



Radiodiagnosis

USEFULNESS OF TIRADS CLASSIFICATION SYSTEM IN THYROID ULTRASONOGRAPHY

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KEYWORDS :

INTRODUCTION

Ultrasonography (US) is the modality of choice for initial characterisation of a thyroid nodule and selecting thyroid nodules that should be assessed by Fine needle aspiration cytology (FNAC). Thyroid nodules (TNs) may show highly diverse ultrasound patterns which often impairs an accurate classification regarding malignancy. However, fewer than 5.0%- 6.5% of incidentally discovered thyroid nodules are malignant<sup>6</sup>. There are several classification systems which categorise thyroid nodules according to the risk of cancer.<sup>4, 7-9</sup> Of the many classification systems that have been described, Thyroid Imaging Reporting and Data System (TIRADS) described by Kwak et al.<sup>4</sup> is a relatively simple system which can be easily adopted, just like Breast Imaging Reporting and Data System (BIRADS) which has been successfully used for several years to assess breast lesions.<sup>10</sup> Similar to BI-RADS, the Thyroid Imaging Reporting and Data System (TI-RADS) was developed for risk stratification of thyroid nodules using US features (Table.1). Many organisations have recommended guidelines for the selection of thyroid nodules for biopsy using size criteria or suspicious US features. For this reason, in 2009 Horvath et al<sup>1</sup> proposed an evaluation system for TNs called TI-RADS (Thyroid Imaging Reporting and Data System), similar to the Breast Imaging Reporting and Data System (BI-RADS)<sup>2-4</sup>. The aim of this study was to verify the usefulness of TI-RADS classification system in thyroid ultrasonography.

Table 1: TI-RADS classification of thyroid nodules.

TIRADS CATEGORY	US FEATURES
TIRADS 1	Normal thyroid gland No focal lesion
TIRADS 2	Benign nodules
TIRADS 3	Probably benign nodules
TIRADS 4a	Undetermined nodules
TIRADS 4b	Suspicious nodules
TIRADS 4c	Highly suspicious nodules
TIRADS 5	Probably malignant nodules
TIRADS 6	Biopsy-proven malignancy

MATERIALS AND METHODS

It was a prospective study carried out at PESIMSR, Kuppam from Jan 2016 - Dec 2017 (Over 2 years). Patients with focal thyroid nodules on ultrasound (US) for which FNAC was performed and pathology results available were selected. The risk of malignancy of each TIRADS category was assessed in the equipment PHILLIPS HD 11XE using high frequency probe (7-11 MHz).

INCLUSION CRITERIA

All Thyroid nodules detected at thyroid ultrasonography with FNAC results.

EXCLUSION CRITERIA

Patients with no focal lesions on US (TIRADS-1 category). Patients who did not undergo FNAC were excluded from the study. TIRADS-6 category cases were also excluded.

RESULTS

Of the 226 thyroid nodule ultrasound scans with FNAC results evaluated, 198 were female and 28 were male patients. The US

features of each thyroid nodule were characterised and classified into different TIRADS categories.

Of these 226 TNs, 196 (87%) showed benign sonographic features and 30 (13%) showed suspicious sonographic features for malignancy. The US features like echogenicity, margins, shape and presence of calcifications were opted for characterising the lesion. 186/226 TNs showed iso-hyperechogenicity and out of these TNs 182 lesions were benign and 4 were malignant. 40/226 TNs showed hypoechogenicity out of which 26 were malignant and 14 were benign lesions (Fig. 1). Based on the margins (Fig.2), 195/226 TNs showed well defined margins. In which 190 TNs were benign and 5 TNs were malignant. 31/226 TNs showed irregular margins, 25 TNs were malignant and 6 TNs were benign lesions. Based on shape (Fig.3), 193/226 TNs showed wider-than-tall shape in which 183 TNs were benign and 10 TNs were malignant. 33/226 TNs showed taller-than-wide shape, 20 TNs were malignant and 13 TNs were benign. Based on presence of calcifications (Fig. 4), 174/226 TNs had no calcifications, 169 TNs were benign and 5 TNs were malignant. 33/226 TNs had macro-calcifications, 23 TNs were benign and 10 TNs were malignant. 19 TNs had micro-calcifications, 15 TNs were malignant and 4 TNs were benign.

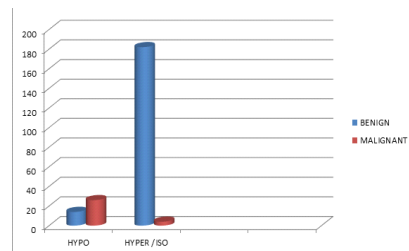


Fig. 1 Based on echogenicity on gray scale US nodules were categorised as – Hyperechoic/isoechoic/hypochoic.

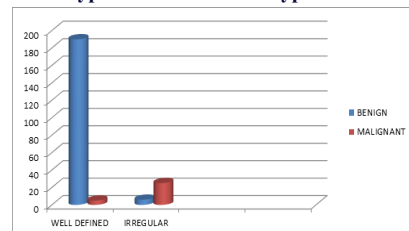


Fig. 2 Based on margins of the nodules – well defined or irregular

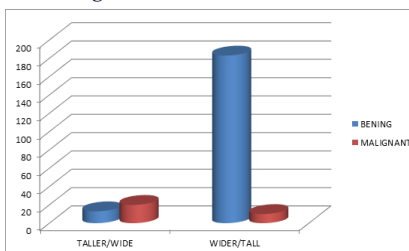
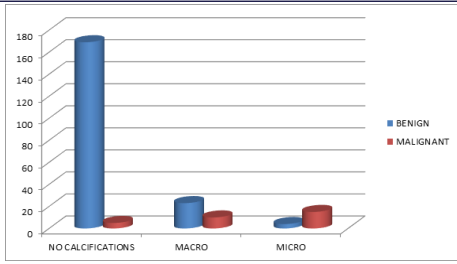
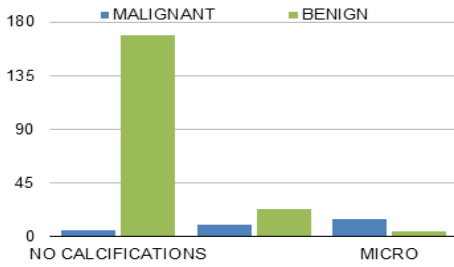


Fig. 3 Based of the shape of the nodule - Taller than wide / Wider than tall.



**Fig. 4 Based on presence of calcifications - No calcifications / macro or microcalcifications**

The different TIRADS categories were confronted with the results of pathology and the risk of malignancy was calculated (Table 2). The risk of malignancy was found to increase from TIRADS 3 to 5.

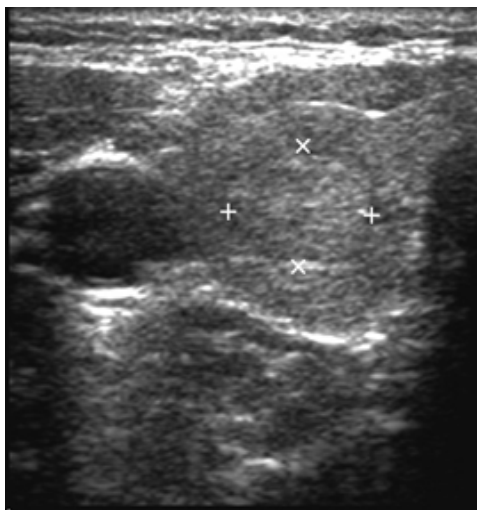


**Table 2 : Pathologically Proved Benign And Malignant Thyroid Nodules With Risk Of Malignancy In Percentage (%).**

The “major” US features suggestive of malignancy were analyzed with respect to TIRADS categories. Positive predictive value, negative predictive value were calculated for each feature. Tables 2 and 3 show the different statistical analysis of the major US features with respect to cytology results, and their respective performance.

**Table 3 : Summary Of The Statistical Performance Of The Main Us Features**

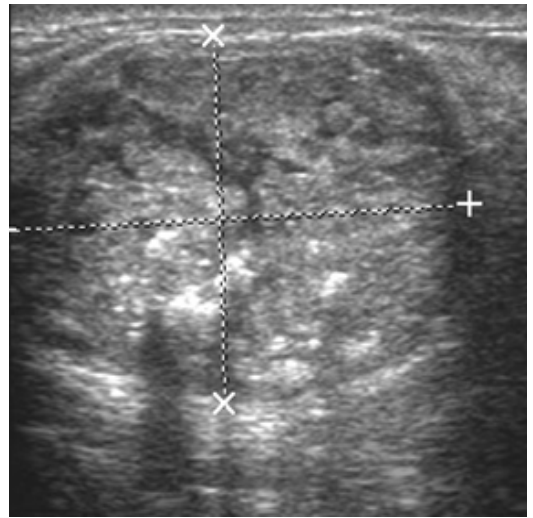
US FEATURES	POSITIVE PREDICTIVE VALUE	NEGATIVE PREDICTIVE VALUE
Hypoechoic	40.9	98.2
Irregular margins	75	98.4
Micro calcifications	78.9	96.9
Taller than wide shape	53.3	96.8



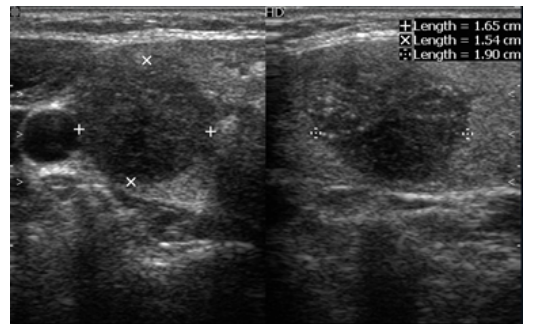
**Fig. 5 Gray Scale Ultrasonography Of Thyroid Demonstrating A Well Defined Isoechoic Nodule With A Thin Peripheral Hypoechoic Halo. Tirads Category 2 - Benign Nodule. (further Fnac Was Not Performed Considering It As A Benign Nodule)**



**Fig. 6 Gray Scale Ultrasonography Of Thyroid Demonstrating A Well Defined Heteroechoic Nodule In Right Lobe Of Thyroid. Tirads Category 3 - Probably Benign Nodule.**



**Fig. 7 Gray Scale Ultrasonography Of Thyroid Demonstrating A Well Defined Heteroechoic Nodule With A Peripheral Hypoechoic Halo. Tirads Category 4 - Probably Malignant Lesion.**

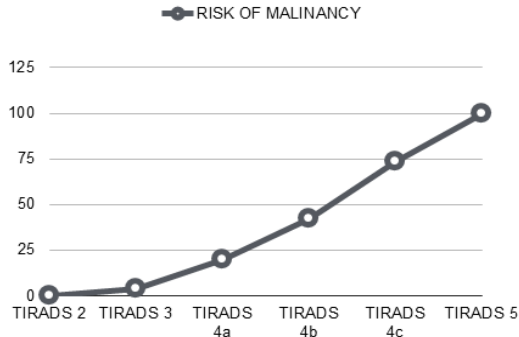


**Fig. 8 Gray Scale Ultrasonography Of Thyroid Demonstrating An Mildly Ill Defined Markedly Hypoechoic Nodule With Internal Microcalcifications In Right Lobe Of Thyroid. Tirads Category 5 - Malignant Nodule.**

**DISCUSSION**

Ultrasound is a safe, noninvasive and easily reproducible imaging modality and suitable sonological criteria could help in precluding unnecessary invasive FNACs in majority of cytologically benign thyroid nodules. The first step in the US classification of TNs consists in evaluating the potential presence of criteria for suspected malignancy. From our results, the risk of malignancy significantly increased from TIRADS 3 to 5 (Table.2). This was zero for TIRADS 2, and would be expected to be so since TIRADS 2 is considered ultrasonographically as a typically benign lesion. In his work, Horvath<sup>1</sup> suggested a malignant risk of less than 5% for TIRADS 3,

5% to 10% for TIRADS 4A, 10% to 80% for TIRADS 4B and greater than 80% for TIRADS 5 (Table. 4).The presence of some US features had earlier been described as highly suspicious for malignancy, and they include hypoechogenicity, taller-than-wide shape, irregular margins and the presence of calcifications. In our study, these features were found to be highly suspicious for malignancy as can be seen from the PPV and NPV. As the suspicious TIRADS features increased, the risk of malignancy also increased (Table.2 and Fig.9). In our study, TIRADS-3 TN's shows significantly lower risk of malignancy when compared to other similar studies (Table.4).



**Fig 9 : RISK OF MALIGNANCY INCREASED FROM TIRADS 2 TO TIRADS 5**

**TABLE : 4 COMPARISON WITH OTHER SIMILAR STUDIES.**

STUDY AND PARAMETER	TIRAD S-1	TIRADS-2	TIRADS-3	TIRADS-4	TIRAD S-5
HARVOTH et. al	0	0	14.1	45	89.6
PARK et.al	1.8	9.6	31.1	76.8	100
CURRENT STUDY	-	-	3.8	Total = 43.1 4a - 20 4b - 42.1 4c - 73.3	100

**CONCLUSION**

A TI-RADS classification of TNs based on a sonographically suspicious features for malignancy can be better and more easily applied in daily practice. It has allowed us to improve patient management and cost-effectiveness, avoiding unnecessary FNAC.

**RECOMMENDATION**

Further research is needed to develop a protocol of a follow up and follow up interval to determine when FNAC has to be done in TIRADS-3 TN's.

**LIMITATIONS**

No FNAC results for TIRADS-2 category.

**ABBREVIATIONS**

TN's - Thyroid nodules; US - Ultrasonography; FNAC - Fine needle aspiration cytology; TIRADS - Thyroid imaging reporting and data system; BIRADS - Breast Imaging Reporting and Data System.

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