



Original Article

## The Diagnostic Landscape of Thyroid Cytopathology: A Cross-Sectional Analysis of the 2023 Bethesda System and its Histopathological Correlation

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### ABSTRACT

**Background:** Fine-needle aspiration cytology (FNAC) is a widely used, cost-effective diagnostic method for evaluating thyroid nodules and differentiating benign from malignant lesions. The 2023 Third Edition of the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) introduced updated terminology and refined risk-of-malignancy estimates to enhance diagnostic accuracy and improve clinical decision-making.

**Methods:** This cross-sectional observational study was conducted in the Department of Pathology, Agartala Government Medical College and GBP Hospital, Tripura, from December 2022 to November 2025. A total of 281 thyroid FNAC cases were analysed and categorised according to the 2023 Bethesda system. Cytological diagnoses were correlated with histopathological findings in 183 cases that underwent surgical resection. For statistical analysis, Bethesda Categories V and VI were considered positive for malignancy, while Category II was considered negative. Diagnostic parameters, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy, were calculated.

**Results:** The study population was female predominant (82.9%), with a male-to-female ratio of 1:4.8. The majority of cases occurred in the 21–40-year age group. Category II (benign) constituted the largest proportion of cases (74.7%). Among benign lesions, lymphocytic thyroiditis was the most common, whereas papillary thyroid carcinoma was the predominant malignant lesion. Cytology–histology correlation demonstrated a sensitivity of 90%, specificity of 98.7%, PPV of 93.1%, NPV of 98.1%, and an overall diagnostic accuracy of 97.3%.

**Conclusion:** The 2023 Bethesda system shows excellent diagnostic performance and remains a reliable preoperative tool for evaluating thyroid nodules in tertiary care settings.

**Keywords:** Thyroid cytology, Bethesda system, Thyroid nodules, Lymphocytic thyroiditis, Papillary carcinoma.

### INTRODUCTION

Thyroid nodules are a prevalent clinical finding, particularly in tertiary care hospitals, where advanced imaging often increases detection rates. Fine-needle aspiration cytology (FNAC) is established as the primary cost-effective triage tool

for differentiating between benign and malignant lesions.<sup>1,2</sup> To provide a standardised framework for this differentiation, the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) was developed.

In late 2023, the Third Edition of TBSRTC was released, introducing significant changes to harmonise with the 2022 WHO Classification of Thyroid Neoplasms.<sup>3,4</sup> One of the most critical updates is the requirement for a single, standardised name for each of the six diagnostic categories to minimise clinical ambiguity.<sup>5</sup> The updated categories are: Category I: Nondiagnostic (previously included 'Unsatisfactory'), category II: Benign, category III: Atypia of Undetermined Significance (AUS) (the term 'Follicular Lesion of Undetermined Significance' is now discouraged), category IV: Follicular Neoplasm (the term 'Suspicious for Follicular Neoplasm' is discontinued), category V: Suspicious for Malignancy and category VI: Malignant. The term 'follicular nodular disease' replaces previously used terminologies, including 'hyperplastic nodule', 'colloid nodule', 'adenomatous nodule', or 'benign follicular nodule'.<sup>2,6</sup>

Beyond nomenclature, the 2023 update refined the Risk of Malignancy (ROM) for each tier, specifically accounting for the impact of Non-invasive Follicular Thyroid Neoplasm with Papillary-like Nuclear Features (NIFTP).<sup>7,8</sup> In Category III, the system now emphasizes subcategorization based on the presence of nuclear atypia, which carries a higher ROM and often necessitates molecular testing or surgical evaluation.<sup>9,10</sup>

Despite these global revisions, the diagnostic performance of TBSRTC is subject to institutional variations in cytotechnique and pathologist expertise.<sup>11</sup> This cross-sectional study aims to evaluate the spectrum of thyroid lesions and the diagnostic utility—specifically the sensitivity and specificity—of the 2023 Bethesda framework within a tertiary care environment, utilising cytohistological correlation as the definitive benchmark for accuracy.<sup>12</sup>

## Objectives

1. To categorise the spectrum of thyroid lesions using the 2023 Third Edition of the Bethesda System.
2. To analyse the frequency and distribution of cases across the six Bethesda diagnostic categories.
3. To calculate the Sensitivity, Specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV) of the updated system, considering histopathology as the gold standard

## MATERIALS AND METHODS

**Study Type-** Observational study

**Study Design-** Cross-sectional study

**Study Setting-** The study was conducted in the Department of Pathology at Agartala Government Medical College (AGMC & GBPH), Agartala, Tripura.

**Study Period-** December 2022 to November 2025.

**Study Population-** Patients who visited the cytology section of the Department of Pathology for FNA of thyroid lesions during the aforementioned period.

### Exclusion Criteria-

Cases with damaged or lost cytological materials were excluded from our study.

**Sample Size-** 281 (determined on the basis of records, Department of Pathology, AGMC and GBPH).

**Sampling Technique-** Census sampling.

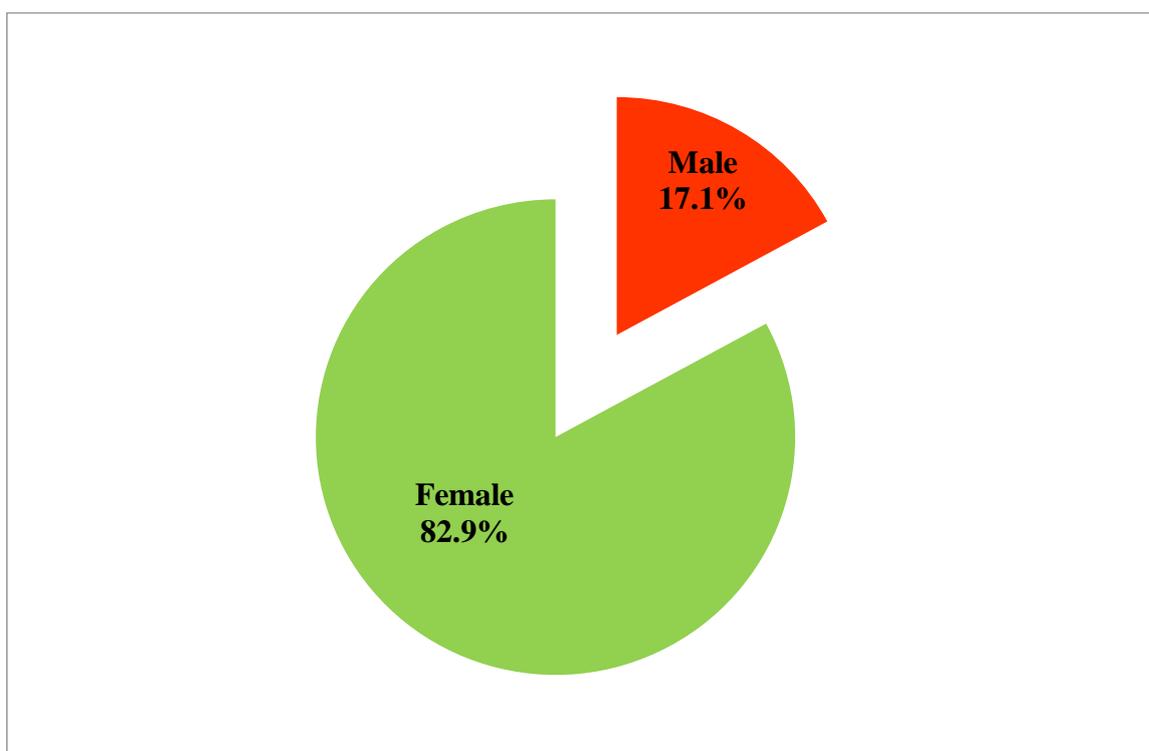
**Study Procedure-** All cytology smears of thyroid lesions were re-evaluated by two pathologists, and, after review, each case was assigned to one of the categories using the strict criteria of the Third Edition of TBSRTC (2023). The review was done blindly, independent of the previous cytological or histopathological diagnosis. All cases were evaluated in reference to the patient's age, sex, and lesion type. The cytological diagnoses were then compared with corresponding histopathological findings, wherever available.

## RESULTS

### 1. Demographic and Clinical Profile

This cross-sectional study analysed 281 thyroid FNAC cases over a three-year period at our hospital. The patient population ranged from 13 to 81 years, with a mean age of 42.6 years. The study cohort showed a predominant female distribution (n=233; 82.9%) compared to males (n=48; 17.1%), yielding a male-to-female ratio of 1:4.8.

**Pie chart 1: Sex distribution of cases**



## 2. Age and Bethesda Category Distribution (2023 Update)

The distribution of the 281 cases across age groups and the Third Edition Bethesda System nomenclature is detailed below. The majority of cases were clustered in the 21–30 and 31–40 year age intervals.

**Table 1: Distribution of Bethesda Categories by Age Group (n=281)**

Age group (Years)	Cat I	Cat II	Cat III	Cat IV	Cat V	Cat VI	Total
0-20	0	10	0	1	1	0	12
21-30	3	58	1	5	2	1	70
31-40	2	51	2	4	3	2	64
41-50	2	38	2	6	1	3	52
51-60	2	29	1	3	2	9	46
61-70	1	15	1	2	2	4	25
>70	0	9	0	1	1	1	12
<b>Total</b>	10	210	7	22	12	20	281
<b>Percentage</b>	3.6%	74.7%	2.5%	7.8%	4.3%	7.1%	100

## 3. Spectrum of Cytological Lesions

The cytological spectrum was categorised according to the 2023 Bethesda criteria, with emphasis on the most prevalent benign and malignant manifestations.

### A. Benign Lesions (Category II: n=210)

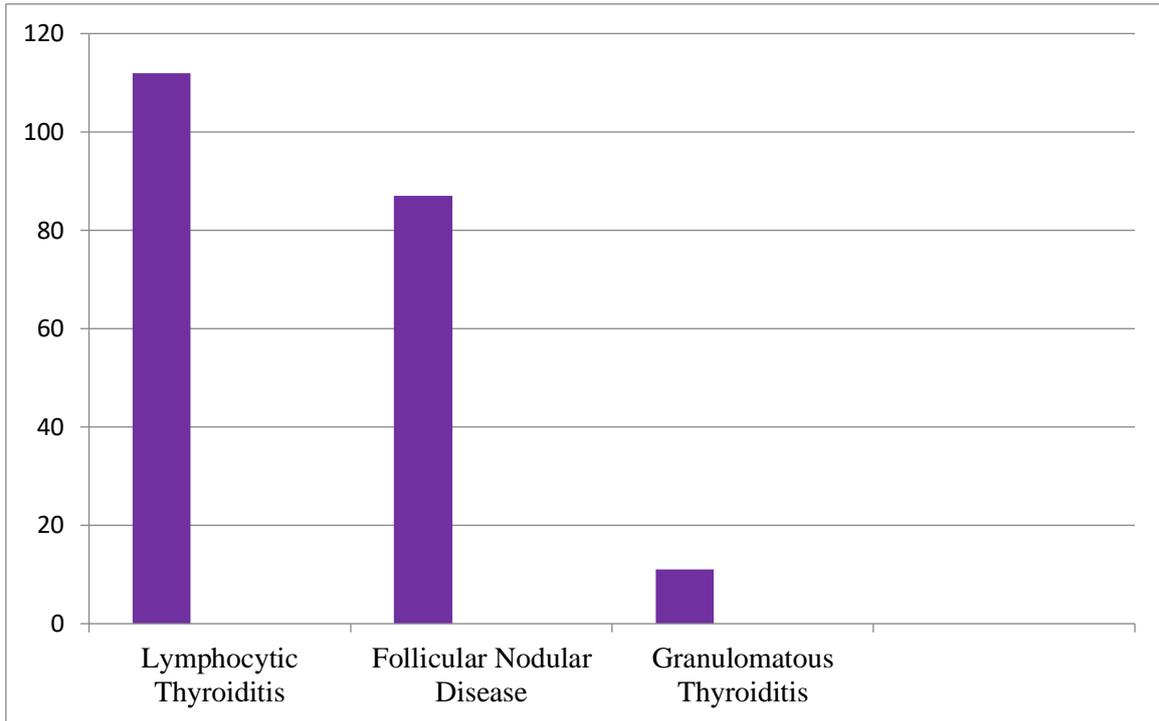
The benign spectrum was dominated by inflammatory and nodular diseases.

Lymphocytic Thyroiditis: 112 cases (53.3%)

Follicular Nodular Disease: 87 cases (41.4%)

Granulomatous Thyroiditis: 11 cases (5.3%)

**Bar diagram 1:** Spectrum of benign (category II) lesions



**B. Malignant Lesions (Category VI: n=20)**

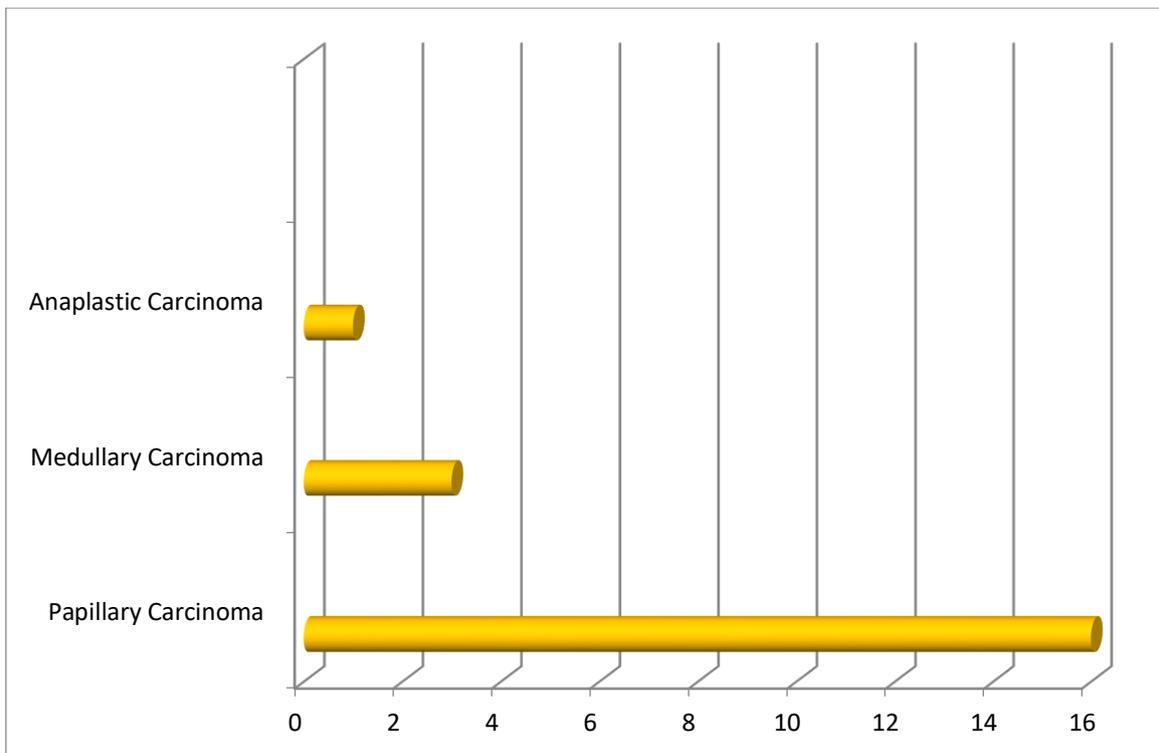
Papillary carcinoma remains the most frequent malignancy detected in our tertiary care setting.

Papillary Carcinoma Thyroid: 16 cases (80%)

Medullary Carcinoma Thyroid: 3 cases (15%)

Anaplastic Carcinoma Thyroid: 1 case (5%)

**Bar diagram 2:** Spectrum of malignant lesions (category VI) lesions



#### 4. Cytohistological Correlation and Diagnostic Performance

Of the 281 cases, 183 underwent surgical resection and histopathological examination (HPE). For statistical analysis, Categories V and VI were grouped as "Positive", while Category II was grouped as "Negative."

**Table 2:** 2x2 Contingency Table (n=183)

FNAC category	Malignant on HPE	Benign on HPE	Total
Positive (Cat V, VI)	27	2	29
Negative (Cat II)	3	151	154
Total	30	153	183

Statistical Parameter Value (%)

Sensitivity 90%

Specificity 98.7%

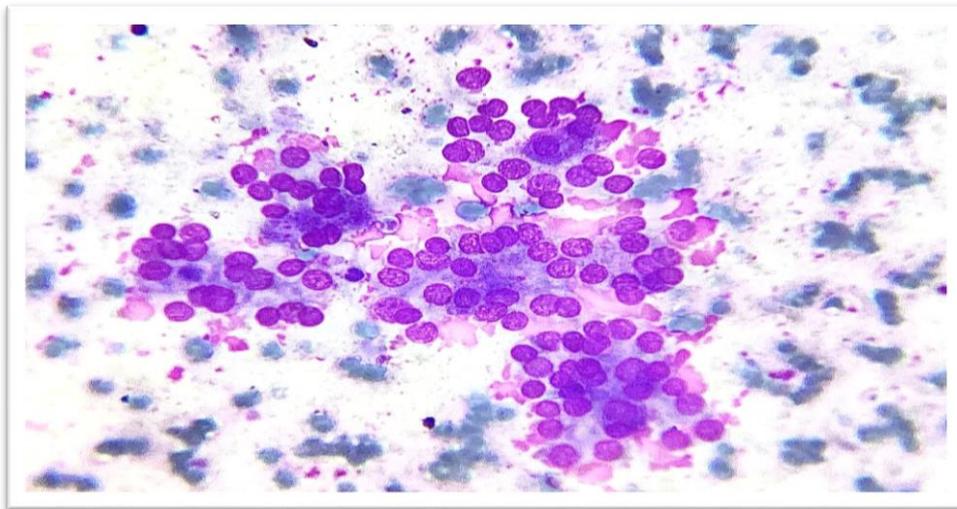
Positive Predictive Value (PPV) 93.1%

Negative Predictive Value (NPV) 98.1%

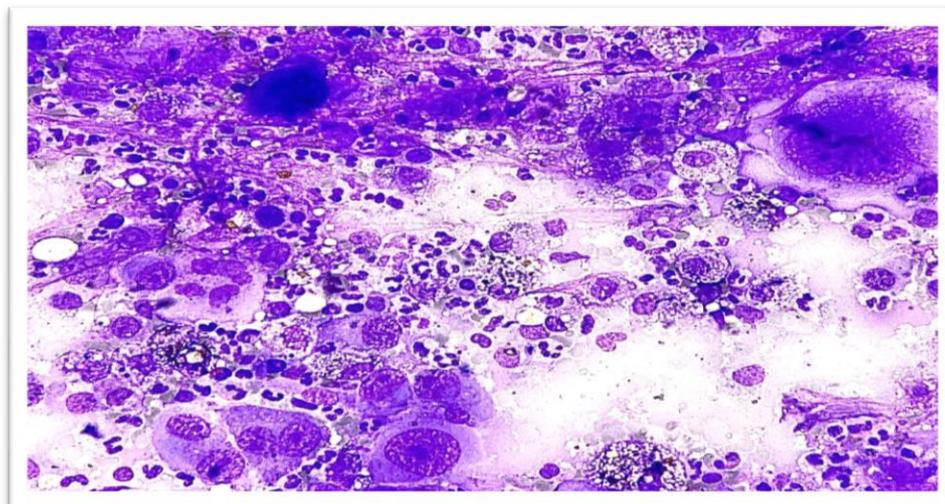
Overall Diagnostic Accuracy 97.3%

#### 5. Summary of Histopathological Spectrum

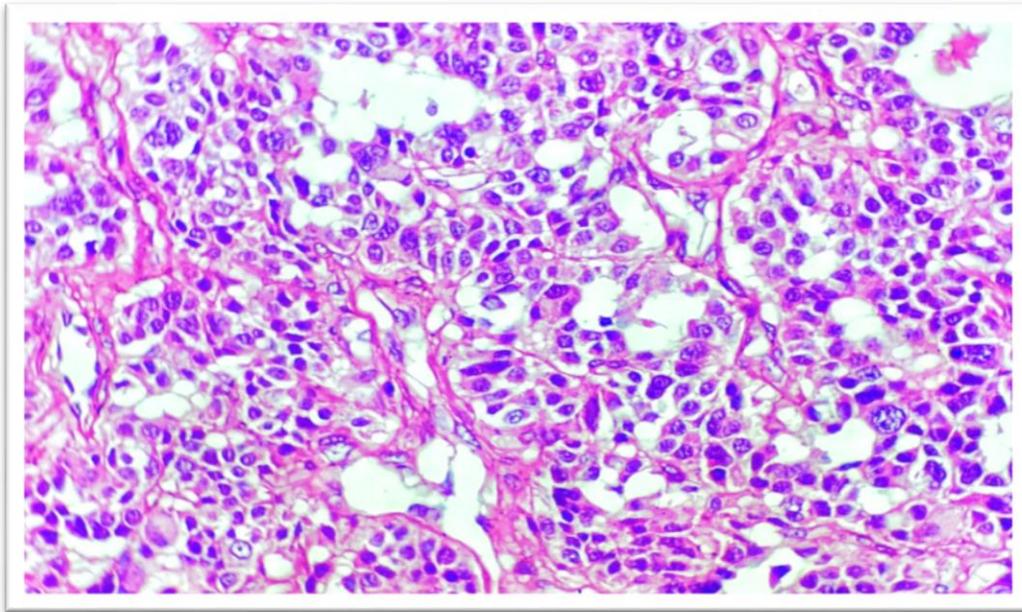
Of the 183 correlated cases, 27 (14.8%) were confirmed as malignant on HPE. The high Negative Predictive Value (98.1%) reinforces the utility of the 2023 Bethesda Category II designation in safely excluding malignancy in a tertiary care setting. The detection of rarer malignancies, such as Medullary and Anaplastic carcinoma, highlights the critical role of FNAC in high-risk patient triaging.



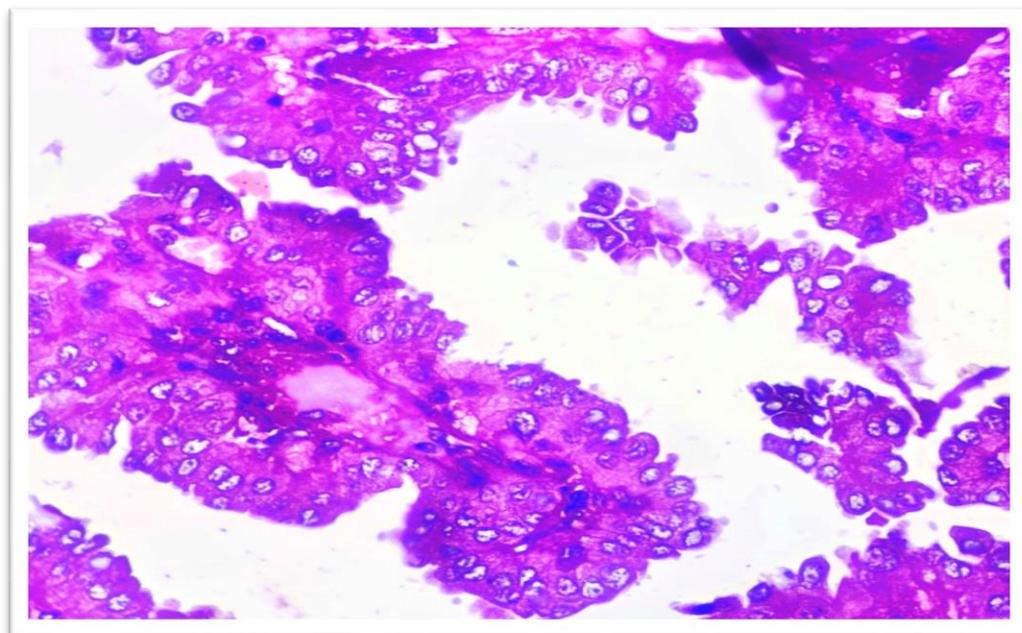
**Figure 1.** 400x view of Giemsa-stained FNAC smear of Follicular Neoplasm



**Figure 2.** 400x view of Giemsa-stained FNAC smear of Anaplastic carcinoma, Thyroid



**Figure 3.** 100x view of H&E stained Histopathology slide of Medullary Carcinoma, Thyroid



**Figure 4.** 100x view of H&E stained Histopathology slide of Papillary Carcinoma, Thyroid

## DISCUSSION

The implementation of the 2023 Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) has revolutionised the diagnostic approach to thyroid nodules by providing a unified nomenclature and refined Risk of Malignancy (ROM) estimates.<sup>13</sup> Our cross-sectional study in a tertiary care setting confirms that this updated framework maintains high diagnostic integrity while offering clearer communication between pathologists and clinicians.<sup>14</sup>

### Demographic and Clinical Spectrum

The study observed a marked female predominance (82.9%) with a male-to-female ratio of 1:4.8, which is consistent with global epidemiological data showing thyroid pathologies are significantly more common in women.<sup>15</sup> The peak incidence of nodules in our cohort was observed in the 21–40 year age range (47.7%), similar to findings by Singh P et al., who reported that thyroid lesions are most frequently diagnosed during the reproductive and middle-aged years.<sup>16</sup>

### Performance of the 2023 Bethesda Categories

Our results showed that Category II (Benign) was the most frequent diagnosis (74.7%), which reflects the high volume of non-neoplastic lesions encountered in a tertiary care setting.<sup>17</sup> The high Negative Predictive Value (98.1%) for Category II in our study is a crucial metric; it supports the 2023 Bethesda recommendation for clinical follow-up rather than surgery for these patients, thereby reducing the burden of unnecessary thyroidectomies.<sup>18,19</sup>

In the malignant spectrum, Papillary Thyroid Carcinoma (PTC) accounted for 80% of our Category VI cases. This dominance of PTC is a recurring theme in recent literature, partly due to the increased detection of microcarcinomas and the precise nuclear criteria established in the 2023 update.<sup>20,21</sup>

### Cytohistological Correlation and Accuracy

The core of our statistical validation was the correlation of 183 surgical cases. By classifying Categories V and VI as "Positive" findings, we achieved a Sensitivity of 90% and a Specificity of 98.7%. This high sensitivity is vital for a screening tool like FNAC, ensuring that fewer malignancies are missed.<sup>22</sup>

Our Diagnostic Accuracy of 97.3% is slightly higher than that reported in some previous studies using the 2017 edition, suggesting that the 2023 refinements—such as the subcategorisation of AUS and the stricter definitions for follicular neoplasms—have improved the correlation between cytological suspicion and histopathological reality.<sup>22,23</sup>

### Conclusion

This cross-sectional study validates the clinical utility of the 2023 Third Edition of the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) in a tertiary care hospital. By evaluating 281 cases with cytohistological correlation in 183 instances, several key conclusions are drawn:

**Exceptional Diagnostic Performance:** The updated Bethesda framework yielded a Sensitivity of 90.0% and a remarkably high Specificity of 98.7%. These metrics, combined with a Diagnostic Accuracy of 97.3%, confirm the system's role as a robust preoperative triaging tool.

**Safety of Conservative Management:** The Negative Predictive Value (NPV) of 98.1% for Category II (Benign) provides strong evidence for the safety of clinical observation, effectively minimising the rate of unnecessary surgical interventions for benign nodules.

**Precision in Malignancy Prediction:** A Positive Predictive Value (PPV) of 93.1% indicates that the 2023 criteria for Categories V and VI are highly reliable, allowing for confident surgical planning and definitive management.

**Impact of 2023 Updates:** The revised nomenclature and refined diagnostic criteria successfully harmonise cytological reporting with the latest WHO classification of thyroid neoplasms. This reduces ambiguity in "Indeterminate" cases and facilitates clearer communication within the multidisciplinary team

### REFERENCES

1. Kosam S, Mire V. Thyroid cytopathology reporting according to Bethesda system with histopathological correlation. *Int J Pharm Clin Res.* 2023;15(11):139–44.
2. Ali SZ, Baloch ZW, Cochand-Priollet B, Schmitt FC, Vielh P, VanderLaan PA. The 2023 Bethesda System for Reporting Thyroid Cytopathology. *Thyroid.* 2023;33(9):1039-44.
3. Sengul I, Sengul D. The 2023 Bethesda system for reporting thyroid cytopathology: novi sub sole, subdivision is no more debatable, in thyroidology. *Rev Assoc Med Bras (1992).* 2023;69(12):e20231124.
4. Baloch ZW, Asa SL, Barletta JA, Ghossein RA, Juhlin CC, Jung CK, et al. Overview of the 2022 WHO Classification of Thyroid Neoplasms. *Endocr Pathol.* 2022;33(1):27-63.
5. Singh A, Gautam A, Ekta T. The interplay of TIRADS and Bethesda system 2023 in the diagnosis of nodular thyroid lesions at a tertiary care teaching hospital. *IP Arch Cytol Histopathol Res.* 2025;10(4):143–8.
6. Hameed S, Khan S, Hassan MJ, Husain M, Prakash A. Critical Appraisal of the 2017 Bethesda System for Reporting Thyroid Cytopathology with Cytohistological Concordance and Estimation of Risk of Malignancy - An Institutional Study. *Indian J Otolaryngol Head Neck Surg.* 2024;76(5):3930-5.
7. Bongiovanni M, Faquin WC, Giovanella L, Durante C, Kopp P, Trimboli P. Impact of non-invasive follicular thyroid neoplasms with papillary-like nuclear features (NIFTP) on risk of malignancy in patients undergoing lobectomy/thyroidectomy for suspected malignancy or malignant fine-needle aspiration cytology findings: a systematic review and meta-analysis. *Eur J Endocrinol.* 2019;181(4):389-96.
8. Rai K, Park J, Gokhale S, Irshaidat F, Singh G. Diagnostic Accuracy of the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC): An Institution Experience. *Int J Endocrinol.* 2023;2023:9615294.
9. Jin X, Jing X. Cytologic assessment of thyroid nodules – Updates in 2023 Bethesda reporting system, diagnostic challenges and pitfalls. *Hum Pathol Rep.* 2024;36:300743.
10. Shrestha RT, Hennessey JV. Cytologic subclassification of atypia of undetermined significance may predict thyroid nodules more likely to be malignant at surgery. *Diagn Cytopathol.* 2016;44(6):492-8.

11. Tessler I, Morand GB, Gecel NA, Dotan A, Yamin T, Alon EE, et al. Guiding Management of Bethesda V Thyroid Nodules: The Role of Molecular Testing. *Clin Endocrinol (Oxf)*. 2025;104(1):67-74.
12. Reuters KB, Mamone MCOC, Ikejiri ES, Camacho CP, Nakabashi CCD, Janovsky CCPS, et al. Bethesda Classification and Cytohistological Correlation of Thyroid Nodules in a Brazilian Thyroid Disease Center. *Eur Thyroid J*. 2018;7(3):133-8.
13. Cibas ES, Ali SZ. The 2017 Bethesda System for Reporting Thyroid Cytopathology. *Thyroid*. 2017;27(11):1341-6.
14. Riddhi, A. Parmar, Keval, Patel. The 2023 Bethesda System for Reporting Thyroid Cytopathology: A review update. *Journal of Clinical and Scientific Research*. 2024;13(4):297-307.
15. Dean DS, Gharib H. Epidemiology of thyroid nodules. *Best Pract Res Clin Endocrinol Metab*. 2008;22(6):901-11.
16. Singh P, Choudhary R, Singrol M, Sahu K, Gangwani A. Comparison of Bethesda versus other international cytology reporting system of thyroid lesions: a single centre study. *Int J Curr Pharm Rev Res*. 2025;17(3):431–6.
17. Kinet S, Cornette H, Van Den Heede K, Brusselaers N, Van Slycke S. Accuracy and diagnostic performance of the Bethesda system for reporting thyroid cytopathology in a tertiary endocrine surgical referral center in Belgium. *World J Surg*. 2024;48(2):386-92.
18. Lamartina L, Grani G, Durante C, Filetti S. Recent advances in managing differentiated thyroid cancer. *F1000Res*. 2018;7:86.
19. Filetti S, Durante C, Hartl D, Leboulleux S, Locati LD, Newbold K, et al. Thyroid cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up†. *Ann Oncol*. 2019;30(12):1856-83.
20. Kakudo K, Liu Z, Bychkov A, Hirokawa M, Lai CR, Jung CK. Diagnostic criteria of papillary thyroid carcinoma (PTC)-type nuclear features impacting thyroid fine needle aspiration (FNA) cytology. In: Kakudo K, Bychkov A, Jung CK, editors. *Thyroid FNA Cytology*. Singapore: Springer; 2024. p. 7–14
21. Bongiovanni M, Giovanella L, Romanelli F, Trimboli P. Cytological Diagnoses Associated with Noninvasive Follicular Thyroid Neoplasms with Papillary-Like Nuclear Features According to the Bethesda System for Reporting Thyroid Cytopathology: A Systematic Review and Meta-Analysis. *Thyroid*. 2019;29(2):222-8.
22. Zarif HA, Ghandurah SE, Al-Garni MA, Binmahfooz SK, Alsaywid BS, Satti MB. Thyroid Nodules Cytopathology Applying the Bethesda System with Histopathological Correlation. *Saudi J Med Med Sci*. 2018;6(3):143-8.
23. Erkinuresin T, Demirci H. Diagnostic accuracy of fine needle aspiration cytology of thyroid nodules. *Diagnosis (Berl)*. 2020;7(1):61-6.