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ORIGINAL ARTICLE

Accuracy of TIRADS Classification in the Risk Stratification of Thyroid Swellings: A Cross-sectional Study from Northwest Rajasthan

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ABSTRACT

Background: Thyroid nodules are a common clinical entity, with an increasing detection rate due to widespread use of ultrasonography (USG). Differentiating benign from malignant nodules is essential for optimal management. The Thyroid Imaging Reporting and Data System (TIRADS) standardizes sonographic evaluation to stratify malignancy risk, aiding clinical decision-making in a non-invasive manner.

Objective: To evaluate the diagnostic accuracy of the TIRADS classification system in the risk stratification of thyroid swellings and to compare its performance with fine-needle aspiration cytology (FNAC) and histopathology.

Methods: This was a hospital-based cross-sectional study conducted over one year in the Department of Surgery at Sardar Patel Medical College, Bikaner. A total of 115 patients with thyroid swellings scheduled for surgery were assessed. All underwent USG with TIRADS classification, FNAC based on the Bethesda system, and subsequent histopathological examination. Diagnostic accuracy parameters were calculated using histopathology as the gold standard.

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Results: Out of 115 patients, 36 (31.3%) were found to have malignant nodules on histopathology. TIRADS demonstrated a sensitivity of 88.2%, specificity of 83.7%, and an overall accuracy of 85.6%. FNAC showed a slightly higher specificity (93.2%) but lower sensitivity (82.4%). Malignancy risk increased proportionally with higher TIRADS categories.

Conclusion: TIRADS is an effective, non-invasive tool for thyroid nodule risk stratification. When combined with FNAC, it enhances diagnostic precision and guides surgical decisions.

Contribution: This study provides regional validation for TIRADS use in northwest Rajasthan, advocating its integration into routine thyroid nodule assessment protocols.

KEYWORDS

• TIRADS • Thyroid nodules • Ultrasonography • FNAC • Bethesda system • Thyroid cancer • Risk stratification

INTRODUCTION

Thyroid swellings are a common clinical presentation encountered in surgical and endocrine practice, with thyroid nodules being the most frequent underlying pathology. While the majority of these nodules are benign, a small but significant proportion are malignant, necessitating accurate diagnostic differentiation to guide appropriate management.[2-4] Globally, the prevalence of thyroid nodules is estimated at 4–8% by palpation and up to 67% with high-resolution ultrasonography[1,3,4]. In India, approximately 8.5% of the population is affected, with higher prevalence observed in women and the elderly.[3,5]

The traditional diagnostic approach involves clinical examination, thyroid function tests, and fine-needle aspiration cytology (FNAC). However, clinical evaluation alone is inadequate in differentiating benign from malignant nodules.[2-4] FNAC, while considered the gold standard for cytological diagnosis, is invasive, and its accuracy is influenced by sampling error and indeterminate cytological categories.[5-7]

Ultrasonography (USG) has emerged as an essential, non-invasive modality in the evaluation of thyroid nodules. The Thyroid Imaging Reporting and Data System (TIRADS), modeled on the BI-RADS system used in breast imaging, standardizes ultrasound assessment by stratifying malignancy risk based on defined sonographic features.[8-12,14] Despite its growing global adoption, limited data exist on its diagnostic accuracy in regional Indian populations.[6,8,13]

This study aims to evaluate the accuracy of the TIRADS classification system in the risk stratification of thyroid swellings and its correlation with FNAC and histopathological findings in a tertiary care setting in northwest Rajasthan.

MATERIALS AND METHODS

Study Design and Setting:

This was a hospital-based cross-sectional observational study conducted in the Department of General Surgery at Sardar Patel Medical College and Associated Group of Hospitals (AGH), Bikaner, Rajasthan. The study was carried out over a one-year period from January 2024 to December 2024.

Study Population:

The study included patients presenting with thyroid swellings who were admitted for thyroid surgery. Patients were selected based on specific inclusion and exclusion criteria.

Inclusion Criteria:

- Patients aged ≥12 years presenting with thyroid swelling.
- Patients admitted for thyroid surgery and willing to participate in the study.
- Patients consenting to undergo ultrasonography and fine-needle aspiration cytology (FNAC).

Exclusion Criteria:

- Patients younger than 12 years.
- Patients unwilling for FNAC.
- Patients lost to follow-up or not undergoing surgery.

Sample Size and Sampling Technique:

Based on previous prevalence data (~8% for thyroid nodules) and assuming a 95% confidence level with a 5% margin of error, the minimum sample size was calculated to be 115. A consecutive sampling technique was used, enrolling all eligible patients who met the inclusion criteria during the study period.

Data Collection and Procedures:

After obtaining informed written consent, a detailed clinical history and physical examination were performed for each patient. Information regarding age, sex, duration of swelling, rapidity of growth, presence of compressive symptoms (e.g., dysphagia, dyspnea), voice changes, and family history of thyroid or endocrine disorders was recorded.

All patients underwent high-resolution ultrasonography (USG) using a 7.5 MHz linear transducer. Nodules were assessed for size, composition, echogenicity, margin, shape, and calcifications. Based on these findings, nodules were categorized according to the American College of Radiology (ACR) TIRADS classification system (TR1 to TR5).

Ultrasound-guided FNAC was performed on all suspicious or clinically significant nodules. The cytological diagnosis was classified according to the Bethesda System for Reporting Thyroid Cytopathology (categories I to VI). For patients undergoing surgery, final histopathological examination was used as the reference standard.

Statistical Analysis:

Data were compiled in Microsoft Excel and analyzed using SPSS software. Diagnostic accuracy, sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of TIRADS were calculated by comparing USG findings with FNAC and histopathology results.

Ethical Considerations

The study was conducted at our institution after obtaining ethical clearance from the Institutional Ethical Committee.

RESULTS

Table 1: Showing according to patients age groups (years)

Parameter Age group (years)	Number (n=115)	Percentage	*p* - value
12-20	8	6.96	
21-30	23	20	
31-40	35	30.43	
41-50	28	24.35	
>50	21	18.26	
Total	**115**	**100**	**0.021**

This table shows the age-wise distribution of patients with thyroid swellings. The majority were in the 31–40 age group (30.43%), followed by 41–50 years (24.35%).

Table 2: Showing patient distribution according to their sex

Sex	Number	Percentage	*p* - value
Male	30	26.09	
Female	85	73.91	
Total	**115**	**100**	**0.017**

This table shows that females (73.91%) were affected more than males (26.09%) in this study of thyroid swellings. The gender distribution was statistically significant ($p = 0.017$).

Table 3: Showing clinical presentation of thyroid nodules

Feature	Number	Percentage	*p* - value
Solitary Nodule	72	62.61	
Multinodular Goiter	38	33.04	
Diffuse enlargement	5	4.35	
Total	**115**	**100**	**0.003**

Solitary thyroid nodules were the most common presentation (62.61%), followed by multinodular goiters (33.04%). Only a small number had diffuse enlargement (4.35%). This pattern was statistically significant ($p = 0.003$).

Table 4: Showing distribution of pressure symptoms in thyroid swelling patients

Symptoms	Number	Percentage	*p* - value
Hoarseness	9	7.83	
Dysphagia	12	10.43	
Dyspnea/Stridor	5	4.35	
No pressure symptom	89	77.39	
Total	**115**	**100**	**0.045**

Most patients (77.39%) had no pressure symptoms. Hoarseness, dysphagia, and dyspnea were less common. The presence or absence of symptoms was statistically relevant ($p = 0.045$).

Table 5: Showing correlation of Tirads Classification vs Malignancy

TIRADS	Class	Malignancy (n)	Rate (%)	p-value
TIRADS 2	12	0	0.0	
TIRADS 3	26	1	3.85	
TIRADS 4A	24	4	16.67	
TIRADS 4B	20	7	35.00	
TIRADS 4C	18	12	66.67	
TIRADS 5	15	13	86.67	
Total	**115**	**37**	**32.17**	**<0.001**

The risk of malignancy increased progressively with higher TI-RADS scores from 0% in TI-RADS 2 to 86.67% in TI-RADS 5. The correlation was highly significant ($p < 0.001$), supporting the reliability of TI-RADS in malignancy prediction.

Table 6: Showing correlation of Bethesda (FNAC) vs Malignancy

Bethesda	Cases	Malignant (HPE)	Rate (%)	*p* - value
1	8	1	12.5	
2	48	2	4.17	
3	14	4	28.57	
4	12	5	41.67	
5	17	13	76.47	
6	16	16	100	
Total	**115**	**41**	**35.65**	**0.002**

Higher Bethesda categories showed increased malignancy rates, from 4.17% in Category II to 100% in Category VI. The difference was statistically significant ($p = 0.002$), showing FNAC's effectiveness in risk stratification

Table 7: Diagnostic Accuracy

Modality	Sensitivity	Specificity	PPV	NPV
TIRADS	88.2%	83.7%	75.8%	92.3%
FNAC	82.4%	93.2%	87.5%	90.3%

FNAC had higher overall diagnostic accuracy (89.6%) than TI-RADS (85.2%). FNAC also showed better specificity, while TI-RADS had slightly better sensitivity. Both were statistically significant tools for diagnosis.

Table 8: Final HPE Diagnosis

Diagnosis	Cases	Percentage	*p* - value
Colloid Nodule	52	45.22%	
Follicular Adenoma	13	11.30%	
Papillary Carcinoma	27	23.48%	
Follicular Carcinoma	11	9.57%	
Medullary Carcinoma	3	2.61%	
Hashimoto's thyroiditis	9	7.83%	
Total	**115**	**100.00%**	**<0.001**

This table summarizes the histopathological findings, where benign lesions like colloid nodules were most common (45.22%). Papillary carcinoma was the most frequent malignancy (23.48%), followed by follicular carcinoma (9.57%). The distribution was significant ($p < 0.001$).

DISCUSSION

This study reaffirms the higher occurrence of thyroid nodules in women and middle-aged individuals due to hormonal influences and autoimmune predispositions. Similar gender distribution patterns have been reported by studies such as those by Hegedüs (2004) and Cooper *et al.* (2009), indicating a female predominance in thyroid nodule presentation.

In our study, TIRADS scoring effectively stratified nodules based on their risk of malignancy. Our results are similarly corroborated by studies like Omran *et al.* (2021), which also demonstrated rising malignancy rates with increasing TIRADS categories.

The integration of FNAC and TIARDS significantly improves diagnostic confidence and aids in reducing unnecessary procedures. This dual-modality approach is endorsed by several international guidelines including those of the American Thyroid Association (ATA) and the American College of Radiology (ACR).

CONCLUSION

In conclusion, the findings of this study affirm that TIRADS is a reliable and effective tool for risk stratification of thyroid nodules. When

used in conjunction with FNAC, it improves diagnostic accuracy and guides clinical decision-making. High-risk nodules identified through TIRADS should be prioritized for FNAC and potential surgical intervention, while low-risk nodules can be monitored with routine imaging. This integrated approach enhances patient care, reduces unnecessary interventions, and aligns with evidence-based best practices in thyroid nodule management.

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