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ULTRASOUND BASED EVALUATION OF THYROID NODULES USING TIRADS DESCRIPTORS WITH ITS HISTOPATHOLOGICAL CORRELATION

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ABSTRACT **Aim :** To characterize the thyroid nodules according to grey scale sonographic using TIRADS scoring system with its TIRADS score and correlate the results with the histopathological examination findings wherever possible. **Materials and methods :** This prospective study was done on the study group comprising of 100 patients , referred for ultrasound thyroid. Ultrasound evaluation was done based on TIRADS lexicon features such as the internal composition, echogenicity, margins, presence and type of calcifications, and the shape of all these lesions. **Observations and analysis :** Out of the five suspicious sonological features, irregular margins showed the highest positive predictive value for malignancy followed by taller than wide shape , microcalcifications . Completely cystic composition, hyper echogenicity, and macrocalcifications were features with 100% PPV and 100% sensitivity for benignity in our study. Among these features, irregular margins were the most sensitive for malignancy followed by taller than wide shape, micro calcification, marked hypoechogenicity, and solid composition in that order. We found that as the number of suspicious TIRADS features increased, the risk of malignancy also increased.

KEYWORDS : TIRADS , malignancy , irregular margins , hypoechogenicity

Aim

To characterize the thyroid nodules according to grey scale sonographic using TIRADS scoring system with its TIRADS score and correlate the results with the histopathological examination findings wherever possible.

MATERIALS AND METHODS

This prospective study was done on the study group comprising of 100 patients, equal to or above 18 years of age, referred to the Department of Radio-diagnosis from Surgical and Medical Departments with clinically suspected thyroid lesions, for ultrasound thyroid.All these patients underwent sonography and subsequent ultrasound guided needle biopsy.In cases where surgery was done, these results were followed up with histopathology report. The study required an invasive investigation FNAC to be conducted on patients.

TECHNIQUE

All the ultrasound scans were performed on PHILIPS AFFINITY50 machine equipped with a 7.5–12 MHz high frequency linear array transducer. All images were examined on real-time two-dimensional gray-scale and Doppler imaging. Both lobes of the thyroid gland including the isthmus were evaluated. With the patient supine and neck hyper-extended, the entire gland was examined.

Image evaluation and data modulation

Ultrasound evaluation was done based on features such as the internal composition, echogenicity, margins, presence and type of calcifications, and the shape of all these lesions. In a patient with more than one thyroid nodule, the nodule with the most number of suspicious sonographic features was considered.

In this study, to evaluate the reliability of TIRADS, the findings from all the 100 ultrasound scans performed were compared to the FNAC reports and histopathology reports whenever surgery was done.

The internal component of the suspected lesion was categorized as solid, cystic (anechoic), and mixed (partially solid with cystic component).[1,2]

Echogenicity was classified as hyperechogenicity , isoechogenicity , hypoechogenicity (echogenicity less than that of the adjacent thyroid parenchyma but more than that of the surrounding strap muscle), or marked hypoechogenicity (echogenicity less smooth) .[1,2]

Calcifications, when present, were categorized as microcalcifications (equal to or <1 mm in diameter and visualized as tiny, punctate, hyperechoic foci, either with or without acoustic shadowing, and without comet tail artifacts) or macrocalcifications (hyperechoic foci larger than 1 mm). [1,2]

Shape was categorized as taller than wide or wider than tall

When assessing a nodule, its point total determines the nodule's ACR TI-RADS stage, which varies from TR1 (benign lesion) to TR5 (high suspicion of malignancy) [1,2].

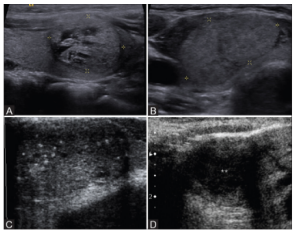

Figure 1: Ultrasound image showing A. Hyperechoic B. isoechoic C. hypoechoic and D. markedly hypoechoic thyroid nodules

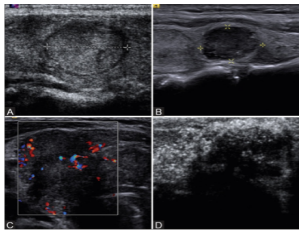

Figure 2 : Ultrasound image showing (A) well-defined (B) microlobulated (C) ill-defined and (D) irregular margins in thyroid nodules

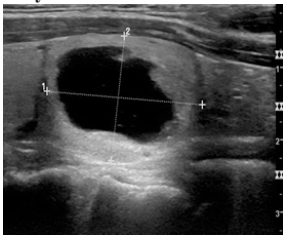

Figure 3 :Spongiform nodule in a 59-year-old woman. More than 50% of the nodule is composed of small cystic spaces. The nodule received 0 points for composition because of its spongiform designation and no additional points in other categories – TR1

Figure 4 : Benign mixed cystic and solid nodule (1 point) in a 40-year-old woman. The 1-point isoechoic solid component is distributed around the periphery. The nodule received 2 points - TR2 CATEGORY LESION

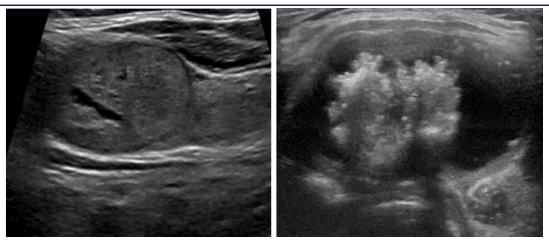

Figure 5 : A benign colloid nodule in a 65-year-old woman. It was classified as mixed solid + cytsic (composition score of 2), With 1 more point for isoechogenicity and none in other categories – TR3 CATEGORY LESION

Figure 6 :Mixed cystic and solid papillary cancer in a 39-year-old man has a lobulated solid mural component with punctate echogenic foci (PEF). The nodule received 1 point for composition, 1 for its isoechoic solid component, and 3 for PEF, for a total of 5 (TR4 CATEGORY LESION).

OBSERVATIONS AND ANALYSIS

Table 1 : Distribution And Risk Stratification Of Cases Based On Its Tirads Category

TIRADS CATEGORY	NO. OF BENIGN LESIONS	NO. OF MALIGNANT LESIONS	TOTAL	RISK OF MALIGNANCY (%)
1	1	0	1	0
2	19	0	19	0
3	44	3	47	0.64
4A	20	1	21	4.76
4B	1	2	3	66.67
4C	1	5	6	83.33
5	0	3	3	100

Table 2 : Statistical Results Of Malignant Descriptors In Tirads

TIRADS FEATURES	SENSITIVITY (%)	SPECIFICITY (%)	POSITIVE PREDICTIVE VALUE (%)	NEGATIVE PREDICITIVE VALUE (%)
SOLID COMPOSITION	57	95.6	50	96.7
MARKED HYPO-ECHOGENICITY	42.8	96.7	50	95.7
IRREGULAR MARGINS	85.7	98.9	85	98.9
MICROCALCIFICATIONS	42.8	98.9	75	95.8
TALLER THAN WIDER SHAPE	57	98.9	80	96.8

Table 3 : Correlation Between Thyroid Imaging Reporting And Data System Features , Benignity And Malignancy

TIRADS FEATURE	BENIGN LESION	MALIGNANT LESION	TOTAL LESIONS
SOLID COMPOSITION			
Present	4	4	8
Absent	89	3	92
MARKED HYPO-ECHOGENICITY			
Present	3	3	6
Absent	90	4	94
IRREGULAR MARGINS			
Present	1	6	7
Absent	92	1	93
MICROCALCIFICATIONS			
Present	1	3	4
Absent	92	4	96
TALLER THAN WIDER SHAPE			
Present	1	4	5
Absent	92	3	95

Of a total of 100 patients included in this study, there were 94 females (93.97%) and 6 males (6.03%) with a male to female ratio of 1:15.5. We observed a rather higher female to male ratio in our study The average age of the patients was 33.1 years (range: 18–68 years).

Correlation between thyroid imaging reporting and data system sonological features, benignity and malignancy

Out of the five suspicious sonological features, irregular margins showed the highest positive predictive value (PPV) (85%) for malignancy followed by taller than wide shape (80%), microcalcifications (75%), marked hypo echogenicity (50%) and solid composition (50%).

Likewise, there were three features which showed a 100% PPV and 100% sensitivity for benignity in our study: Completely cystic composition, hyper echogenicity, and macrocalcifications. There were totally 25 lesions which were completely cystic, 30 lesions which were hyperechoic and 7 lesions with macrocalcifications and all these lesions were confirmed to be benign on cytopathology.

The rest of the lesions comprised 19 mixed composition lesions (18 benign and 1 malignant lesions), 10 isoechoic lesions (9 benign and 1 malignant lesion), 7 hypoechoic lesions (6 benign and 1 malignant lesion), 96 lesions with no calcifications, (92 benign and 4 malignant lesions), 93 lesions with regular margins (92 benign and 1 malignant lesions), and 95 wider than tall lesions (92 benign and 3 malignant lesions).

Among these features, irregular margins were the most sensitive for malignancy followed by taller than wide shape, micro calcification, marked hypoechogenicity, and solid composition in that order.

We found that as the number of suspicious TIRADS features increased, the risk of malignancy also increased.

DISCUSSION

In our study, we tried to establish the sonological features which are highly sensitive for benignity. All the 19 lesions in TIRADS category 2 were found to be benign on FNAC.

The sonological features which were found to have 100% sensitivity for benignity in our study were “completely cystic component” of a thyroid nodular lesion, “hyper echogenicity” and presence of “macrocalcification” in the absence of microcalcification.

Kwak *et al*. found various independent ultrasonographic features that were significantly associated with malignancy. These included hypoechogenicity, marked hypoechogenicity, taller than wide shape, micro calcifications, microlobulated or irregular margins, and solid composition.[3]

We also compared our results with those obtained by Srinivas *et al*.[9] and Chandramohan *et al*. [10], who also evaluated the efficacy of Kwak TI-RADS in differentiating benign and malignant nodules.

Bonavita et al., in their study also observed that presence of hyper echogenicity or the “white knight” appearance was 100% sensitive for a nodule to be benign[4].

Hoang et al., have noted that though a cystic component occurs in 13–26% of all thyroid malignancies, a predominantly cystic appearance is uncommon.[5]

Popli *et al*. in their study observed that all of the four cystic nodular lesions and seven lesions that showed hyperechogenicity in their study were found to be benign on FNAC [6]

Horvath *et al*. in their study found that anechoic, non-vascularised lesions with hyperechoic spots classified as a colloid type 1 lesion were found to have 0% risk of malignancy. In our study all the nodules that had mixed solid-cystic component or predominantly cystic component presented benign cytopathology. Malignancy was seen only among solid nodules. [7]

Vinayak and Sande in their study[8] found that all 14 thyroid lesions which had macrocalcifications were found to be benign. They also observed that thyroid ultrasound can accurately characterize benign thyroid nodules using an index scoring system and therefore preclude FNAC in these patients.In our study, we found a 0% risk of malignancy in TIRADS 2 lesions and 0.64% risk of malignancy in TIRADS 3 lesions.

So, it can be affirmed confidently that all TIRADS category 2 and 3

lesions can be left alone and regular periodic follow-up for the change in the sonological features of the lesion would suffice and help in reducing unnecessary FNACs.

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