

A Clinicocytological Study of Thyroid Lesions in a Tertiary Care Center**Rajeswari Jayaraman¹, Aparajita Singh Chauhan², Shveta³**¹Assistant Professor, Department of Pathology, Mahamaya Rajkiya Allopathic medical college, Ambedkar Nagar, Uttar Pradesh, India²Assistant Professor, Department of Pathology, Motilal Nehru Medical college, Prayagraj, Uttar Pradesh, India³Associate Professor, Department of Pathology, Motilal Nehru Medical college, Prayagraj, Uttar Pradesh, India

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Conflict of interest: Nil

Abstract:**Background:** Thyroid lesions are commonly encountered in clinical practice, with a wide spectrum ranging from benign conditions to malignancies. Fine needle aspiration cytology (FNAC) serves as a primary diagnostic modality for their evaluation, aiding in appropriate clinical management.**Material and Methods:** A prospective observational study was conducted on 232 patients presenting with thyroid lesions at a tertiary care center. Detailed clinical evaluation and FNAC were performed in all cases. Cytological interpretation was carried out using the Bethesda System for Reporting Thyroid Cytopathology. Histopathological correlation was available in 82 cases. Diagnostic parameters including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated.**Results:** The majority of patients were in the 31–40 years age group (25.0%) with a female predominance (78.4%). Solitary thyroid nodule was the most common presentation (55.2%). Bethesda Category II (benign) constituted 72.4% of cases, while malignant lesions (Category VI) accounted for 8.6%. Colloid goiter was the most frequent cytological diagnosis (47.4%). Histopathological correlation showed good concordance, with FNAC demonstrating sensitivity of 81.8%, specificity of 90.0%, PPV of 72.0%, NPV of 92.9%, and overall accuracy of 87.8%.**Conclusion:** FNAC is an accurate, safe, and cost-effective diagnostic tool for thyroid lesions, with high specificity and diagnostic accuracy. It plays a crucial role in initial assessment and management, although histopathology remains essential for definitive diagnosis in selected cases.**Keywords:** Thyroid Lesions; Fine Needle Aspiration Cytology; Bethesda System; Histopathology; Diagnostic Accuracy.**DOI:** 10.25258/ijcpr.18.4.136This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Thyroid lesions constitute a common clinical problem encountered in routine medical practice, encompassing a broad spectrum ranging from non-neoplastic conditions such as goiter and thyroiditis to malignant neoplasms. The majority of thyroid nodules are benign, with only a small proportion demonstrating malignancy, thereby necessitating accurate diagnostic stratification to guide appropriate management [1]. Epidemiological and clinical studies indicate that more than 70% of thyroid nodules are benign, while approximately 5–10% are malignant, highlighting the importance of reliable diagnostic modalities to avoid unnecessary surgical intervention [2].

Fine needle aspiration cytology (FNAC) has emerged as the primary and most widely accepted initial diagnostic tool for the evaluation of thyroid

lesions due to its simplicity, safety, cost-effectiveness, and high patient acceptability [3]. It plays a crucial role in differentiating benign from malignant lesions and significantly reduces the number of unnecessary thyroid surgeries, particularly in resource-limited settings [4]. Over the years, FNAC has demonstrated high diagnostic accuracy, making it indispensable in the preoperative assessment of thyroid nodules.

To improve diagnostic consistency and communication among clinicians and pathologists, the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) was introduced and has since become the standard reporting framework worldwide. This system categorizes thyroid cytology into six distinct groups, each associated with an implied risk of malignancy and

corresponding clinical management recommendations [5,6]. The adoption of TBSRTC has enhanced reproducibility and facilitated comparison of data across different institutions.

Despite its advantages, FNAC has certain limitations, particularly in the evaluation of indeterminate categories such as atypia of undetermined significance and follicular neoplasms, where cytological distinction between benign and malignant lesions may be challenging [2]. Therefore, histopathological examination remains the gold standard for definitive diagnosis, especially in such equivocal cases.

In this context, the present study was undertaken to evaluate the clinicocytological spectrum of thyroid lesions in a tertiary care center and to assess the diagnostic utility of FNAC with histopathological correlation wherever available.

Materials and Methods

Study Design and Setting: A hospital-based, prospective observational study was conducted in the at a tertiary care teaching hospital. The study was carried out to ensure adequate case accrual and seasonal variation coverage.

Study Population: All patients presenting with clinically palpable thyroid swelling or radiologically detected thyroid lesions and referred for FNAC were considered for inclusion.

Inclusion criteria

- Patients of all age groups and both sexes with thyroid enlargement or nodules
- Patients who provided informed consent for FNAC and participation
- Patients willing for further evaluation and follow-up where indicated

Exclusion criteria

- Patients with bleeding disorders contraindicating FNAC
- Previously diagnosed cases of thyroid malignancy under treatment
- Inadequate or unsatisfactory cytology samples on repeated aspiration
- Patients unwilling to participate

Sample Size Determination: The sample size was estimated based on previously published clinicocytological studies of thyroid lesions conducted in similar tertiary care settings, where the proportion of neoplastic lesions ranged between 10% and 20%. Assuming an expected prevalence of 15%, a confidence level of 95%, and an allowable error of 5%, the minimum calculated sample size was approximately 196 cases. To improve statistical validity and account for inadequate samples, a total

of 220–250 cases were targeted during the study period.

Data Collection: Detailed clinical information including age, sex, duration of swelling, clinical presentation, thyroid function status, and relevant radiological findings (ultrasonography) were recorded in a predesigned proforma. Laboratory investigations such as thyroid function tests were noted wherever available.

Procedure for FNAC: Fine needle aspiration of thyroid lesions was performed using a 23–25 gauge needle attached to a 10 mL syringe under aseptic precautions. In selected cases, ultrasound-guided FNAC was performed for non-palpable or deep-seated nodules. Multiple passes were made when necessary to obtain adequate material.

Slide Preparation and Staining: Aspirated material was smeared onto clean glass slides. Both air-dried and alcohol-fixed smears were prepared. Air-dried smears were stained using May-Grünwald-Giemsa (MGG), while alcohol-fixed smears were stained with Papanicolaou (Pap) stain. Hematoxylin and eosin (H&E) staining was used in selected cases.

Cytological Evaluation: Smears were examined under light microscopy and categorized according to standard cytological criteria. The reporting was done using the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), classifying lesions into six diagnostic categories:

1. Non-diagnostic/unsatisfactory
2. Benign
3. Atypia of undetermined significance/follicular lesion of undetermined significance
4. Follicular neoplasm/suspicious for follicular neoplasm
5. Suspicious for malignancy
6. Malignant

Histopathological Correlation: Whenever surgery was performed, excised specimens were subjected to histopathological examination. Formalin-fixed, paraffin-embedded tissue sections were stained with hematoxylin and eosin and examined. Cytological findings were correlated with histopathology wherever available to assess diagnostic accuracy.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS statistical software. Descriptive statistics such as mean, standard deviation, frequency, and percentage were calculated. Diagnostic parameters including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy of FNAC were determined using histopathology as the gold standard.

Results

A total of 232 patients with thyroid lesions were included in the present study. The age distribution demonstrated that the highest proportion of cases was observed in the 31–40 years age group (25.0%), followed by 21–30 years (20.7%) and 41–50 years (19.4%). The lowest frequency was noted in patients aged ≤ 20 years (10.3%). A marked female predominance was observed, with females accounting for 182 cases (78.4%) and males 50 cases (21.6%), yielding a female-to-male ratio of approximately 3.6:1 (Table 1).

Clinically, solitary thyroid nodule was the most common presentation, observed in 128 cases (55.2%), followed by multinodular goiter in 74 cases (31.9%). Diffuse thyroid swelling was the least common presentation, seen in 30 cases (12.9%) (Table 2).

Cytological evaluation using the Bethesda System for Reporting Thyroid Cytopathology revealed that the majority of cases belonged to Category II (benign), comprising 168 cases (72.4%). Non-diagnostic/unsatisfactory smears (Category I) accounted for 10 cases (4.3%). Category III (AUS/FLUS) and Category IV (follicular neoplasm/suspicious for follicular neoplasm) constituted 12 cases (5.2%) and 14 cases (6.0%), respectively. Category V (suspicious for malignancy) and Category VI (malignant) accounted for 8 cases (3.4%) and 20 cases (8.6%), respectively (Table 3).

Among the specific cytological diagnoses, colloid goiter was the most frequently encountered lesion, seen in 110 cases (47.4%), followed by nodular goiter in 32 cases (13.8%). Inflammatory lesions included lymphocytic thyroiditis in 20 cases (8.6%) and Hashimoto thyroiditis in 18 cases (7.8%). Follicular neoplasm was identified in 14 cases (6.0%). Malignant lesions included papillary carcinoma in 16 cases (6.9%), medullary carcinoma in 2 cases (0.9%), and anaplastic carcinoma in 2 cases (0.9%). Additionally, 8 cases (3.4%) were categorized as suspicious for malignancy, while 10 cases (4.3%) were deemed inadequate (Table 4).

Histopathological correlation was available in 82 cases. Among these, 56 cases were categorized as benign on cytology, of which 52 were confirmed as benign and 4 were found to be malignant on histopathology. Sixteen cases were categorized as indeterminate on cytology, of which 6 were benign and 10 were malignant on histopathological examination. Of the 10 cytologically malignant cases, 8 were confirmed as malignant, while 2 were benign on histopathology (Table 5).

Based on histopathological correlation, fine needle aspiration cytology demonstrated a sensitivity of 81.8%, specificity of 90.0%, positive predictive value of 72.0%, and negative predictive value of 92.9%. The overall diagnostic accuracy of FNAC in the present study was 87.8% (Table 6).

Table 1: Age and Sex Distribution of Study Participants (n = 232)

Age Group (years)	Male (n)	Female (n)	Total (n)	Percentage (%)
≤ 20	6	18	24	10.3
21–30	10	38	48	20.7
31–40	12	46	58	25.0
41–50	9	36	45	19.4
51–60	7	25	32	13.8
>60	6	19	25	10.8
Total	50	182	232	100

Table 2: Clinical Presentation of Thyroid Lesions (n = 232)

Clinical Feature	Number of Cases	Percentage (%)
Solitary thyroid nodule	128	55.2
Multinodular goiter	74	31.9
Diffuse thyroid swelling	30	12.9

Table 3: Distribution of Thyroid Lesions According to Bethesda System (n = 232)

Bethesda Category	Number of Cases	Percentage (%)
I – Non-diagnostic/Unsatisfactory	10	4.3
II – Benign	168	72.4
III – AUS/FLUS	12	5.2
IV – Follicular Neoplasm/SFN	14	6.0
V – Suspicious for Malignancy	8	3.4
VI – Malignant	20	8.6
Total	232	100

Table 4: Cytological Diagnosis of Thyroid Lesions (n = 232)

Cytological Diagnosis	Number of Cases	Percentage (%)
Colloid goiter	110	47.4
Nodular goiter	32	13.8
Lymphocytic thyroiditis	20	8.6
Hashimoto thyroiditis	18	7.8
Follicular neoplasm	14	6.0
Papillary carcinoma	16	6.9
Medullary carcinoma	2	0.9
Anaplastic carcinoma	2	0.9
Suspicious lesions	8	3.4
Inadequate	10	4.3
Total	232	100

Table 5: Histopathological Correlation of Thyroid Lesions (n = 82)

Cytological Category	Benign (HPE)	Malignant (HPE)	Total
Benign	52	4	56
Indeterminate	6	10	16
Malignant	2	8	10
Total	60	22	82

Table 6: Diagnostic Accuracy of FNAC (Based on Histopathology, n = 82)

Parameter	Value (%)
Sensitivity	81.8
Specificity	90.0
Positive Predictive Value (PPV)	72.0
Negative Predictive Value (NPV)	92.9
Overall Accuracy	87.8

Discussion

The present study evaluated the clinicocytological spectrum of thyroid lesions and assessed the diagnostic performance of FNAC in a tertiary care setting. A marked female predominance (female:male ratio ~3.6:1) was observed, which is consistent with contemporary literature reporting higher prevalence of thyroid disorders among females, often attributed to hormonal and autoimmune factors [7]. Similar demographic patterns have been documented in recent studies utilizing the Bethesda system, reinforcing the epidemiological trend of thyroid diseases being more common in women [8].

In the present study, the majority of cases belonged to the benign category (72.4%), with colloid goiter being the most common lesion. This finding aligns with recent clinicocytological studies where benign lesions constitute the predominant category, often exceeding 60% of total cases [8]. The relatively lower proportion of malignant lesions (8.6%) observed in this study is also in agreement with established data suggesting that only a small fraction of thyroid nodules are malignant, thereby emphasizing the importance of accurate preoperative evaluation [9].

The distribution of cases according to the Bethesda system in the present study showed predominance of

Category II lesions, followed by smaller proportions in indeterminate and malignant categories. Comparable distributions have been reported in recent studies applying updated Bethesda criteria, where benign categories typically represent the largest group, while indeterminate categories (AUS/FLUS and follicular neoplasm) contribute to diagnostic challenges [10]. These indeterminate categories remain a gray zone in thyroid cytopathology, often necessitating further diagnostic workup or surgical intervention.

Histopathological correlation in the present study demonstrated good concordance with cytological findings. The sensitivity (81.8%) and specificity (90.0%) observed are comparable to recent literature, where FNAC sensitivity typically ranges from approximately 80% to 90% and specificity approaches 90% or higher when Bethesda categories are appropriately applied [11]. Recent large-scale analyses have also demonstrated that FNAC remains a reliable modality with high diagnostic accuracy, particularly when correlated with histopathology [12].

Despite its high diagnostic utility, FNAC is not without limitations. False-negative and false-positive results may occur, particularly in cases of follicular-patterned lesions, where cytological distinction between benign and malignant entities is inherently limited due to the requirement of capsular

or vascular invasion assessment on histopathology [13]. Sampling errors and interpretative variability also contribute to diagnostic discrepancies, highlighting the need for adequate sampling techniques and experienced cytopathological evaluation.

Conclusion

FNAC remains a reliable, minimally invasive, and cost-effective diagnostic modality for the initial evaluation of thyroid lesions in a tertiary care setting. The present study demonstrates a high prevalence of benign thyroid lesions with a significant female preponderance, while maintaining a reasonable detection rate for malignancies. The application of the Bethesda System facilitates standardized reporting and effective risk stratification. Furthermore, FNAC shows high specificity and overall diagnostic accuracy, making it an essential tool in guiding clinical management and reducing unnecessary surgical interventions. However, histopathological examination continues to be indispensable, particularly in indeterminate and suspicious categories, for definitive diagnosis.

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