Original Article

Comparative Evaluation of Thyroid Imaging Reporting and Data System (TIRADS) and Cytopathological Findings in Thyroid Nodules among the Population of South West Bihar

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ABSTRACT

Background: We frequently observe thyroid lesions in our day-to-day clinical work. In order to lessen the number of needless biopsies, auxiliary instruments for assessing thyroid lesions worthy of cytological evaluation should be developed. However, there are a number of limitations to ultrasound, such as equipment resolution differences, observer variability, and overlapping findings. TIRADS categorization makes an effort to reduce these drawbacks.

Aims/ objective: To compare the clinical value of TIRADS in evaluating the malignancy of thyroid nodule with the final histopathological results in our setup.

Materials and Method: A total of 93 patients with thyroid swelling with TIRADS category 2-5 were evaluated. Every patient had high resolution B-mode ultrasound. If thyroid nodules were found, they were classified using the ACR-TIRADS. The final histopathology results were reviewed and interpreted with the ultrasonography TIRADS categorization results.

Results: Most of patients belonged to TIRADS 2 category (56.99%) followed by TIRADS 4 (22.58%) and TIRADS 3 (22.58%). Only 3.23% of patients belonged to TIRADS 5. Most of the patients (>80%) in TIRADS category 2 & 3 category had benign lesion. More than 60% patients in TIRADS 4 category had malignant lesion. TIRADS 5 category had 100% malignancy. TIRADS classification had more specificity (88.89%) and negative predictive value as compared to sensitivity (76.19%) and positive predictive value. Adenomatoid nodule was most common benign lesion whereas papillary carcinoma was most common malignant lesion.

Conclusion: ACR-TIRADS classification is a very specific and accurate method for classifying benign and malignant nodules and a reliable signal for predicting cancer.

Keywords: Thyroid Swelling, Malignancy, TIRADS, Ultrasonography, Histopathology.

INTRODUCTION

We frequently observe thyroid lesions in our day-to-day clinical work. Thyroid nodules are more frequent in women and have a prevalence of approximately 8.5%.[1] There are various diagnostic techniques for assessing thyroid nodules. When evaluating a thyroid nodule, the likelihood of cancer is the primary concern. The reported percentage of malignancy among thyroid nodules identified through radiological and clinical means varies greatly. Benign or malignant nodules cannot be reliably distinguished by clinical examination.

The most extensively used imaging technique for the preliminary evaluation of thyroid nodules is ultrasound.[2] Due to the significant overlap between thyroid cancer and benign nodules' sonographic characteristics, ultrasonography has a low specificity. Therefore, the only approach to distinguish between the uncommon malignant nodules and the more frequent benign nodules is to surgically remove the nodule and examine it histopathologically.[3]

While fine needle aspiration cytology (FNAC) is a valuable non-invasive method for evaluating the composition of nodules, first-level hospitals typically deal with a high incidence of benign, multinodular, and hyperplastic goiter cases. As such, FNACs must only be performed on significant lesions in these situations. In order to lessen the number of needless biopsies, auxiliary instruments for assessing thyroid lesions worthy of cytological evaluation should be developed.[4]

To classify thyroid lesions, a risk stratification method called ACR-TIRADS (the American College of Radiology Thyroid Imaging Reporting and Data Systems) is used. Based on ultrasound features, a five-point categorization system is used to assess the cancer risk in thyroid nodules. However, there are a number of limitations to ultrasound, such as equipment resolution differences, observer variability, and overlapping findings. TIRADS categorization makes an effort to reduce these drawbacks.[5]

Several studies have attempted to provide a trustworthy assessment of thyroid nodules on ultrasonography.[6] Based on the breast imaging reporting and data systems (BI-RADS), which are widely used for the assessment of breast lesions, the TIRADS (thyroid imaging reporting and data system) has been developed for the classification of thyroid nodules.[7,8] Thyroid nodules have been categorized

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by TIRADS according to USG characteristics. Its goal is to lessen the variation between observers. [9]

The aim of the current study is to perform a comparative assessment of TIRADS and histopathology reporting of thyroid nodules in the Indian scenario. Specifically, we compare the clinical value of TIRADS in evaluating the malignancy of thyroid nodule with the final histopathological results in our setup.

MATERIALS AND METHODS

This was an observational and prospective study conducted in department of pathology in collaboration with department of radio-diagnosis in NMCH, Sasaram (a tertiary care centre in eastern India) from January 2023 to December 2023. The study was conducted on patients with thyroid swelling after getting written informed consent as per guidelines of declaration of Helsinki and Good Clinical Practice.

Sampling Method: Consecutive sampling was done and 93 patients fulfilling our inclusion and exclusion criteria were recruited in the study.

Inclusion criteria: Patients of age greater than 18 years of either sex having thyroid swelling with ultrasonography (USG) based TIRADS classification were included.

Exclusion criteria: Patients with TRADS 1 category or not giving informed consent were excluded from the study.

Every patient had high resolution B-mode ultrasound performed with a linear transducer operating at 5–14 MHz on a Toshiba Aplio TM500. The highly sensitive software MicroPure imaging was employed as an extra tool to detect microcalcifications.

If thyroid nodules were found, they were classified using the ACR-TIRADS. The size, composition, echogenicity, margins, taller-than-wider form, micro-calcification, macro-calcification, intra-nodular vascularity, and aberrant cervical lymphadenopathy of each node were evaluated. Each ACR TIRADS category's feature(s) was given a score, which was then calculated as follows:

1) Normal thyroid gland
2) Benign lesions
3) Probably benign lesions
4) Suspicious lesions
5) Probably malignant lesions

Trained radiologists used a 10-milliliter syringe and a 24-gauge (24G) needle to perform FNAC under USG guidance. Written informed consent was obtained before beginning any of these procedures. During these FNACs, a pathologist remained present to ensure that the slides were prepared correctly and that the samples were assessed for quality and sufficiency. The patient was forced into an extremely stretched supine position. By using betadine solution to clean the area of concern and allowing for a five-minute contact period, aseptic measures were guaranteed. The area was then cleansed using a gauge piece and sterillium solution. Acoustic gel was a prepackaged, sterilized gel.

The probe of the linear transducer was held vertically. In the plane of the USG probe, the needle was inserted at an angle perpendicular to the skin. The needle tip was consistently maintained within the scan plane. A non-cutting, bevelled-edge 22-gauge needle was employed. Non-aspiration technique was utilized. Samples were taken from the primarily solid areas by moving the needle. The pathologist received the sample thus collected and used it to create slides and determine whether it was adequate. For every nodule, 2 specimen slides were created on average.

The final histopathology results were reviewed and interpreted with the ultrasonography TIRADS categorization results.

Statistical Analysis: Data collected from patients with thyroid nodules were recorded in tabular form using Microsoft Excel 365 and then transferred to graph pad version 8.4.3 for further statistical analysis. Descriptive analysis was done to express the findings as frequency and percentage for comparison.

OBSERVATIONS AND RESULTS

A total of 93 patients with thyroid swelling with TIRADS category 2-5 were evaluated. Their baseline demographic findings are given below.

Table 1: Distribution of patients with thyroid swelling with respect to baseline demographic.

Parameters	Number of Patients	% of patients (n=93)
Age in Years		
18-30	15	16.13
31-40	32	34.41
41-50	23	24.73
51-60	17	18.28
61-70	4	4.30
>70	2	2.15
Gender		
Male	16	17.20
Female	77	82.80

Most of patients belonged to 31-50 years of age group (59.14%) and most of them were female (82.80%).

Table 2: Distribution of patients with thyroid swelling with respect to TIRADS category

Category	Number of Patients	% of patients (n=93)
TIRADS 2	53	56.99
TIRADS 3	16	17.20
TIRADS 4	21	22.58
TIRADS 5	3	3.23

Most of the patients belonged to TIRADS 2 category (56.99%) followed by TIRADS 4 (22.58%) and TIRADS 3 (22.58%). Only 3.23% of patients belonged to TIRADS 5.

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Table 3: Distributions of various TIRADS category with respect to histopathological malignancy

Category	Benign	Malignant	P-Value (Chi-square test)
TIRADS 2, n (%)	51 (96.23)	2 (3.77)	<0.0001
TIRADS 3, n (%)	13 (81.25)	3 (18.75)	
TIRADS 4, n (%)	8 (39.10)	13 (61.90)	
TIRADS 5, n (%)	0	3 (100.00)	

Figure 1: TIRADS Category and Malignancy as per FNAC

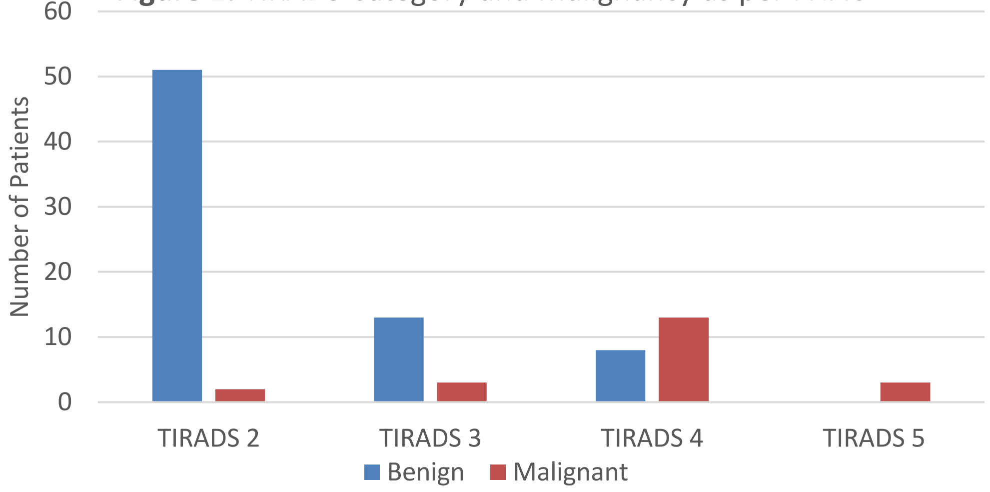
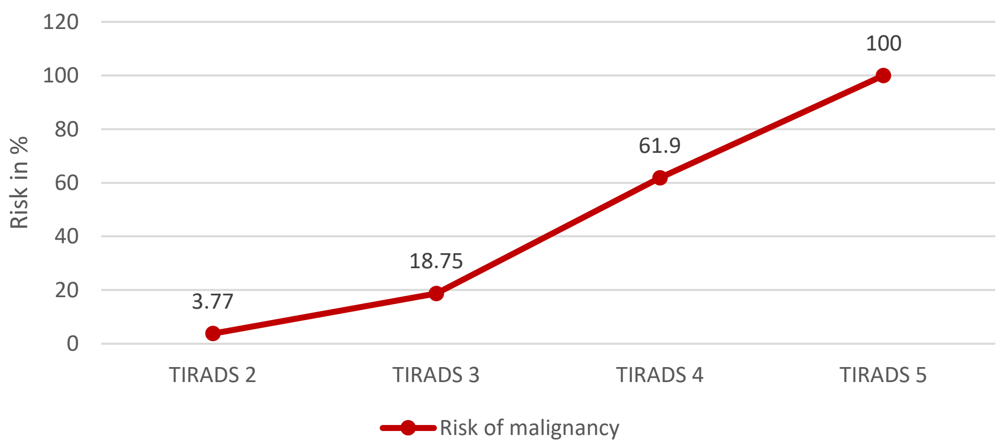


Figure 2: Risk of malignancy in TIRADS category



Most of the patients (>80%) in TIRADS category 2 & 3 category had benign lesion. More than 60% patients in TIRADS 4 category had malignant lesion. TIRADS 5 category had 100% malignancy.

Table 4: Sensitivity, specificity, PPV, and NPV of TIRADS scoring of diagnosing malignancy (considering category 2 & 3 as benign and 4 & 5 as malignant)

Statistic	Value	95% Confidence Interval
Sensitivity	76.19%	52.83% to 91.78%
Specificity	88.89%	79.28% to 95.08%
Positive Predictive Value	66.67%	49.94% to 80.04%
Negative Predictive Value	92.75%	85.57% to 96.51%
Accuracy	86.02%	77.28% to 92.34%

TIRADS classification had more specificity (88.89%) and negative predictive value as compared to sensitivity (76.19%) and positive predictive value.

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Table 5: Distributions of various TIRADS category with respect to histopathological diagnosis

Category	Adenomatoid nodule	Colloid Goitre	Follicular Adenoma	Nodular Goitre	Lymphocytic Thyroiditis	Follicular Ca	Papillary Carcinoma
TIRADS 2	22	10	2	13	4	0	2
TIRADS 3	4	2	1	7	0	0	2
TIRADS 4	3	1	4	1	0	2	10
TIRADS 5	0	0	0	0	0	1	2

Adenomatoid nodule was most common benign lesion whereas papillary carcinoma was most common malignant lesion.

DISCUSSION

Of the 93 patients in this study, 16 were men and 77 were women. According to our study, the incidence of thyroid nodules is 4.8 times higher in females than in males. The oldest patient was seventy-two years old, while the youngest was twenty-two. The majority of the patients belonged to the 31–40 age range. Similar research by Bakhos et al. and Virk et al. revealed that thyroid nodules are most frequently discovered in people between the ages of 20 and 40.[10, 11]

When the TIRADS classification and the histological results were correlated, it was found that the likelihood of malignancy for nodules that were confirmed by histopathology varied between 3.77% in TIRADS 2, 18.75% in TIRADS 3, 61.90% in TIRADS 4 and 100% in TIRADS 5. Even though the TIRADS 2 group was thought to be benign, patients in these cases had surgery to treat multinodular goitres and, in the case of large goitres, for cosmetic reasons.

Just under five percent of patients in the TIRADS 2 group had a risk of cancer, according to Horvath et al.'s conclusion.[12] In contrast to this study, the probability of cancer in TIRADS category 2 was 0% in the studies conducted by Mofio et al. and Sanchez et al.[13, 14] This study's 13.3% probability of malignancy in TIRADS 3 is comparable to that of Horvath et al.'s study, which found that these nodules had a 5-to 10% risk of malignancy. [12]

On the other hand, this is somewhat more than research conducted by Mofio et al. and Sanchez et al. [13, 14] According to these two studies, there is a 2.2% chance of cancer in TIRADS 3. This study's TIRADS 4 category cancer risk is comparable to that of Mofio et al.'s investigation.[13] These two investigations revealed a 57.9% risk. Malignancy likelihood in TIRADS 4 was shown to be 48% by Sanchez et al.'s study, which is marginally less than what these investigations found. In every study, the TIRADS 5 category's risk of cancer was comparable.[14]

According to all of these studies, the TIRADS 2 group has the lowest risk of malignancy, while the TIRADS 5 category is highly suggestive of malignancy. These patients with TIRADS 2 category, however, should not be disregarded and should have routine follow-ups to monitor the development of malignant thyroid nodules.

According to this study, the TIRADS classification for malignancy prediction has a 76.19% sensitivity, an 88.89% specificity, a 66.67% positive predictive value, and a 92.75% negative predictive value. These findings were compared to those of a study conducted by Singaporewalla et al., which showed similar results in terms of specificity, negative predictive value, and sensitivity for predicting malignancy.[15] However, this study exhibited a lower but greater specificity when compared to the data published by Horvath et al. The TIRADS score in this investigation likewise exhibited a similar negative predictive value for malignancy.[12]

Anuradha et al. conducted a study on the Indian subcontinent to evaluate the usefulness and accuracy of TIRADS in routine clinical practice. They found that TIRADS 2 had a predictive value for malignancy of 6.6%, TIRADS 3 was 32 percent, TIRADS 4 was 64 percent, and TIRADS 5 was 91%. [16] Similar research conducted in India by Srinivasan et al. found that TIRADS 2 had a 0% risk of malignancy, TIRADS 3 had a 6.4% risk, TIRADS 4 had a 66.6% risk, and TIRADS 5 had a 100% risk. [17]

Despite the low risk of cancer in TIRADS 2 and 3, young female patients had a significantly higher incidence of malignancy. In these individuals, there should always be a degree of suspicion regarding malignancy, and follow-up with serial ultrasounds or cytopathological diagnoses is crucial, particularly in young female patients.

One weakness of this study is that it could not identify the pathological link between the histopathological data and TIRADS 4 subgroups 4a, 4b, and 4c.

CONCLUSION

An ultrasound of the thyroid is essential for assessing thyroid swellings. The likelihood that a certain nodule is malignant can be confidently estimated if the nodules are categorized using the ultrasound-based TIRADS classification system. As a result, ACR-TIRADS classification is a very specific and accurate method for classifying benign and malignant nodules and a reliable signal for predicting cancer. Thyroid nodule evaluation should adhere to the TIRADS classification standard.

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