

Cytological Distribution and Histopathological Correlation of Thyroid Lesions According to the 2023 Bethesda System: An Institutional Study

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Received: 01-07-2026 / Revised: 15-08-2026 / Accepted: 23-09-2026

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Conflict of interest: Nil

Abstract

Background: Thyroid nodules are frequently encountered in clinical practice and comprise a wide spectrum of benign and malignant lesions. Fine-needle aspiration cytology (FNAC) is an important minimally invasive investigation for the preoperative evaluation of thyroid nodules. The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) provides standardized terminology for thyroid FNAC and facilitates communication between cytopathologists and clinicians. The 2023 third edition incorporates refinements in diagnostic terminology and updated concepts regarding risk of malignancy, molecular testing and clinical management.

Materials and Methods: A retrospective observational study was conducted in the Department of Pathology, NAMO Medical Education and Research Institute, Silvassa, from August 2025 to August 2026. A total of 120 patients with clinically or radiologically detected thyroid lesions who underwent FNAC were included. Cytological specimens were categorized according to the six categories of the 2023 Bethesda System. Histopathological correlation was assessed in cases that subsequently underwent thyroidectomy.

Results: Of the 120 cases, 100 (83.3%) were females and 20 (16.7%) were males. The most commonly affected age group was 30–40 years, comprising 48 cases (40.0%). Bethesda category II (benign) was the predominant category, accounting for 93 cases (77.5%), followed by category III (atypia of undetermined significance) with 13 cases (10.8%). Papillary thyroid carcinoma was the most frequent malignant cytological diagnosis. Histopathological follow-up was available in 37 cases.

Conclusion: The 2023 Bethesda System provided a standardized framework for reporting thyroid FNAC in this institutional cohort. Benign lesions constituted the majority of cytological diagnoses, while papillary thyroid carcinoma was the predominant malignant diagnosis. The available cytohistological correlation demonstrated concordance in the surgically followed suspicious and malignant cases. However, the limited proportion of cases with histopathological follow-up restricts assessment of definitive diagnostic performance and category-specific risk of malignancy.

Keywords: Thyroid Nodule; Fine-Needle Aspiration Cytology; Bethesda System, 2023; Cytohistological Correlation; Papillary Thyroid Carcinoma.

DOI: 10.25258/ijcpr.18.9.161

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Introduction

Thyroid nodules are frequently encountered in clinical practice and may represent benign and malignant lesions. Established risk factors for thyroid nodule development include increasing age, female gender and exposure to ionizing radiation involving the thyroid. Nutritional iodine status may also influence the prevalence and pattern of thyroid. [1][2]

The evaluation of thyroid nodule integrates clinical examination, Ultrasonography, thyroid function tests, antibody profiles and Fine needle aspiration cytology (FNAC). Because it is relatively simple, minimally invasive, diagnostically useful and cost-effective, FNA has an important role in the preoperative assessment of thyroid lesions. It can identify many benign and malignant lesions and can assist in clinical management.[2][3]

The Bethesda System for Reporting Thyroid Cytopathology was introduced to provide standardized terminology and facilitate communication between cytopathologists and clinicians. The 2023 third edition retains six major diagnostic categories: I, nondiagnostic; II, benign; III, atypia of undetermined significance (AUS); IV, follicular neoplasm; V, suspicious for malignancy; and VI, malignant. The third edition also updates the estimated risk of malignancy, refines AUS terminology, aligns nomenclature with the WHO classification of thyroid neoplasms, and expands discussion of molecular testing and clinical management. [4]

Histopathological examination of thyroidectomy specimens provides the reference standard for definitive tissue diagnosis in surgically managed lesions. Cytohistological correlation is therefore essential for accuracy of cytological interpretation, identifying diagnostic pitfalls and determining the observed risk of malignancy in individual Bethesda categories.

The present study was undertaken to evaluate the distribution of thyroid lesions according to the Bethesda system and to assess their cytohistological correlation at tertiary care hospital.

Aim

1. To study the cytological spectrum of thyroid lesions using the 2023 Bethesda system for reporting thyroid cytopathology.
2. To evaluate cytohistological correlation in the tertiary care hospital.

Objectives

1. To classify thyroid FNAC specimens according to 2023 Bethesda system.[4]
2. To study demographic and clinical profile of patients with thyroid lesions.
3. To correlate cytological diagnosis with corresponding histopathological findings.
4. To assess the observed diagnostic performance of FNAC in differentiating benign and malignant thyroid lesions among cases with histopathological follow up.

Material and Method

Study design: A hospital based retrospective observational study

Study setting: Study conducted in Department of pathology, NAMO medical education and research institute, Silvassa.

Study duration: August 2025 to August 2026.

Study population: Patient presenting with clinically or radiologically detected thyroid nodules who underwent FNAC in the pathology department during the study period.

Sample size: 120 cases

Inclusion criteria

- Patients of any age having diffuse swelling, palpable thyroid nodule, with multinodular goiter, with suspected malignancy, with enlarged cervical lymph nodes or having compression symptoms, who underwent FNAC during the study period.
- Written informed consent was obtained before the procedure; In case of minors/paediatric cases, consent was taken from their parents/guardians.

Exclusion criteria

- Patients who did not provide consent to participate in the study.
- Patients who were uncooperative or excessively apprehensive.
- Patients unable to suppress their cough reflex and were at risk for thyroid laceration by needle.

Methodology: Patients fulfilling the required criteria underwent thyroid FNAC. Smears were prepared and stained with hematoxylin and eosin (H&E) and Papanicolaou (PAP) stain. Special stains, Ziehl-Neelsen stain (ZN stain) was done wherever necessary. The reporting of FNA smears was done by 2023 Bethesda system under the following six categories:

Category I Non-diagnostic

- comprising of cyst fluid only, virtually acellular specimen, others (obscuring blood, clotting artifact etc.).

Category II Benign

- consistent with benign follicular nodule (includes adenomatoid nodule, colloid nodule etc).
- consistent with lymphocytic (Hashimoto's) thyroiditis in proper clinical context.
- consistent with granulomatous (subacute) thyroiditis and others.

Category III Atypia of undetermined significance

Category IV Follicular neoplasm/suspicious for follicular neoplasm: (specify if Hurthle cell (oncocytic) type.

Category V Suspicious for malignancy

- suspicious for papillary carcinoma, suspicious for medullary carcinoma, suspicious for metastatic carcinoma, suspicious for lymphoma.

Category VI Malignant

- papillary carcinoma thyroid, poorly differentiated carcinoma, medullary thyroid

carcinoma, undifferentiated (anaplastic) carcinoma, squamous cell carcinoma, carcinoma with mixed features (specify), metastatic carcinoma, non-Hodgkin lymphoma and others.

Based on FNA report and other investigations, patients were subjected to total/partial thyroidectomy. Resected Specimens were fixed in 10% neutral buffered formalin for one day to allow proper fixation.

Gross features were noted, representative sections were taken and stained with haematoxylin and eosin stains. Special stains (ZN stain) were used

when necessary. The histopathological diagnosis will be compared with the corresponding cytological diagnosis to determine concordance and discordance.

Results

A total of 120 thyroid FNAC cases with thyroid swelling were included. Histopathological follow up was available in 37 cases.

There were 20 male patients (16.7%) and 100 female patients (83.3%). Female to Male ratio is of 5:1. The Most common age group affected was 30-40 years comprising 48 cases (40%). [table 1]

Table 1: Age group wise distribution of cases

Age group	No. of cases	Percentage %
10-20 years	04	3.3 %
20-30 years	25	20.8%
30-40 years	48	40 %
40-50 years	26	21.7%
50-60 years	08	6.7 %
60-70 years	08	6.7 %
70-80 years	00	00 %
80-90 years	01	0.8 %

Out of 120 cases, Bethesda category II was the most common category, accounting for 93 cases (77.5%). Category III accounted for 13 cases (10.8%), while categories I, IV, V and VI accounted for 4.2%, 1.7%, 0.8% and 5.0%, respectively. Papillary thyroid carcinoma was the most frequent malignant cytological diagnosis. [table 2]

Table 2: Distribution of cases according to Bethesda system

Bethesda category	%	FNAC diagnosis	No. of cases
1. Nondiagnostic (05)	4.2 %	Cyst fluid only	01
		Obscuring Blood	02
		Scant Cellularity	02
2. Benign (93)	77.5 %	Benign adenomatoid nodule	08
		Benign Colloid goitre	49
		Benign follicular nodule	20
		Lymphocytic Thyroiditis	12
		Acute thyroiditis	04
3. Atypia of undetermined significance (13)	10.8%	Atypia of undetermined significance	13
4. Follicular Neoplasm (02)	1.67 %	Follicular Neoplasm	02
5. Suspicious for malignancy (01)	0.83 %	Suspicious for papillary thyroid carcinoma	01
6. Malignancy (06)	5%	Papillary thyroid carcinoma	05
		Medullary thyroid carcinoma	01

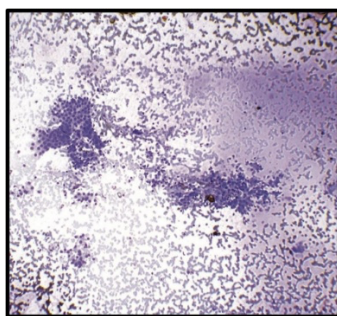


Figure 1: Category II (Benign)- Colloid Nodule: Sheets of benign follicular cells with well defined cell borders arranged in abundant colloid background

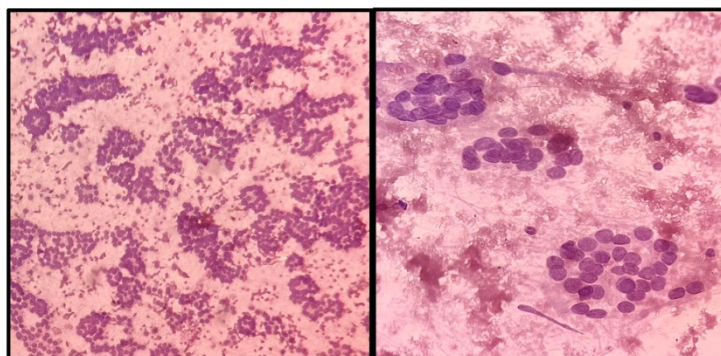


Figure 2: Category IV (Follicular Neoplasm)- Highly cellular smear with cells arranged predominantly in microfollicular pattern

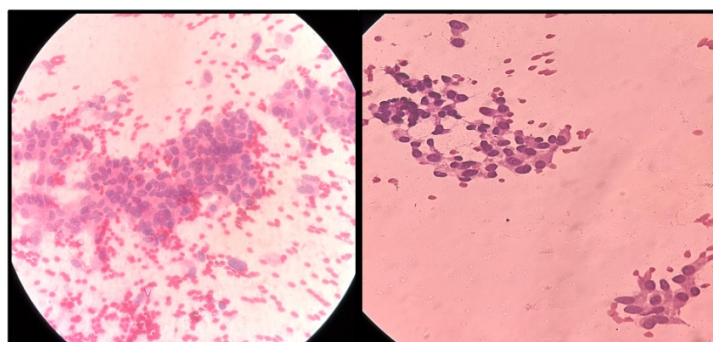


Figure 3: category VI: Medullary carcinoma thyroid - cellular smear show round, ovoid, plasmacytoid, spindle cells having abundant cytoplasm and eccentric nuclei arranged singly and in sheets under hemorrhagic background

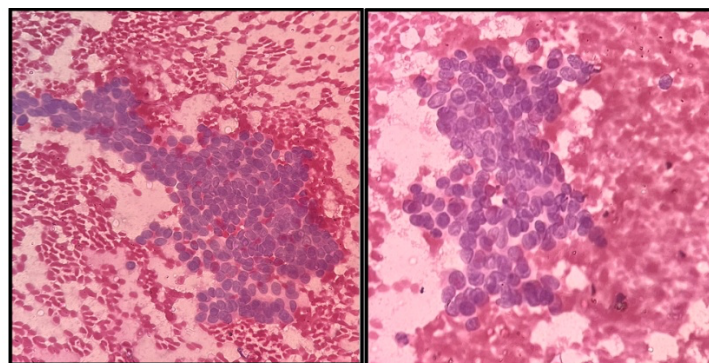


Figure 4: category VI: Papillary thyroid carcinoma - Flat monolayered sheet of epithelial cells showing nuclear overlapping, uniformly enlarged oval nuclei with pale powdery chromatin and small nucleoli, nuclear grooving and nuclear pseudo inclusions

Histopathological follow up was available in 37 of the 120 cases (30.8%). No histopathological follow-up was available for the remaining 83 FNAC cases. 9 were confirmed as benign in Bethesda category II. Two category III cases were diagnosed as follicular adenoma on histopathology. The single category IV case was diagnosed as

Noninvasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP). The single category V case and four category VI cases were diagnosed as papillary thyroid carcinoma. Therefore among the 37 cases with available histopathological follow up, five were confirmed as papillary thyroid carcinoma and one as NIFTP.

Table 3: Cytohistological correlation

Bethesda category	No. of cases	cases that underwent surgery	Histopathological diagnosis
cat I- Nondiagnostic	05 (4.2%)	0	
cat II- Benign	93 (77.5%)	29	Nodular goitre (20) Adenomatoid hyperplasia (08) Lymphocytic Thyroiditis (01)
cat III- Atypia of undetermined significance	13 (10.8%)	02	Follicular adenoma (02)
cat IV- Follicular neoplasm	02 (1.67%)	01	Non-invasive Follicular tumor with papillary like nuclear feature (01)
cat V- Suspicious for malignancy	01 (0.83%)	01	Papillary thyroid carcinoma (01)
cat VI- Malignancy	06 (5%)	04	Papillary thyroid carcinoma (04)

Statistical interpretation of the cyto-histopathological correlation: Histopathological follow up was available for 30.8% (37/120) of the study population. The proportion of cases undergoing surgery varied substantially among Bethesda categories: 31.2% of category II cases, 15.4% of category III cases, 50% of category IV cases, 100% of category V, 66.7% of category VI cases underwent surgery. The single category V case and all 4 histologically followed category VI cases were confirmed papillary thyroid carcinoma. Thus among the 5 histologically verified cases belonging to Bethesda categories V and VI, all five were confirmed as papillary thyroid carcinoma. However this observation should be interpreted as concordance within the histologically verified subset, rather than as a measure of overall sensitivity or specificity, because histopathological verification was not available for all 120 cases.

Discussion

The goal of thyroid FNA is to successfully differentiate benign from malignant lesions and to triage patients requiring surgery. The six-tiered Bethesda system provides standardized nomenclature for reporting thyroid FNA smears which enables better communication and understanding between clinicians and pathologists.

The advantage of this systematic approach is that each of the six Bethesda categories has implied risk of malignancy which helps the clinicians to plan appropriate therapy necessary for the patient.

In present study, age wise distribution of cases, majority of cases belong to the age group of 30-40 years (40%). Similar result was observed by Raychaudhuri S et al. [6] where majority of belong to 30-40 years of age group. Gender wise distribution shows majority of cases were found in female (83.3%), whereas only 16.7% found in the males. Study conducted by Bhatnagar A et al. [7] also shows female predominance i.e. 82.3%.

Table 4: Comparisons of Distribution of cases according to Bethesda system for thyroid cytopathology, 2023 with other studies

Bethesda category	Our study	Raychaudhuri S et al. [6]	Bhatnagar A et al. [7]
cat I- Nondiagnostic	05 (4.2%)	08 (1.8%)	12 (6.6%)
cat II- Benign	93 (77.5%)	373 (86.9%)	113 (62.4%)
cat III- Atypia of undetermined significance	13 (10.8%)	10 (2.33 %)	01 (0.6%)
cat IV- Follicular neoplasm	02 (1.67%)	17 (3.96%)	13 (7.2%)
cat V- Suspicious for malignancy	01 (0.83%)	12 (2.79%)	02 (1.1%)
cat VI- Malignancy	06 (5%)	09 (2.09%)	40 (22.1%)

In our study, 120 cases were evaluated. 93 cases were benign (77.5 %). Thus, there were more number of non-neoplastic lesions as compared to neoplastic lesions which was consistent with the studies conducted by Raychaudhuri S et al. [6] and Bhatnagar A et al. [7] i.e., 373 (86.9%) and 113 (62.4%) cases.

Histopathological correlation was available in 37 cases. Discrepancies in thyroid cytology may arise from overlapping cytomorphological features,

limited sampling, cystic degeneration, follicular pattern lesions and difficulty in distinguishing certain benign from malignant entities. Follicular adenoma and follicular carcinoma for example can't be reliably differentiated by cytology alone because of diagnosis of carcinoma depends on capsular and vascular invasion in the appropriate histopathological context.

Limitations

- Retrospective, single-institution study design.
- Histopathological follow-up was available in only 37 of 120 FNAC cases.
- The surgical subset may not represent the full FNAC cohort and may introduce verification/selection bias.
- Molecular testing and systematic ultrasound risk stratification were not included in the available study data.
- Category-specific risk-of-malignancy estimates cannot be reliably calculated from the available follow-up numbers.

Conclusion

The 2023 Bethesda System provided a standardized framework for reporting thyroid FNAC in this institutional series. Benign lesions constituted the majority of cytological diagnoses, while papillary thyroid carcinoma was the most frequent malignant diagnosis. Cytohistological correlation was available in 37 cases and demonstrated concordance between suspicious/malignant cytology and papillary thyroid carcinoma in the surgically followed malignant cases. However, interpretation of diagnostic performance is limited by the small number of histologically correlated cases and potential selection bias. Larger studies with comprehensive follow-up are required to establish institution-specific risks of malignancy for individual Bethesda categories.

References

1. Karima rai et al. Diagnostic Accuracy of the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC): An Institution Experience, International Journal of Endocrinology, Volume 2023.
2. Orell SR, Sterrett GF. Orell and sterrett's fine needle aspiration cytology. 5th Ed. Edinburgh: Churchill livingstone; 2012.
3. Dey P. Diagnostic cytology.3rd ed. New Delhi: Jaypee brothers' medical publishers;2025.
4. Ali SZ, Baloch ZW, Cochand-Priollet B, Schmitt FC, Vielh P, Vander Laan PA. The 2023 Bethesda System for Reporting Thyroid Cytopathology. Thyroid. 2023;33(9):1039–1044. doi:10.1089/thy.2023.0141.
5. WHO Classification of Tumours Editorial Board. Endocrine and Neuroendocrine Tumours. WHO Classification of Tumours, 5th ed. Vol. 10. Lyon (France): International Agency for Research on Cancer; 2025.
6. Raychaudhuri S et al., Diagnostic accuracy and utility of The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), 2017 in an Indian Scenario: A tertiary care appraisal. Al Am een J Med Sci 2024; 17(1): 39-49.
7. Bhatnagar A et al., The Bethesda system for reporting thyroid cytology: a prospective study in a tertiary care institute along with review of literature. Int J Res Med Sci. 2020 Oct;8(10):3670-3677.