A Study of Clinico-pathological correlation of ACR-TIRDAS score on Thyroid Nodules with FNAC: Dr.

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Abstract

Background/Objectives: In the general surgery department, thyroid cancers are consistently among the most prevalent types of the disease to be diagnosed in patients. Because the majority of thyroid nodules are benign and malignant nodules that are less than one centimetre in size are typically indolent, FNAC and surgery may not be necessary for all diagnosed nodules.

This study is being carried out in order to evaluate the ACR-TIRADS classification, which is a practical non-invasive approach that distinguishes benign nodules from malignant nodules and provides direction for the further evaluation of nodules.

Keywords: ACR-TIRADS, Bethesda, thyroid nodules, thyroid malignancy

Introduction

The General Surgery Department sees a significant number of patients with thyroid cancer, making it one of the most common types of endocrine cancer.

A "thyroid nodule" is a discrete lesion in the thyroid gland that can be distinguished radiologically or palpably from the surrounding thyroid parenchyma. This distinction can be made through physical examination. Nodules on the thyroid are not uncommon and are found in approximately 8.5% of the population. They are more common in females.[1] According to one of the studies, the percentage of people in the Indian community who have a palpable thyroid nodule is approximately 12.2%.[2] The annual incidence of thyroid cancer is 8.7 cases per 100,000 persons, however this number appears to be growing in the wrong direction.[3]

An ultrasound of the thyroid can detect nodules in as much as 67 percent of the population.[4] On the other hand, fewer than 10% of them are cancerous.[5]

The ultrasonogram, often known as a USG, is widely regarded as the most effective diagnostic tool for the initial evaluation of thyroid nodules. It is difficult to separate benign thyroid nodules from malignant thyroid nodules because of the wide variety of patterns shown by thyroid nodules that are found during USG.[6] Because of this, multiple different categorization systems have to be proposed in order to categorise thyroid nodules according to the likelihood that they may develop into cancer. The TIRADS (2009), the improved

TIRADS (2011), the British U-system (2014), and the ATA standards (2015) are only a few examples of such classifications.[7] Since 2017, the ACR-TIRADS classification system, which is named after the organisation that developed it, the American College of Radiology, has gained widespread popularity.[8,9]

The fine-needle aspiration cytology test is now the most effective test that can be effectively performed to assess whether or not a nodule is cancerous or whether or not it may require surgery to make a clear diagnosis.[10]

The vast majority of nodules are harmless, and even malignant nodules, particularly those that are less than 1 centimetre in size, frequently display activity that is passive or nonaggressive. As a result, FNAC and/or surgery are not necessary for treating all of the diagnosed nodules.

The purpose of the study is to validate the ACR-TIRADS classification and to examine the similarities and differences between the ACR-TIRADS classification of USG and the Bethesda classification of FNAC.

If the ACR-TIRADS classification is accurate, then we should be able to comprehend the malignant risk stratification of a particular thyroid nodule. In turn, this should serve as a guide on the subsequent evaluation and care of the specific thyroid nodule.

Materials and Methods

After receiving approval from the hospital's Ethical Committee, this study was carried out in collaboration of Department of General Surgery, Department of General Medicine and the Department of OBG of Srinivas Institute of Medical Sciences, Mangalore.

The type of research carried out here is known as a prospective observational study. The study was conducted from March 2019 until August 2020.

Patients who were admitted and scheduled to undergo thyroid surgery during the course of the study made up the study's population.

The following are the inclusion criteria

- Patients who are hospitalized and scheduled to undergo thyroid surgery,

There is consideration given to the ACR-TIRADS.

Patients who have TIRADS scan data from an institution that is not the study's primary hospital or lab are not eligible.

- Patients who have a history of having their thyroid operated in the past.
- In cases where the results of the thyroid echography were not reported as required by the ACR-TIRADS score.
- In cases in which FNAC Cytology was not reported in accordance with the Bethesda Classification.
- Ages less than 18 and greater than or equal to 90

Procedure: Patients who have been admitted and are scheduled to undergo thyroid surgery are recruited for the study according to the inclusion and exclusion criteria, and proper informed consent is obtained before doing so.

- Clinical data, imaging data and cytology reports are gathered from the patients who were recruited in accordance with the ethical committee guidelines.
- A correlation is drawn between the data so gathered and the final histopathology.

Statistical analysis

The analysis of the data was carried out with the assistance of AKIBM SPSS Statistics 21.0 (IBM Corp., Armonk, NY, USA).

Observations and Results

- A total of 48 patients were included in the final analysis.
- Mean age of the study population is 47 years. Females (87%) forms majority of the study population.

ACR-Tirads Score

Table 1 describes the distribution of study population according to ACR-TIRADS score. No patients in study population had TR-1(Benign) ACR-TIRADS score.

Table 1: Descriptive analysis of ACR-TIRADS classification in the studypopulation (N=48)

USG Scan (ACR-TIRADS Score)	Per cent (%)
TR 2 (Not suspicious)	22.9
TR 3 (Mild suspicious)	35.4
TR 4 (Moderately suspicious)	37.5
TR 5 (Highly suspicious)	4.2
Total	100.0

Final histopathology report (Final H.P.E)

Table 4 and 5 describes the distribution of study population in accordance with Final H.P.E.

Table 2: Descriptive analysis of Final H.P.E in the study population (N=48)

H.P.E	**Frequency (Per cent)**
Multinodular Goitre	(12.5 %)
Adenoma	(16.7 %)
Colloid goitre	(29.2 %)
Medullary carcinoma of the thyroid	(6.3 %)
Papillary carcinoma of the thyroid	(20.8 %)
Follicular carcinoma of the thyroid	(6.3 %)
Hurthle cell adenoma	(4.2 %)
Non-invasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP)	(4.2 %)
Total	(100 %)

Among the study population, 33.3% of participants had a malignant disease. NIFTP is also included under benign disease.

Table 3: Descriptive analysis of Final H.P.E (benign and malignant) in the study population (N=48)

HPE	**Percent**
Malignant	33.3
Benign	66.7
Total	100.0

Correlation of acr tirads score with final H.P.E. report

Out of 11 people with ACR-TIRADS score 2, one (9.1%) tumour was labelled as malignant by HPE findings, and ten (90.9%) tumours were labelled as benign by HPE findings.

Out of 17 people with ACR-TIRADS score 3,2 (11.8%) tumours were labelled as malignant by HPE diagnosis, and 15 (80.2%) tumours werelabelled as benign by HPE diagnosis.

Out of 18 people with ACR-TIRADS score 4, 11 (61.1%) tumours werelabelled as malignant by HPE diagnosis, and 7 (38.9%) tumours were labelled as benign by HPE diagnosis.

All the people with ACR-TIRADS score 5,2 (100%) tumours were labelled.as malignant by HPE diagnosis.

This was found to be statistically significant with a P-value = 0.001.

Table 4: Correlation of ACR-TIRADS classification with Final H.P.E (N=48)

USG (ACR-Tirads)	HPE	
	Malignant	Benign
	Count %	Count %
Not suspicious (TR 2)	9.1%	90.9%
Mild suspicious (TR 3)	11.8%	88.2%
Moderately suspicious (TR 4)	61.1%	38.9%
Highly suspicious (TR 5)	100.0%	0.0%
Total	33.3%	66.7%

ACR TIRADS score group has been divided into 2 groups mostly benign-including ACR TIRADS 2 and 3 and Mostly Malignant-including ACR TIRADS 4 and 5.
Among 28 people with mostly benign ACR-TIRADS score, only 3 were labelled as malignant by Final H.P.E
Among 20 people with mostly malignant ACR TIRADS score, 7 people were labelled as benign by Final H.P.E.
Statistically significant relation with $p < 0.001$ was noted between ACR-TIRADS and Final H.P.E.

Table 5: Correlation of ACR-TIRADS classification (Malignant and Benign) with Final H.P.E (N=48)

	N	Final H.P.E	
		Benign	Malignant
ACR-Tirads Score		9.1%	90.9%
Mostly Benign (TR 2, 3)		11.8%	88.2%
Mostly Malignant (TR 4,5)		61.1%	38.9%
Total		100.0%	0.0%
Chi-square value = 15.47; P<0.001:: Kappa Value = 0.56; P < 0.001			

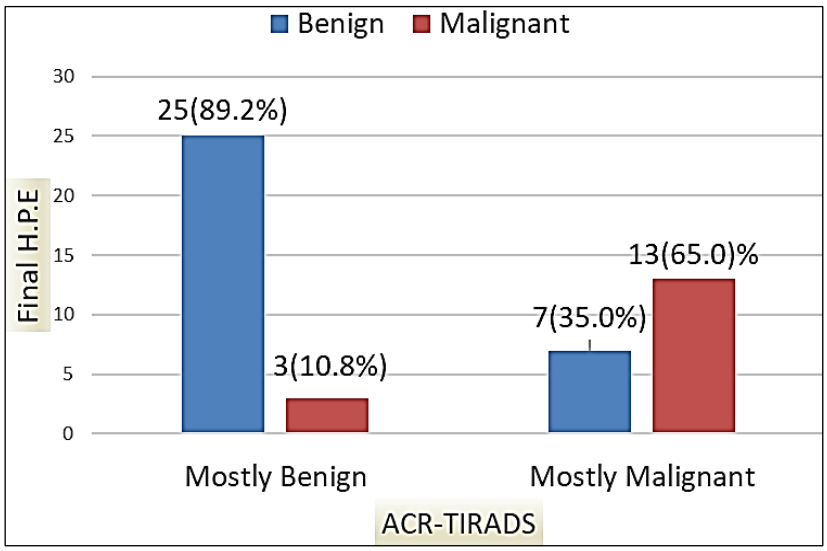

Chart 1: Clustered bar chart comparison of ACR-TIRADS classification (benignand malignant) with Final HPE diagnosis (N=48)

The ACR-TIRADS classification shows high sensitivity (81.25%) and high specificity (78.12%) in predicting final HPE malignancy and also a high negative predictive value (89.29%) in ruling out thyroid malignancies. Overall diagnostic accuracy of ACR-TIRADS classification is 79.17%.

Table 6: Predictive validity of ACR-TIRADS classification in predicting Final HPE diagnosis (N=48)

Statistic	Value
Sensitivity	81.25%
Specificity	78.12%
Positive Predictive Value	65.00%
Negative Predictive Value	89.29%
Diagnostic Accuracy	79.17%

Discussion

Methodology

Our study is a prospective observational study in a surgical cohort of 48 participants. Studies that are being compared here either prospective or retrospective.
In our study we have compared, ACR-TIRADS with H.P.E

Methodology

Table 7: Comparing methodology of different studies

Study	Type of Study	Sample size	
White paper of the ACR-Tirads committee by Tessler *et al*., (2017)[8]	Retrospective	3000	ACR-Tirads VS H.PE/FNAC.
Jayashree mohanthy *et al*., (2019)[6]	Prospective	50	ACR-Tirads VS H.PE/FNAC.
Periakaruppan G *et al*., (2018)[11]	Prospective	184	ACR-Tirads VS H.PE/FNAC.
Middleton *et al*., (2017)[12]	Retrospective	3422	ACR-Tirads VS H.PE/FNAC.
Nam *et al*., (2017)[13]	Prospective	630	Tirads VS HPE/FNAC FNAC VS HPE
Zhang *et al*., (2015)[14]	Prospective	220	Tirads VS HPE/FNAC FNAC VS HPE
Chakravarthy *et al*., (2018)[15]	Prospective	290	Tirads VS HPE/FNAC FNAC VS HPE
Chandramohan *et al*., (2016)[16]	Prospective	238	Tirads VS HPE/FNAC
Current study	Prospective	48	ACR TIRADS VS H.P.E,ACR Tirads VS FNAC, FNAC VS H.P.E.

Malignancy rates

In our study, malignancy rates of ACR-TIRADS classification is increased as it goes from TR 2 to TR 5 in correspondence to other International and Indian studies.

Compared to other studies, there are higher rates of malignancy are noted in our study (for all groups).

In our study population, TR-2 has malignancy rate of 9.1 %, higher compared to White paper of ACR-TIRADS (<2%), a prospective study of 50 thyroid nodules by Jayashree mohathy *et al*., in 2009(6%), a prospective study of 184 thyroid nodules by Perikaruppan G *et al.*, in 2018(0 %) and a retrospective study of 3422 thyroid nodules done by Middleton *et al*., in 2017(1.5%).

Similarly malignancy rate is higher all other groups, especially for TR-5 which is 100 % in our study is very higher compared to White paper of ACR-TIIRADS (>20%), a prospective study of 50 thyroid nodules by Jayashree mohathy *et al*., in 2009(56%), a prospective study of 184 thyroid nodules by Perikaruppan G *et al.*, in 2018(77.8 %) and a retrospective study of 3422 thyroid nodules done by Middleton *et al*., in 2017 (35%).

As we have *included only people who have underwent surgery*, there is *bias to have higher rates of malignancy* in the study population compared to general population

Table 8: Comparing Malignancy rates among different studies

ACR-Tirads	Current study	Jayashree mohanthy *et al*. (2019) [6]	Periakaruppan G *et al*., (2018) [11]	Tessler *et al*., (2017) [8]	Middleton *et al*., (2017) [12]
	Malignant	Malignant	Malignant	Malignant	Malignant
2	9.1%	6%	0%	< 2%	1.5%
3	11.8%	14%	2.2%	2-5%	4.8%
4	61.1%	30%	38.5%	5-20%	9.1%
5	100%	56%	77.8%	>20%	35%

Correlation of TIRADS with H.P.E

- Ours study showed high sensitivity, specificity and negative predictive value for ACR-TIRADS on correlation with HPE.
- Our study correlating ACR-TIRADS with HPE showed similar sensitivity in comparison to studies correlation TIRADS with HPE/FNAC(Zhang *et al*. (73.1%), Chandramohan *et al*., (72%), and Chakravarthy *et al*., (83.6%) and other studies correlating ACR-TIRADS with HPE/FNAC (Periakaruppan G *et al*., (92.3%), Nam *et al*., (100%)).

Table 9: Comparing predictive validity of TIRADS/ACR-TIRADS among different studies

Parameter	Current study	Periakaruppan G *et al*., (2018) [11]	Zhang *et al*. (2015) [14] (TIRADS)	Chandramohan (2016) [16] (TIRADS)	Nam *et al*., (2017)[13]	Chakravarthy *et al*., (2018) [15] (TIRADS)
Sensitivity	81.25%	92.3%	73.1%	72%	100%	83.6%
Specificity	78.12%	94.15%	88.4%	68.8%		60%
PPV	65.00%	54.5%	90.7%	63.9%	13.4%	
NPV	89.29%	99.38%	73.7%	76.2%		
Diagnostic accuracy	79.17%	93.2%		70.2%		

Conclusion

ACR-TIRADS was found to be a highly specific and accurate classification system for categorizing the thyroid nodules based on ultrasound features, for assessing the risk of malignancy.

Initial screening of a thyroid lesion with USG with ACR-TIRADS score will help to rule out benign lesions.

Lesions suspicious of malignancy to be investigated with FNAC.

This helps in decreasing the risk and cost of subjecting patients with benign nodules or indolent cancers with unnecessary biopsy and treatment.

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