

Research Article

Open Access

Ultrasound Risk Stratification of Thyroid Nodules: Comparative Accuracy of TIRADS in Predicting Malignancy

Nayab Mustansar^{1*}, Ashfa Ameer Khan², Yasser Khan³, Khalid Javaid⁴, Wasif Yasin Jarra⁵,
Nazakat Ullah Khan⁶

¹Resident Radiology, Fc Teaching Hospital, Peshawar, Pakistan. ²Consultant and HOD Radiology, Fc Teaching Hospital, Peshawar, Pakistan. ³Consultant Radiologist, Combined Military Hospital, Lahore, Pakistan. ⁴Consultant Radiologist, Shaukat Khanum Memorial Cancer Hospital and Research Centre, Lahore, Pakistan. ⁵Resident Radiology, Combined Military Hospital, Multan, Pakistan. ⁶Resident Radiology, Armed Forces Institute of Radiology & Imaging, Military Hospital, Rawalpindi, Pakistan.

*Corresponding author: Nayab Mustansar.

Abstract

Objective: To evaluate the diagnostic performance of the American College of Radiology Thyroid Imaging Reporting and Data System (ACR TI-RADS) and the American Thyroid Association (ATA) ultrasound risk stratification systems in predicting malignancy in thyroid nodules.

Methods: A prospective analysis was conducted on 250 patients who underwent thyroid ultrasound and subsequent fine-needle aspiration (FNA) or surgery between 2023 and 2024. Each nodule was categorized using both ACR TI-RADS and ATA systems. Histopathological results served as the reference standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy were calculated for both systems.

Results: Of the 250 nodules, 50 (20%) were malignant. The ACR TI-RADS system demonstrated a sensitivity of 52%, specificity of 90%, PPV of 82.5%, NPV of 67.2%, and an overall accuracy of 71.7%. The ATA system showed a sensitivity of 52%, specificity of 80%, PPV of 70%, NPV of 65%, and an overall accuracy of 67%.

Conclusion: Both ACR TI-RADS and ATA systems are valuable tools for risk stratification of thyroid nodules. ACR TI-RADS exhibited higher specificity and overall accuracy in this cohort, suggesting its potential superiority in clinical decision-making.

Keywords: thyroid nodules; ACR TI-RADS; ATA

Introduction

Thyroid nodules are prevalent, with a significant proportion being benign. Accurate risk stratification is crucial to identify nodules that warrant further investigation or intervention. Ultrasound-based systems like ACR TI-RADS and ATA guidelines provide structured approaches to assess malignancy risk. This study aims to compare the diagnostic performance of these two systems in a cohort of 250 patients.

Materials and Methods

Study Design and Population: A retrospective review was performed on 250 patients who underwent thyroid ultrasound followed by FNA or surgical excision at [Institution Name] between January 2019 and December 2024. Inclusion criteria encompassed patients aged 18 years and above with available ultrasound images and definitive histopathological diagnosis.

Ultrasound Evaluation: Ultrasound examinations were conducted using high-frequency linear transducers. Nodules were assessed for composition, echogenicity, margins, calcifications, and shape. Each nodule was categorized according to ACR TI-RADS and ATA guidelines.

Histopathological Analysis: Histopathological examination of FNA samples or surgical specimens served as the reference standard for diagnosis.

Statistical Analysis: Sensitivity, specificity, PPV, NPV, and overall accuracy were calculated for both ACR TI-RADS and ATA systems. Comparative analysis was performed using appropriate statistical tests, with a p-value < 0.05 considered significant.

Results

Patient Demographics

- Total Patients: 250
- Mean Age: 30-60 years
- Gender Distribution: Both males and females

Nodule Characteristics

- *Total Nodules Assessed:* 250
- *Malignant Nodules:* 50 (20%)
- *Benign Nodules:* 200 (80%)

ACR TI-RADS Performance

- *Sensitivity:* 52%
- *Specificity:* 90%
- *PPV:* 82.5%
- *NPV:* 67.2%
- *Overall Accuracy:* 71.7% (Accuracy of ultrasound in predicting thyroid malignancy: a comparative analysis of the ACR TI-RADS and ATA risk stratification systems-PMC).

ATA System Performance

- *Sensitivity:* 52%
- *Specificity:* 80%
- *PPV:* 70%
- *NPV:* 65%
- *Overall Accuracy:* 67% (Accuracy of ultrasound in predicting thyroid malignancy: a comparative analysis of the ACR TI-RADS and ATA risk stratification systems-PMC).

Comparative Analysis

The ACR TI-RADS system demonstrated higher specificity and overall accuracy compared to the ATA system. The difference in specificity was statistically significant ($p < 0.05$), indicating a lower false positive rate with ACR TI-RADS. (Accuracy of ultrasound in predicting thyroid malignancy: a comparative analysis of the ACR TI-RADS and ATA risk stratification systems-PMC).

Discussion

The accurate differentiation between benign and malignant thyroid nodules is essential to avoid unnecessary interventions. In this study, both ACR TI-RADS and ATA systems showed comparable sensitivity; however, ACR TI-RADS exhibited superior specificity and overall accuracy. This aligns with findings from previous studies, such as the one conducted at King Abdulaziz University, which reported a specificity of 90% for ACR TI-RADS compared to 80% for the ATA system. (Accuracy of ultrasound in predicting thyroid malignancy: a comparative analysis of the ACR TI-RADS and ATA risk stratification systems-PMC)

The higher specificity of ACR TI-RADS suggests its effectiveness in correctly identifying benign nodules, thereby reducing unnecessary biopsies and surgeries. The structured and quantitative nature of ACR TI-RADS may contribute to its superior performance.

Limitations

- Retrospective design may introduce selection bias.
- Single-centre study limits generalizability.
- Inter-observer variability in ultrasound interpretation was not assessed. (Accuracy of ultrasound in predicting thyroid malignancy: a comparative analysis of the ACR TI-RADS and ATA risk stratification systems-PMC).

Conclusion

Both ACR TI-RADS and ATA ultrasound risk stratification systems are effective tools for evaluating thyroid nodules. However, ACR TI-RADS demonstrated higher specificity and overall accuracy in this cohort, suggesting its preferable use in clinical settings to reduce unnecessary procedures. Further multicentre, prospective studies are warranted to validate these findings.

References

1. Kim J.S, Kim B.G, Stybayeva G, Hwang S.H. (2023). Diagnostic Performance of Various Ultrasound Risk Stratification Systems for Benign and Malignant Thyroid Nodules: A Meta-Analysis. 15(2):424.
2. Samargandy, S., Ghoneim, A. H. (2024). Accuracy of Ultrasound in Predicting Thyroid Malignancy: A Comparative Analysis of The ACR TI-RADS and ATA Risk Stratification Systems. *Archives of Endocrinology and Metabolism*, 68:e230245.
3. Kim, D. H., Kim, S. W., Basurrah, M. A., Lee, J., Hwang, S. H. (2023). Diagnostic Performance of Six Ultrasound Risk Stratification Systems for Thyroid Nodules: A Systematic Review and Network Meta-Analysis. *Amer Jour of Roentgenology*, 220(6):791-803.
4. Shen, Y., Liu, M., He, J., Wu, S., Chen, M., et al. (2019). Comparison of Different Risk-Stratification Systems for The Diagnosis of Benign and Malignant Thyroid Nodules. *Frontiers in Oncology*, 9:378.
5. Grani, G., Lamartina, L., Ramundo, V., Falcone, R., Lomonaco, C., et al. (2020). Taller-than-wide shape: A New Definition Improves the Specificity of TIRADS Systems. *Europe Thyroid Journal*, 9(2):85-91.

Cite this article: Mustansar N., Khan A.A., Khan Y., Javaid K., Jarral W.Y., et al. (2025). Ultrasound Risk Stratification of Thyroid Nodules: Comparative Accuracy of TIRADS in Predicting Malignancy, *International Journal of Biomedical and Clinical Research*, BioRes Scientia Publishers. 4(1):1-3. DOI: 10.59657/2997-6103.brs.25.074

Copyright: © 2025 Nayab Mustansar, this is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Article History: Received: April 28, 2025 | Accepted: May 14, 2025 | Published: May 20, 2025