital Islamabad from 1st December 2018 to 30th June 2019. All patients who visited the general OPD with suspicious thyroid nodule/thyroid mass and referred to radiology department were enrolled. A total of 150 patients from both genders were included. The patients within the age group of 25-60 years were included. Known cases of thyroidal malignancy or other carcinoma, previously treated patients and pediatric patients were excluded. The sample size was calculated using web-based WHO sample size calculator which applied a prevalence of thyroidal nodule in general population as 30%, 95% CI, 80% power of test

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and 5% margin of error. The cytological examination fine needle aspiration cytology was requested to all these patients in addition to complete ultrasonographical Doppler based imaging. A complete thyroid nodule assessment was performed using ultrasound technique by a professional radiologist. The suspicious Ultrasound imaging findings were further examined for the solid or mixed composition, central vascularity, irregular margins hypo echogenicity, taller versus wider shape, positive extra thyroid extension evidence. The TIRADS classification for ultrasonographical assessment in correlation with cytological classification through Bethesda was adapted for thyroid nodule identification. A well-structured questionnaire was used for documenting the clinical symptoms, clinical history as well as demographic and clinical details /findings of the patient. The data was further entered and analyzed using SPSS version 26.0 wherein Chi square test and Odds Ratio was applied as an assessment tool. P value <0.001 was considered as significant.

RESULTS

There were 125 (83.3%) females while 25 (16.6%) males with the mean age of 40.1±6.7 years. Majority of the patients were within the age group of 35 to 54 years with minimum number of patients as young adults (Table 1). Within the various ultrasound related features, it was observed that majority of the cases were having higher number of positivity for composition as well as vascularity while there were 142 cases out of 150 cases having negative results for shape followed by 114 having negative margins and 102 having negative echogenic foci (Fig. 1).

An analysis of the diagnostic performance of individual radiological features including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy revealed that the feature of nodule composition demonstrated the highest sensitivity and NPV, both at 100%. In contrast, the shape of the nodule exhibited the highest specificity (96.2%), PPV (30%), and diagnostic accuracy (88.9%) [Table 2]. 84% cases were benign while 16% were malignant. A significant number of benign cases were reported in the TIRADS classification of category 2 followed by category 1 while malignant cases were majorly reported in the TIRADS 5 followed by 4 (Table 3).

The majority of the patients were TIRADS 2 and Bethesda 2 classification and benign. There were 24/150 cases as 16% cases were malignant with highest number of cases within the TIRADS 5 and Bethesda 5 smear (Table 4). There were 90% of the patients identified with papillary thyroid carcinoma while 10% were suffering from follicular carcinoma (Fig. 3).

Table 1: Demographical features of the enrolled patients (n=150)

Demographics	No.	%
Gender		
Female	125	83.3
Male	25	16.6
Age (years)		
18–24	10	6.6
25–34	30	20.0
35–44	35	23.3
45–54	42	28.0
55–64	22	14.6
>64	11	7.3

Table 2: Radiological features sensitivity, specificity, positive and negative predictive values

	Sensitivity	Specificity	PPV	NPV	Accuracy
Composition	100% (81-100%)	26.2% (19.8-33.5%)	11.82% (10.9-12.7%)	100% (99.9-100%)	33.8% (26.2-40.0%)
Echogenicity	7.20% (0.3-33.9%)	89.93% (83.6-95%)	7.7% (1.1-37.2%)	89.3% (88.1-90.6%)	81.3% (73.6-87.5%)
Shape	17.8% (3.9-43.5%)	96.2% (92.3-99.1%)	30.0% (10.8-60.1%)	92.2% (90.5-93.7%)	88.9% (83.4-93.0%)
Margin	58.9% (33.1-82.0%)	79.5% (73.1-83.1%)	22.1% (14.8-31.9%)	96.0% (92.6-97.3%)	77.8% (72.0-83.5%)
Vascularity	89.1% (52.0-99.8%)	30.3% (23.1-39.1%)	7.0% (5.7-9.1%)	97.6% (87.5-99.7%)	33.6% (26.3-41.5%)
Echogenic foci	65.6% (38.4-85.8%)	70.5% (63.1-76.2%)	18.4% (12.5-25.2%)	95.3% (92.3-98.4%)	70.0% (63.0-76.5%)

PPV: positive predictive value; NPV: negative predictive value

Table 3: The categories of the enrolled patient on the basis of TIRADS classification

TIRADS classification	Benign	Malignant	Total	OR (95% CI)	P value
	Age (years)				
	24-58	30-50			
1	17 (100%)	-	17	0.22 (0.01-4.7)	0.34
2	90(100%)	-	90	0.04 (0.001-0.96)	0.04
3	13 (81.3%)	3 (18.8)	16	Reference	
4	6 (54.6%)	5 (45.5)	11	1.2 (0.3-5.2)	0.73
5	-	16 (100)	16	6.06 (1.3-26.6)	0.01

Table 4: The correlation between cytopathological and ultrasound thyroidal classification

Bethesda	TIRADS										Total
	1 (n=17)		2 (n=90)		3 (n=16)		4 (n=9)		5 (n=16)		
	B	M	B	M	B	M	B	M	B	M	
2	13	-	89	-	12	-	6	-	-	-	120
3	4	-	-1	-	-	-	-	-	-	-	5
4	-	-	-	-	1	1	-	2	-	-	4
5	-	-	-	-	-	2	-	3	-	16	21
Total	17	-	90	-	13	3	6	-5	-	16	150

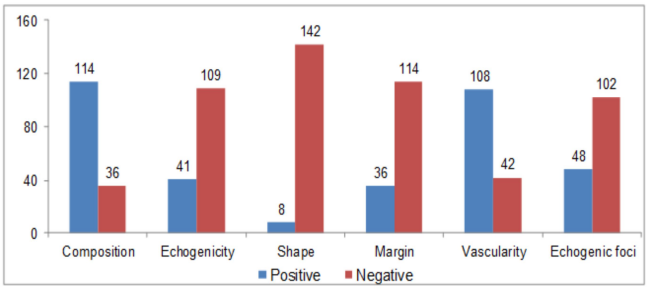

Fig.1: Radiological features of the enrolled patients

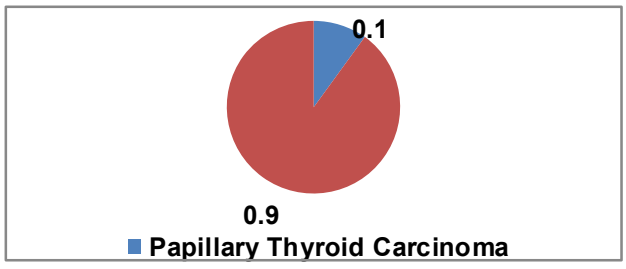

Fig. 2: Frequency of various types of malignancy found among enrolled patients

DISCUSSION

The advanced research shows the importance of assessment of thyroid nodules. Within the various systems of assessments the TIRADS for interpreting Ultrasound results is the most unique one. It applies the classification on the base of staging thyroid nodules.[12-14] Recent research has shown its association with Bethesda system of cytological examination interpretation. However, it is still ambiguous and needs research to be conducted on it. It has also supported that the determination of thyroid nodule assessment on the basis of TIRADS classification and its association with cytology determinants is very crucial and challenging in clinical decision making.[15]

In the current research the TIRADS as well as cytological assessment was conducted where and it was seen that majority of the cases around 84% were benign and the majority from the TIRADS 2 and the Bethesda classification 2. Similar results have been reported from the studies elsewhere.[16] Poller[17] reported that the cytopathology review of thyroid does provide useful information however the thyroid radiological scan has efficient finding. These examinations show cystic mass, solid or pure cystic thyroid relations specifically in cases of unsatisfactory find needle aspirational cytology as well as non-diagnostics

Various researchers have supported the present study results wherein the TIRADS examination is considered as highly significant prior to FNAC reporting and is there by used for assessing the benign or malignant condition of a thyroid.[18,19] Ultrasonographical findings are considered as a superior technique which must be applied for accurate malignant identification of a thyroid nodule. In the present research almost 16% of the patients were identified with malignant thyroid nodule. Similar results have been reported in previous research[20] as well where in malignant thyroid nodule findings were reported. The risk of malignancy increases with the staging of TIRADS, with highest number reported within TIRADS 5. The malignancy rate of TR 5 nodules was instituted to be 97.1% in a study with a significant p-value (0.022). This study further elaborated a 6 fold increased malignancy in TIRADS 5. Rahal et al[21] reported the risk of malignancy for TIRADS 4 patients around 10.86-fold in comparison to TIRADS 3 patients.

CONCLUSION

The application of TIRADS classification based on ultrasonographical results is highly significant in bringing accuracy to the cytopathological results and also reducing unnecessary fine needle aspiration cytology.

REFERENCES

1. Paschou SA, Vryonidou A, Goulis DG. Thyroid nodules: a guide to assessment, treatment and follow-up. Maturitas 2017;96:1–9.
2. Hegedüs L. Encyclopedia of endocrine diseases. Odense, Denmark: Elsevier; 2018; 4: 529-38.
3. Burch HB, Burman KD, Cooper DS, Hennessey JV, Vietor NO. A 2015 survey of clinical practice patterns in the management of thyroid nodules. J Clin Endocrinol Metab 2016;101:2853-62.
4. Sughayer MA, Abdullah N. The Bethesda system for reporting thyroid cytopathology: a meta-analysis. Acta Cytol 2017;61:172.
5. Haugen BR, Alexander EK, Bible KC, et al. American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: the American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer. Thyroid 2016;26(1):1–133.
6. Guth S, Theune U, Aberle J, Galach A, Bamberger CM. Very high prevalence of thyroid nodules detected by high frequency (13 MHz) ultrasound examination. Eur J Clin Invest 2009;39:699-706.
7. Rice CO. Incidence of nodules in the thyroid. A comparative study of symptomless thyroid glands removed at autopsy and hyperfunctioning goiters operatively removed. Arch Surg 1932;16:505-15.
8. Vander JB, Gaston EA, Dawber TR. The significance of nontoxic thyroid nodules. Final report of a 15-year study of the incidence of thyroid malignancy. Ann Intern Med 1968;69:537-40.
9. Canberk S, Atasoy T, Kilicoglu G, Vardar FA, Meric K. Is it possible to avoid unnecessary FNAs with the use of TIRADS (Thyroid Imaging Reporting and Data System) and elastogram? A comparison study with the 6-tiered (Bethesda System for Reporting Thyroid Cytology - “TBSRTC”) and 5-tiered (British Thyroid Association-Royal College of Physicians - “BTA/RCP” and Italian Society for Anatomic Pathology and Cytopathology - “SIAPEC”) FNA classification systems. J Am Soc Cytopathol 2014;3(5):558-9.
10. Vrinten C, McGregor LM, Heinrich M, von Wagner C, Waller J, Wardle J, Black GB. What do people fear about cancer? A systematic review and meta-synthesis of cancer fears in the general population. Psychooncology 2017;26:1070-79.
11. Ito Y, Miyauchi A, Kudo T, et al. Trends in the implementation of active surveillance for low-risk papillary thyroid microcarcinomas at Kuma Hospital: gradual increase and heterogeneity in the acceptance of this new management option. Thyroid 2018;28:488-95.
12. Drake T, Gravely A, Westanmo A, Billington C. Prevalence of thyroid incidentalomas from 1995 to 2016: a single-center, retrospective cohort study. J Endocr Soc 2019;4(1):bvz027
13. Tan L, Tan YS, Tan S. Diagnostic accuracy and ability to reduce unnecessary FNAC: a comparison between four Thyroid Imaging Reporting Data System (TIRADS) versions. Clin Imaging 2020;65:133–7.
14. Periakaruppan G, Seshadri KG, Vignesh Krishna GM, Mandava R, Sai VP, Rajendiran S. Correlation between ultrasound-based TIRADS and Bethesda system for reporting thyroid-cytopathology: 2-year experience at a tertiary care center in India. Indian J Endocrinol Metab 2018;22:651-5.
15. Alshaikh R, Almaghribi K, Alshammari DM, Mohamad H, Ebrahim W, Alshammari SM, Sabra O. Correlation Between Ultrasound and Cytological Findings of Patients With Suspicious Thyroid Nodules: The King Hamad University Hospital Experience. Cureus 2022;14(3):e22877.
16. Hwang SH, Sung JM, Kim EK, Moon HJ, Kwak JY. Imaging-cytology correlation of thyroid nodules with initially benign cytology. Int J Endocrinol 2014;2014:491508.
17. Poller DN. Value of cytopathologist review of ultrasound examinations in non-diagnostic/unsatisfactory thyroid FNA. Diagn Cytopathol 2017;45:1084-7.
18. Yoon JH, Lee HS, Kim EK, Moon HJ, Kwak JY. Thyroid nodules: nondiagnostic cytologic results according to Thyroid Imaging Reporting and Data System before and after application of the Bethesda system. Radiology 2015;276:579-87.
19. Grant EG, Tessler FN, Hoang JK, et al. Thyroid ultrasound reporting lexicon: white paper of the ACR Thyroid Imaging, Reporting and Data System (TIRADS) Committee. J Am Coll Radiol 2015;12:1272-9.
20. Delfim RL, Veiga LC, Vidal AP, Lopes FP, Vaisman M, Teixeira PF. Likelihood of malignancy in thyroid nodules according to a proposed Thyroid Imaging Reporting and Data System (TI-RADS) classification merging suspicious and benign ultrasound features. Arch Endocrinol Metab 2017;61:211-21.
21. Rahal A Junior, Falsarella PM, Rocha RD, et al. Correlation of Thyroid Imaging Reporting and Data System [TIRADS] and fine needle aspiration: experience in 1,000 nodules. Einstein (Sao Paulo) 2016;14:119-23.

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