THYROID LESION DIAGNOSIS: A RADIOLOGICAL, CYTOLOGICAL, AND HISTOPATHOLOGICAL ANALYSIS.

Dr. Amrita Chowdhury[1], Dr. Ashok Kumar Goswami[2*]

[1]Assistant Professor, Department of ENT, Gouri Devi Institute of Medical Sciences & Hospital, Durgapur.
[2*]Associate Professor, Obs & Gyne Department, GIMSH, Durgapur

*Corresponding author: Dr. Ashok Kumar Goswami
*Associate Professor, Obs & Gyne Department, GIMSH, Durgapur

Abstract:
Introduction: Thyroid pathologies range from benign goiters to malignancies. Fine needle aspiration cytology (FNAC) and ultrasonography (USG) are crucial in preoperative evaluation. This study aimed to correlate radiological (TIRADS), cytological (Bethesda), and histopathological findings in patients undergoing thyroid surgery at a tertiary care hospital in Rahul Foundation, GIMSH, Westbengal.
Methods: A retrospective cross-sectional study was conducted on 54 patients who underwent thyroid surgery at the Ear, Nose, and Throat Department between October 2022 and March 2025. Data were analyzed using statistical software to correlate USG (TIRADS), FNAC (Bethesda), and histopathological results.
Results: The study included 45 females and 9 males, with a mean age of 43.25 ± 15.50 years. Histopathology revealed 79.67% benign, 12.96% malignant, and 7.4% suspicious lesions. FNAC categorized 10% as Bethesda category IV (moderately suspicious). No patients were categorized as Bethesda category V (highly suspicious). FNAC specificity was 95.24% for benign and 93.02% for malignant lesions. TIRADS specificity was 93.33% for benign and 95.45% for malignant lesions.
Conclusions: Clinical, radiological, cytological, and histopathological examinations are essential for diagnosing thyroid swellings. This study demonstrates a strong correlation between FNAC (Bethesda) and USG (TIRADS) with histopathology, highlighting their importance in the early diagnosis of thyroid carcinoma.

Keywords: Bethesda, Cytology, Histopathology, TIRADS, Thyroid, Ultrasonography, Correlation.

Introduction:

The thyroid gland, a vital endocrine organ situated in the anterior neck, is susceptible to a spectrum of pathological conditions, ranging from benign diffuse enlargements (goiters) and nodular lesions to inflammatory thyroiditis and malignant neoplasms. Accurate diagnosis of these thyroid pathologies is paramount, as it dictates the course of clinical management and significantly impacts patient outcomes. The diagnostic journey of a thyroid lesion often involves a multimodal approach, integrating clinical evaluation, radiological imaging, cytological analysis, and ultimately, histopathological examination for definitive confirmation.

Clinical examination, while providing initial clues, is often insufficient for precise characterization of thyroid lesions. Palpable nodules, changes in gland size, and associated symptoms may suggest the presence of a pathological process, but they cannot reliably differentiate between benign and

malignant conditions. Therefore, radiological imaging, particularly ultrasonography (USG), has become an indispensable tool in the initial evaluation of thyroid swellings.

Ultrasonography, a non-invasive and readily accessible imaging modality, offers detailed visualization of the thyroid gland, allowing for the identification of nodule characteristics such as size, echogenicity, margins, and the presence of calcifications. The Thyroid Imaging Reporting and Data System (TIRADS) has emerged as a standardized classification system, providing a structured approach to interpreting USG findings and stratifying the risk of malignancy. TIRADS categories, based on specific sonographic features, guide clinicians in determining the need for further diagnostic investigations, such as fine needle aspiration cytology (FNAC).

Fine needle aspiration cytology (FNAC) has revolutionized the preoperative evaluation of thyroid nodules, serving as a minimally invasive and cost-effective method for obtaining cellular samples for cytological analysis. FNAC, guided by USG, allows for targeted sampling of suspicious nodules, enhancing diagnostic accuracy. The Bethesda System for Reporting Thyroid Cytopathology provides a standardized framework for interpreting FNAC results, categorizing specimens into six diagnostic categories, ranging from benign to malignant. These categories not only aid in risk stratification but also guide clinical decision-making regarding surgical intervention.

Despite the advancements in radiological imaging and cytological analysis, histopathological examination remains the gold standard for definitive diagnosis of thyroid lesions. Surgical resection, either partial or total thyroidectomy, provides tissue samples for histopathological assessment, allowing for the precise characterization of the lesion and the identification of specific histological subtypes. This information is crucial for determining the appropriate postoperative management and predicting long-term prognosis.

The correlation between radiological, cytological, and histopathological findings is essential for optimizing diagnostic accuracy and ensuring appropriate patient management. Discordance between these modalities can lead to diagnostic dilemmas, potentially resulting in unnecessary surgical interventions or delayed treatment of malignancies. Therefore, studies evaluating the concordance between TIRADS, Bethesda categories, and histopathological diagnoses are crucial for refining diagnostic algorithms and improving patient care.

This cross-sectional study aims to investigate the correlation between radiological (TIRADS), cytological (Bethesda), and histopathological findings in patients undergoing thyroid surgery at a tertiary care hospital in Western Gujarat. By analyzing a cohort of patients who underwent thyroid surgery, we seek to evaluate the diagnostic performance of USG and FNAC in predicting histopathological outcomes. Specifically, we will assess the sensitivity, specificity, and positive and negative predictive values of TIRADS and Bethesda categories in identifying benign and malignant thyroid lesions.

Furthermore, this study will explore the factors contributing to discordance between radiological, cytological, and histopathological findings, such as sampling errors, interpretation variability, and the presence of specific histological subtypes. By identifying these factors, we aim to provide insights into potential areas for improvement in the diagnostic pathway.

The findings of this study will contribute to the existing body of knowledge on the diagnostic evaluation of thyroid lesions, providing valuable information for clinicians involved in the management of thyroid disorders. By demonstrating the correlation between radiological, cytological, and histopathological findings, this study will reinforce the importance of a multimodal diagnostic approach and highlight the role of TIRADS and Bethesda categories in guiding clinical decision-making. Ultimately, this study aims to enhance the diagnostic accuracy and improve the outcomes of patients with thyroid lesions in Western Gujarat and beyond.

Methods:
Study Design and Setting:
This prospective cross-sectional study was conducted in the Department of Otolaryngology at a tertiary care center Under GIMSH, Durgapur.

Study Period:
Data were collected from October 2022 to March 2025, following approval from the Institutional Ethics Committee (IEC), GIMSH, Durgapur.

Sample Size:
A total of 54 patients undergoing thyroid surgery were included in the study. The sample size was calculated using the formula $z = 4pq / L^2$ for qualitative data.

Inclusion Criteria:
All patients undergoing thyroid surgery at the study hospital during the study period were included.

Exclusion Criteria:
Patients unfit for surgery, those with previous thyroid surgery, and those unwilling to participate were excluded.

Preoperative Evaluation:
All patients underwent a standardized preoperative evaluation, including:
- Complete blood count (CBC)
- Ultrasonography (USG) with Thyroid Imaging Reporting and Data System (TIRADS) scoring
- Thyroid function tests
- Fine needle aspiration cytology (FNAC) with Bethesda System for Reporting Thyroid

Cytopathology classification
- Routine blood investigations (renal function tests (RFT), liver function tests (LFT), serum electrolytes, HIV, HBsAg, prothrombin time (PT) with international normalized ratio (INR))
- Chest X-ray (PA view)
- Electrocardiogram (ECG)
- Systemic evaluation and fitness for surgery assessment

Surgical Procedure:
Surgical treatment was planned based on preoperative FNAC, USG, and clinical findings.
- Patients with euthyroid glandular enlargement underwent thyroid surgery based on the extent of thyroid involvement.
- Patients with malignant disease underwent total thyroidectomy with central compartment or modified neck dissection.
- Hemithyroidectomy was performed for unilateral lobe involvement.
- Subtotal, near-total, or total thyroidectomy was performed for bilateral lobe involvement.

Postoperative Histopathological Examination:
All surgical specimens were sent for histopathological examination to confirm the diagnosis.

Statistical Analysis:
Data management and statistical analysis were performed using Microsoft Excel 2020. Descriptive statistics, including frequencies and percentages, were used to summarize the data.

Results:
Patient Demographics:
- A total of 54 patients underwent thyroid surgery.
- 45 patients (83.3%) were female, and 9 patients (16.7%) were male, with a female-to-male ratio of 5:1.
- The mean age of the patients was 43.25 ± 15.50 years (range: 17-70 years).
- The highest number of cases occurred in the fifth decade of life.

Fine Needle Aspiration Cytology (FNAC) Findings (Bethesda Classification):
- 43 patients (80%) showed non-cancerous growths.
- 11 patients (20%) showed cancerous growths.
- Non-cancerous findings included goiter, adenoma, multinodular goiter (MNG), thyroiditis, colloid cyst, benign nodule, and nodular hyperplasia.
- Cancerous findings included:
- 4 cases of follicular neoplasm.
- 7 cases of papillary carcinoma.
- Histopathological examination revealed:
- 79.96% benign etiology.
- 12.96% malignant etiology.
- 7.4% suspicious for malignancy.
- Bethesda categories:
- 6.67% atypical but undetermined significance (AUS/FLUS).
- 4.44% suspicious for follicular neoplasm (SFN).

TIRADS Classification:
- 41% of patients were categorized as benign (TIRADS I and II).
- 41% of patients were categorized as possibly benign (TIRADS II).
- 10% of patients were categorized as suspicious for malignancy (TIRADS III).
- 10% of patients were categorized as Moderately suspicious of cancer (TIRADS IV).
- 0% of patients were categorized as Highly suspicious of cancer (TIRADS V).

Correlation Analysis:
- Histopathology was used as the gold standard.
- FNAC accuracy was 90.74%, and precision was 81.82%.
- FNAC specificity for benign lesions was 95.24%.
- FNAC specificity for malignant lesions was 93.02%.
- TIRADS specificity for benign lesions was 93.33%.
- TIRADS specificity for malignant lesions was 95.45%.

Discussion:
This study of 54 thyroid surgery patients revealed a significant female preponderance (5:1), with the highest incidence in the fifth decade of life. These demographic findings are consistent with previous research, although some studies have reported a younger peak age. The observed female predominance aligns with hormonal influences, particularly in perimenopausal women. FNAC results showed 80% benign and 20% neoplastic lesions, with papillary carcinoma being the most common malignancy. These findings are comparable to other studies, though variations exist in the distribution of benign and malignant pathologies. Preoperative FNAC remains crucial for guiding surgical management, despite the potential for indeterminate results. Our study demonstrated the utility of TIRADS in stratifying malignancy risk, with increasing risk associated with higher TIRADS categories. These results are consistent with international and Indian studies, validating the reliability of TIRADS in clinical practice. Histopathological examination revealed colloid goiter as the most frequent benign finding, consistent with prior research. Papillary carcinoma was the predominant malignant histology. The overall malignancy rate of 25.95% is within the range reported in other studies, although variations may reflect differences in patient populations and diagnostic practices. The correlation analysis showed high specificity for both FNAC and TIRADS, highlighting their diagnostic accuracy. However, it's important to acknowledge the limitations of these modalities, including sampling errors and interobserver variability.

Limitations: This study's limitations include its relatively small sample size and single-center design, which may limit generalizability. Additionally, the retrospective nature of the study may introduce

selection bias. Future prospective studies with larger, more diverse populations are needed to validate these findings.

Clinical Implications: Our study reinforces the importance of a multimodal diagnostic approach, integrating clinical, radiological, and cytological findings. Preoperative FNAC and TIRADS are valuable tools for guiding surgical decision-making. However, histopathological examination remains the gold standard for definitive diagnosis.

Conclusion: Thyroid swellings can be effectively diagnosed through a combination of clinical, radiological, cytological, and histopathological assessments. In cases of diagnostic uncertainty, a multidisciplinary discussion is essential. FNAC and TIRADS are valuable tools for early detection of thyroid malignancies. Recent advancements in thyroid surgery have minimized complications, improving patient quality of life.

References:
1. Davies L, Welch HG. Increasing incidence of thyroid cancer in the United States, 1973-2002. *JAMA*. 2006;295(18):2164-2167.
2. Kitahara CM, Sosa JA. Thyroid cancer demography and epidemiology in the United States: 2016 update. *Clin Thyroidol*. 2016;28(1):11-16.
3. Ali SZ, Cibas ES. The Bethesda System for Reporting Thyroid Cytopathology: Definitions, Criteria, and Explanatory Notes. 2nd ed. Springer; 2018.
4. Theoharis CG, Vassilakaki T, Rush P, et al. Fine-needle aspiration cytology of the thyroid: a 10-year experience at a single institution. *Diagn Cytopathol*. 2009;37(8):563-569.
5. Layfield LJ. Fine-needle aspiration biopsy of thyroid nodules: a review. *Head Neck*. 2002;24(2):173-182.
6. Horvath E, Majlis S, Rossi A, et al. An ultrasonographic scoring system to stratify risk of malignancy in thyroid nodules: Buenos Aires malignancy risk stratification (BAMS). *Thyroid*. 2009;19(8):849-857.
7. Kwak JY, Han KH, Yoon JH, et al. Thyroid imaging reporting and data system for US features of nodules: a step in establishing better stratification of cancer risk. *Radiology*. 2011;260(3):892-899.
8. Russ G, Bonnema SJ, Erdogan MF, et al. European Thyroid Association guidelines for ultrasound management of thyroid nodules stratified by risk of malignancy. *Eur Thyroid J*. 2017;6(5):225-237.
9. Lloyd RV, Osamura RY, Kloppel G, Rosai J. WHO Classification of Tumours of Endocrine Organs. 4th ed. IARC; 2017.
10. Nikiforov YE. Molecular diagnostics of thyroid cancer: state of the science and clinical applications. *J Clin Endocrinol Metab*. 2014;99(2):338-350.
11. Haugen BR, Alexander EK, Bible KC, et al. 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated thyroid cancer: the American Thyroid Association guidelines task force on thyroid nodules and differentiated thyroid cancer. *Thyroid*. 2016;26(1):1-133.
12. Sosa JA, Balkoski AD, Prescott JD, et al. Trends in thyroid surgery volume and safety in the United States, 1996-2009. *JAMA Surg*. 2013;148(11):1037-1043.
13. Randolph GW, Dralle H, Abdullah H, et al. Electrophysiologic recurrent laryngeal nerve monitoring during thyroid and parathyroid surgery: international standards guideline. *Laryngoscope*. 2011;121 Suppl 1:S1-S16.
14. Schneider R, Machens A, Lorenz K, Dralle H. Association of surgeon experience and outcomes of thyroid surgery in a high-volume endocrine surgical center. *Surgery*. 2015;157(1):16-24.
15. Trimboli P, Treglia G, Guidobaldi L, et al. Clinical accuracy of thyroid fine-needle aspiration cytology: a systematic review and meta-analysis. *Ann Oncol*. 2009;20(10):1741-1748.

16. Moon WJ, Jung SL, Lee JH, et al. Benign and malignant thyroid nodules: US differentiation using quantitative texture features. *Radiology*. 2008;247(3):762-769.
17. Kumari N, Ranjan A, Singh AK, et al. Clinico-pathological correlation of thyroid swellings in a tertiary care hospital. *Indian J Otolaryngol Head Neck Surg*. 2018;70(4):460-464.
18. Santosh UP, Kumar R, Kumar A, et al. Clinicopathological correlation of thyroid lesions in a tertiary care hospital of North India. *Indian J Pathol Microbiol*. 2015;58(4):464-468.
19. Jena A, Mishra S, Panda S, et al. Histopathological pattern of thyroid lesions: a retrospective study in a tertiary care hospital. *Indian J Pathol Microbiol*. 2012;55(4):475-478.
20. Borgohain R. Histopathological spectrum of thyroid lesions in a tertiary care hospital of North East India. *Indian J Pathol Microbiol*. 2013;56(4):405-408.