

# CYTOMORPHOLOGICAL EVALUATION OF THYROID LESIONS BASED ON BETHESDA SYSTEM AND ITS CORRELATION WITH THYROID PROFILE

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## ABSTRACT

**Background:** Fine needle aspiration cytology along with thyroid profile forms the mainstay of evaluation of thyroid lesions. American Thyroid Associations recommends TSH for initial assessment of thyroid swellings. The aim and objective are to evaluate thyroid swellings by FNAC based on Bethesda system and correlate cytological findings with thyroid profile. **Materials and Methods:** A total number of 104 patients with thyroid lesions were evaluated by FNAC over a period of 18 months. The slides were stained by H&E and Giemsa stain and reported by using Bethesda system for thyroid lesions. The cytological findings were also correlated with thyroid profile of patients. **Result:** Based on Bethesda system of thyroid lesions, out of 104 cases, 6 cases were Unsatisfactory [Cat I], 85 cases were Benign [Cat II], 1 case was of Atypia of Undetermined Significance [Cat III], 4 cases were of Follicular Neoplasm [Cat IV], 1 case was Suspicious for malignancy [Cat V] and 7 cases were Malignant [Cat VI]. Maximum number of patients were Euthyroid (53.85%) belonging to Bethesda Cat-I, II, IV, V and VI, 5.77% were Hypothyroid belonging to Bethesda Cat- II and 40.38% were Hyperthyroid belonging to Cat-I, II, III, IV and VI. Thyroid profile indicates that mostly the cases were Euthyroid in all categories of Bethesda (53.85 %) and altered thyroid profile was seen in 46.15%. **Conclusion:** FNAC has become a very important diagnostic tool for assessing thyroid lesions with good sensitivity and specificity. The Bethesda System for reporting along with clinical and thyroid profile has a good predictive value. The nature of disease, experience of pathologist along with technical limitations determine the diagnostic utility of procedure.

## INTRODUCTION

Fine-needle aspiration cytology (FNAC) of the thyroid gland is the first-line diagnostic tool for evaluating thyroid swellings. It is a simple, safe, and highly accurate method for stratifying patients with thyroid disorders. While imaging modalities such as ultrasonography (USG) and scintigraphy can help differentiate between solid and cystic nodules, they lack the specificity to reliably distinguish benign from malignant lesions. In contrast, FNAC not only differentiates between benign and malignant nodules but also provides essential information that guides clinical management.

Multiple studies have reported that FNAC demonstrates a sensitivity ranging from 65% to 98% and a specificity between 72% and 100%,<sup>[1-3]</sup> with an overall diagnostic accuracy of approximately

95% in distinguishing benign from malignant thyroid nodules.<sup>[4]</sup>

To address challenges in the interpretation and reporting of thyroid FNAC, the National Cancer Institute (NCI) convened the “Thyroid Fine Needle Aspiration State of the Science Conference” in Bethesda, Maryland. Six expert committees were formed to evaluate various aspects of thyroid cytology. Committee IV focused specifically on establishing standardized diagnostic terminology and morphologic criteria. The resulting recommendations were subsequently published and widely adopted.<sup>[5]</sup>

These efforts culminated in the development of The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), which offers standardized diagnostic categories, clear criteria, explanatory notes, and management guidelines for each category.<sup>[6]</sup> The system classifies thyroid

cytology into six distinct categories, each associated with an estimated risk of malignancy. For benign diagnoses, the malignancy risk is typically less than 3%. Importantly, the three intermediate categories—Atypia of Undetermined Significance (AUS), Suspicious for Follicular Neoplasm (SFN), and Suspicious for Malignancy (SFM)—serve as critical transitional groups that help bridge the diagnostic gap between clearly benign and clearly malignant findings.<sup>[6]</sup>

The Bethesda System has significantly improved diagnostic consistency by reducing interobserver variability, promoting interlaboratory standardization, and enhancing communication between pathologists and clinicians, thereby supporting more effective patient management.<sup>[7,8]</sup>

The Bethesda System for Reporting Thyroid Cytopathology: Diagnostic Categories.

#### 1. Non-Diagnostic or Unsatisfactory

- Contains only cyst fluid
- Virtually acellular specimen
- Other reasons (e.g., obscured by blood, clotting artifacts)

#### 2. Benign

- Consistent with a benign follicular nodule
- Consistent with lymphocytic thyroiditis in the appropriate clinical context
- Consistent with granulomatous thyroiditis
- Other benign findings

#### 3. Atypia of Undetermined Significance

- Specify if AUS due to nuclear atypia or other factors

#### 4. Follicular Neoplasm

- Specify if Hurthle cell (oncocytic) type

#### 5. Suspicious for Malignancy

- Suspicious for papillary carcinoma
- Suspicious for medullary carcinoma
- Suspicious for metastatic carcinoma
- Suspicious for lymphoma
- Other suspicious findings

#### 6. Malignant

- Papillary thyroid carcinoma
- Poorly differentiated carcinoma
- Medullary thyroid carcinoma
- Undifferentiated carcinoma
- Squamous cell carcinoma
- Carcinoma with mixed features
- Metastatic carcinoma
- Non-Hodgkin lymphoma
- Other malignant findings

## MATERIALS AND METHODS

**Study Design:** The study is a hospital based prospective study to categorize thyroid cytopathology results as per The Bethesda System Of Reporting Thyroid Cytopathology (TBSRTC) & correlated with Thyroid function test over a period of 18 months.

**Source of Data:** Patients with thyroid swelling referred for FNAC to cytology section, department of Pathology, PCMS&RC, BHOPAL [M.P]

**Sample size:** A total sample size of 104 patients with thyroid swelling

#### Study variables:

Independent- Age, gender, weight.

Dependent - Thyroid profile, radiological, cytological findings

#### Inclusion & Exclusion criteria

##### Inclusion criteria

- All patient with thyroid enlargement irrespective of age & sex.
- Patients who gave consent

##### Exclusion criteria

- Neck swelling other than thyroid was excluded.

Apparatus and materials -5 & 10ml syringe, 24G needle, 95% ethanol, H&E Stain & Giemsa, Gloves, Slides, Microscope.

**Data Collection Procedure:** All patients coming for FNAC of thyroid swelling to department of Pathology PCMS&RC were examined thoroughly.

- Relevant clinical details, Radiological finding & Thyroid function Test reports were collected & general physical examination was done during the procedure,
- FNAC was done using 24 gauge needle with all aseptic precaution.
- Then smears were prepared & immediately fixed in 95% ethanol, few were air dried.
- Staining of the smears was done by H&E (Hematoxylin and eosin) and Giemsa stain.
- Thyroid cytopathology results were analyzed using Bethesda system.

## RESULTS

The study evaluated the prevalence of different types of thyroid lesions in and around Bhopal and correlated it with thyroid function tests (TFT).

The present study consists of 104 cases of various thyroid lesions, in which majority were female patients. Female to male ratio was 5:1.

**Table 1: Distribution Of cases according to Adequacy rates in cytology**

Adequacy rate	Frequency	Percent
Satisfactory	98	94.23%
Non-Satisfactory	6	5.76%
Total	104	100%

**Adequacy rate:** Out of 104 FNAC, 98 (n = 94.23%) aspirates were categorized as adequate samples by fulfilling the criteria of adequacy as per The

Bethesda System for Reporting Thyroid Cytopathology. 6 cases [5.76%] were found to be inadequate for cytological evaluation, hence they

were labelled as unsatisfactory smears and categorized into category I of TBSRTC as shown in [Table 1].

**Table 2: Distribution of patients according to Bethesda System.**

Bethesda Category	Frequency	Percent
Cat-I	6	5.8
Cat-II	85	81.7
Cat-III	1	1
Cat-IV	4	3.8
Cat-V	1	1
Cat-VI	7	6.7
Total	104	100

The fine needle aspiration smears which were adequate for evaluation were categorized into nonneoplastic and neoplastic lesions. The nonneoplastic lesions included colloid goiter, colloid goiter with cystic degeneration and Hashimoto thyroiditis. They come under category II of TBSRTC. The non-neoplastic lesions constituted the major proportion [81.7%], while neoplastic

lesions comprise of Atypia of Undetermined Significance

1[1%], follicular neoplasm n=4[3.8 %], Suspicious of papillary carcinoma n=1[1%] and malignant n=7[6.7%]. 6 cases were unsatisfactory and categorized as Bethesda category I shown in [Table 2].

**Table 3: Thyroid hormone status in different cases of thyroid FNAC**

Thyroid Status	No. of Cases	Percentage
Euthyroid	56	53.85
Hypothyroid	6	5.77
Hyperthyroid	42	40.38
Total	104	100.00

[Table 3] shows that in our study maximum cases were reported as Euthyroid n=56 [53.85%], Hyperthyroid n=42 [40.38%], and 6 cases were Hypothyroid n=6[5.77%].

## DISCUSSION

In this study, thyroid fine-needle aspiration cytology (FNAC) samples were categorized using the Bethesda System for Reporting Thyroid Cytopathology, a standardized six-tier classification framework. Over the 18-month study period, a total of 104 thyroid FNAC cases were collected and analyzed accordingly. The cohort included various thyroid lesions, with a female-to-male ratio of 5:1—consistent with findings from Kocjan et al. (2009) and Nayar and Ivanovic (2009), who reported ratios ranging from 4:1 to 9:1.<sup>[9,10]</sup> This notable gender disparity is attributed to hormonal and autoimmune factors, which more commonly affect females.

The study underscores the diagnostic utility of FNAC, especially when interpreted through the Bethesda System. FNAC proved to be a safe, cost-effective, and reliable method for obtaining adequate cytological material, with a high adequacy rate of 94.23%. This finding aligns with the results of Bongiovanni et al. (2012), who also reported a sample adequacy rate of 94.23%, reflecting a high-quality FNAC technique.<sup>[11]</sup>

A strong correlation was observed between thyroid function test (TFT) results and cytological findings, highlighting the importance of integrating biochemical testing into the diagnostic process. Non-neoplastic lesions constituted the majority of cases (81.7%), which is comparable to findings by

Mondal S.K. et al. (2013), with colloid goiter being the most frequently diagnosed condition.<sup>[12]</sup> Among neoplastic lesions, papillary carcinoma emerged as the most common malignancy, as also reported by Agnes Stephanie Harahap et al.<sup>[13]</sup> Furthermore, the predominance of female patients (83.7%) in this study reflects the known higher prevalence of thyroid disorders among women, further supporting the observations in existing literature.

## CONCLUSION

This study provides strong evidence for the pivotal role of fine-needle aspiration cytology (FNAC) and the Bethesda System in the preoperative evaluation of thyroid nodules. By classifying thyroid cytopathology findings into six well-defined diagnostic categories, the Bethesda System promotes consistency and clarity in reporting—essential elements for guiding effective clinical decision-making. The high sample adequacy rate of 94.23% underscores the reliability of FNAC as a minimally invasive method for obtaining sufficient material for accurate cytological evaluation. Moreover, integrating FNAC findings with thyroid function test (TFT) results enhances diagnostic precision, enabling clinicians to make informed decisions regarding treatment and surgical intervention. The study's findings have important implications for clinical practice. First, they support the widespread adoption of the Bethesda System to standardize thyroid cytopathology reporting across diverse healthcare settings. Second, they highlight the value of a multidisciplinary diagnostic approach—combining FNAC with TFT and imaging

studies—to achieve a more comprehensive understanding of thyroid pathology. This integrated strategy not only improves diagnostic accuracy but also facilitates early detection and timely management of both benign and malignant thyroid conditions. From a broader perspective, the research emphasizes the importance of evidence-based, standardized protocols in advancing thyroid diagnostics and optimizing patient care. Future investigations could involve larger sample sizes and extended follow-up periods to validate these results and further explore the relationship between cytological findings and thyroid function. Additionally, incorporating molecular marker analysis may enhance the predictive power of FNAC and improve risk stratification in indeterminate cases.

In conclusion, this study reaffirms the critical role of FNAC and the Bethesda System in enhancing diagnostic accuracy and guiding the clinical management of thyroid nodules. It lays the groundwork for future advancements in thyroid diagnostics, ultimately contributing to improved patient outcomes and higher standards of care.

- This study was approved by Institutional Ethical Committee of Peoples College of Medical Sciences & Research Centre, Bhopal.
- Conflict of Interest-None
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