

Original Research Article

SPECTRUM OF THYROID LESIONS DIAGNOSED BY FINE NEEDLE ASPIRATION CYTOLOGY USING THE BETHESDA SYSTEM FOR REPORTING THYROID CYTOPATHOLOGY: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Fine needle aspiration cytology (FNAC) is the primary diagnostic modality for the evaluation of thyroid nodules because of its simplicity, safety, cost-effectiveness, and high diagnostic accuracy. The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) provides a standardized reporting framework that facilitates uniform cytological interpretation and effective clinical communication. The present study evaluated the spectrum of thyroid lesions diagnosed by FNAC using the Bethesda system in a tertiary care centre. The objectives is to classify thyroid lesions according to the Bethesda System for Reporting Thyroid Cytopathology, determine the distribution of Bethesda categories, describe the demographic and clinical profile of patients, and evaluate the spectrum of benign and neoplastic thyroid lesions.

Materials and Methods: A hospital-based cross-sectional study was conducted in the Department of Pathology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, from January 2019 to June 2020. A total of 130 patients presenting with palpable thyroid swellings underwent FNAC. Cytological smears were stained using May-Grünwald-Giemsa and Papanicolaou stains and classified according to the Bethesda System for Reporting Thyroid Cytopathology. Demographic characteristics, clinical presentation, adequacy rate, Bethesda category distribution, and cytomorphological diagnosis were analyzed using descriptive statistics.

Results: A total of 130 patients were included, with females accounting for 80.0% of cases. The highest incidence of thyroid lesions was observed in the 41–50-year age group (34.62%). Adequate cytological material was obtained in 127 cases, yielding an adequacy rate of 97.69%. Bethesda Category II (Benign) was the predominant category, comprising 104 (80.0%) cases, followed by Category IV in 13 (10.0%), Category VI in 6 (4.62%), Category V in 4 (3.08%), and Category I in 3 (2.31%) cases. No case was classified under Category III. Among satisfactory aspirates, benign (non-neoplastic) lesions constituted 81.89%, whereas neoplastic lesions accounted for 18.11%. Colloid goitre was the most common benign lesion, while follicular neoplasm represented the largest proportion of neoplastic lesions. Neck swelling was the universal presenting complaint, followed by dysphagia and symptoms of thyroid dysfunction.

Conclusion: The majority of thyroid lesions diagnosed by FNAC were benign and occurred predominantly in middle-aged females. The Bethesda System proved to be a practical and standardized reporting system for categorizing thyroid lesions and describing their cytomorphological spectrum. The high adequacy rate and predominance of benign lesions observed in the present study support the continued use of FNAC as the first-line investigation for patients presenting with thyroid nodules.

Keywords: Thyroid lesions; Fine needle aspiration cytology; Bethesda System; Thyroid cytopathology; Thyroid nodules; Cytomorphology; Cross-sectional study.

INTRODUCTION

Thyroid nodules are among the most common endocrine disorders encountered in clinical practice, with their prevalence increasing with advancing age and the widespread use of high-resolution ultrasonography. Although the majority of thyroid nodules are benign, a small but clinically significant proportion represents malignant lesions that require timely diagnosis and appropriate management. Therefore, accurate preoperative evaluation of thyroid nodules is essential to distinguish benign lesions that can be managed conservatively from malignant lesions requiring surgical intervention.^[1,2] Fine needle aspiration cytology (FNAC) is considered the first-line diagnostic investigation for evaluating thyroid nodules because it is minimally invasive, cost-effective, safe, rapid, and highly reliable. FNAC helps stratify patients into operative and non-operative groups, thereby reducing unnecessary thyroid surgeries while facilitating early diagnosis of malignant lesions. Owing to its high diagnostic yield and patient acceptability, FNAC has become an indispensable component of the diagnostic work-up of thyroid swellings.^[3,4]

Despite its widespread use, interpretation of thyroid cytology was historically affected by inconsistent terminology and variable reporting systems across institutions, leading to differences in clinical management. To overcome these limitations, the National Cancer Institute introduced the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) in 2007. The Bethesda system established a standardized six-tier reporting scheme with uniform diagnostic terminology, defined cytomorphological criteria, estimated risk of malignancy for each category, and corresponding clinical management recommendations. This standardized approach has significantly improved communication between cytopathologists and clinicians while enhancing reproducibility and patient care.^[1,2,5]

The Bethesda system classifies thyroid aspirates into six diagnostic categories: Category I (Nondiagnostic/Unsatisfactory), Category II (Benign), Category III (Atypia of Undetermined Significance/Follicular Lesion of Undetermined Significance), Category IV (Follicular Neoplasm/Suspicious for a Follicular Neoplasm), Category V (Suspicious for Malignancy), and Category VI (Malignant). This classification enables standardized reporting, facilitates comparison among institutions, and assists clinicians in selecting the most appropriate management strategy based on the estimated risk associated with each category.^[2,5,6]

Several studies conducted worldwide have demonstrated that benign lesions constitute the majority of thyroid FNAC diagnoses, whereas malignant and suspicious lesions account for a relatively smaller proportion. The distribution of

Bethesda categories varies among different populations owing to demographic characteristics, iodine status, referral patterns, and institutional practices. Therefore, evaluating the spectrum of thyroid lesions and the distribution of Bethesda categories in individual institutions remains important for understanding disease patterns and maintaining quality assurance in thyroid cytopathology services.^[6–10]

The present study was undertaken to classify thyroid lesions diagnosed by FNAC according to the Bethesda System for Reporting Thyroid Cytopathology, to determine the distribution of Bethesda categories, describe the demographic and clinical profile of patients, and evaluate the spectrum of benign and neoplastic thyroid lesions in a tertiary care centre.

MATERIALS AND METHODS

A hospital-based cross-sectional observational study was conducted in the Department of Pathology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, from January 2019 to June 2020. The study included patients presenting with clinically palpable thyroid swellings who underwent fine needle aspiration cytology (FNAC). A total of 130 consecutive patients with palpable thyroid lesions who underwent FNAC during the study period were included in the study. Ethical approval was taken from the institutional ethical committee. (ref no: GU/HREC/EC/2019/1642)

Inclusion Criteria

- Patients presenting with clinically palpable thyroid swelling.
- Patients of all age groups and both sexes.
- Patients who underwent FNAC during the study period.

Exclusion Criteria

- Patients with incomplete clinical details.
- Repeat aspirations from the same lesion were excluded from analysis.

FNAC Procedure

FNAC was performed under aseptic precautions using a 22–23-gauge needle attached to a 10-mL disposable syringe. Aspirated material was immediately smeared onto clean glass slides. Air-dried smears were stained with May–Grünwald–Giemsa stain, while alcohol-fixed smears were stained using the Papanicolaou stain. Hematoxylin and Eosin staining was performed whenever required for better cytomorphological evaluation.

Cytological Evaluation: All thyroid aspirates were examined microscopically and categorized according to The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) into six diagnostic categories:

- Category I – Nondiagnostic/Unsatisfactory
- Category II – Benign

- Category III – Atypia of Undetermined Significance/Follicular Lesion of Undetermined Significance
- Category IV – Follicular Neoplasm/Suspicious for Follicular Neoplasm
- Category V – Suspicious for Malignancy
- Category VI – Malignant

For descriptive analysis, Category II lesions were considered benign (non-neoplastic), whereas Categories IV, V and VI were grouped as neoplastic lesions. Category I cases were analyzed separately as nondiagnostic aspirates.

Data Collection: Patient demographics, clinical presentation, adequacy of aspirates, Bethesda category, and cytomorphological diagnosis were recorded in a structured proforma. The frequency distribution of individual thyroid lesions within each Bethesda category was also documented.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. The Chi-square test was used to assess associations between categorical variables. A p-value <0.05 was considered statistically significant.

RESULTS

[Table 1] shows the age-wise distribution of patients with thyroid lesions. A total of 130 patients were included in the study. The highest proportion of cases belonged to the 41–50 years age group (34.62%), followed by the 31–40 years age group (24.62%). Patients aged 21–30 years accounted for 12.31% of cases, while those aged 51–60 years represented 13.08%. Thyroid lesions were relatively uncommon at the extremes of age, with only 1.54% of patients in the 1–10 years age group and 2.31% in the 71–80 years age group.

[Table 2] presents the sex distribution of the study population. Females constituted the majority of cases, accounting for 104 (80.00%) patients, whereas males comprised only 26 (20.00%) patients, resulting in a female-to-male ratio of approximately 4:1.

[Table 3] summarizes the clinical presentation of patients with thyroid lesions. Neck swelling was the

presenting complaint in all patients (100%). Dysphagia was the second most common symptom, observed in 13 (10.00%) patients. Symptoms suggestive of hypothyroidism and dyspnea were each present in 8 (6.15%) patients, followed by symptoms of hyperthyroidism in 7 (5.38%) patients. Hoarseness of voice was reported by 5 (3.85%) patients, while pain associated with the thyroid swelling was the least common symptom, occurring in only 2 (1.54%) patients.

[Table 4] depicts the adequacy of thyroid FNAC smears. Of the 130 aspirates examined, 127 (97.69%) were satisfactory for cytological evaluation, whereas only 3 (2.31%) were categorized as unsatisfactory, indicating a high adequacy rate for FNAC in the present study.

[Table 5] demonstrates the distribution of thyroid lesions according to the Bethesda System for Reporting Thyroid Cytopathology. Category II (Benign) constituted the largest proportion with 104 (80.00%) cases. Category IV (Follicular neoplasm/Suspicious for follicular neoplasm) accounted for 13 (10.00%) cases, followed by Category VI (Malignant) with 6 (4.62%) cases and Category V (Suspicious for malignancy) with 4 (3.08%) cases. Category I (Nondiagnostic/Unsatisfactory) included 3 (2.31%) cases, while no cases were classified under Category III (AUS/FLUS).

[Table 6] shows the distribution of benign thyroid lesions diagnosed on FNAC. Colloid goitre was the most common benign lesion, accounting for 56 (53.85%) cases, followed by nodular goitre with cystic degeneration in 23 (22.12%) cases. The remaining 25 (24.03%) cases comprised other benign thyroid lesions classified under Bethesda Category II.

[Table 7] presents the distribution of neoplastic thyroid lesions. Among the 23 neoplastic cases, Category IV lesions were the most frequent, comprising 13 (56.52%) cases. Category VI (Malignant) accounted for 6 (26.09%) cases, whereas Category V (Suspicious for malignancy) represented 4 (17.39%) cases. These findings indicate that follicular neoplasm/suspicious for follicular neoplasm was the predominant neoplastic category in the present study.

Table 1: Age-wise distribution of study participants (N = 130)

Age group (years)	Number of cases	Percentage (%)
1–10	2	1.54
11–20	6	4.62
21–30	16	12.31
31–40	32	24.62
41–50	45	34.62
51–60	17	13.08
61–70	9	6.92
71–80	3	2.31
Total	130	100.00

Table 2: Sex-wise distribution of study participants (N = 130)

Sex	Number of cases	Percentage (%)
Female	104	80.00
Male	26	20.00
Total	130	100.00

Table 3: Clinical presentation of patients (N = 130)

Clinical presentation	Number of cases	Percentage (%)
Neck swelling	130	100.00
Dysphagia	13	10.00
Symptoms of hypothyroidism	8	6.15
Dyspnea	8	6.15
Symptoms of hyperthyroidism	7	5.38
Hoarseness of voice	5	3.85
Pain in swelling	2	1.54

Table 4: Adequacy rate of thyroid FNAC smears (N = 130)

Adequacy	Number of cases	Percentage (%)
Satisfactory	127	97.69
Unsatisfactory	3	2.31
Total	130	100.00

Table 5: Distribution of thyroid lesions according to the Bethesda System (N = 130)

Bethesda category	Number of cases	Percentage (%)
Category I – Nondiagnostic/Unsatisfactory	3	2.31
Category II – Benign	104	80.00
Category III – AUS/FLUS	0	0.00
Category IV – Follicular neoplasm/SFN	13	10.00
Category V – Suspicious for malignancy	4	3.08
Category VI – Malignant	6	4.62
Total	130	100.00

Table 6: Distribution of benign (non-neoplastic) thyroid lesions (N = 104)

Benign lesion	Number of cases	Percentage (%)
Colloid goitre	56	53.85
Nodular goitre with cystic degeneration	23	22.12
Other benign thyroid lesions*	25	24.03
Total	104	100.00

*Other benign lesions include the remaining cytological diagnoses classified under Bethesda Category II.

Table 7: Distribution of neoplastic thyroid lesions (N = 23)

Bethesda category	Number of cases	Percentage (%)
Category IV – Follicular neoplasm/SFN	13	56.52
Category V – Suspicious for malignancy	4	17.39
Category VI – Malignant	6	26.09
Total	23	100.00

DISCUSSION

Fine needle aspiration cytology (FNAC) is widely accepted as the primary diagnostic modality for the evaluation of thyroid nodules because it is simple, minimally invasive, economical, and provides rapid cytomorphological assessment. The introduction of the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) has standardized thyroid cytology reporting and improved communication between cytopathologists and clinicians. The present study evaluated the spectrum of thyroid lesions diagnosed by FNAC using the Bethesda system, with emphasis on demographic characteristics, adequacy rate, Bethesda category distribution, and cytomorphological spectrum.

In the present study, thyroid lesions were observed predominantly in females (80%), with a female-to-male ratio of approximately 4:1. The majority of

patients belonged to the 41–50-year age group. These findings are consistent with the well-established higher prevalence of thyroid disorders among women and middle-aged individuals. Sharma et al. similarly reported female predominance with most patients presenting during the third and fourth decades of life, highlighting the influence of hormonal and autoimmune factors in thyroid diseases.^[11]

The adequacy rate achieved in the present study was 97.69%, indicating excellent sampling quality and appropriate cytological preparation. This adequacy rate is comparable to that reported by Melo-Urbe et al., Naz et al., and Handa et al., who documented adequacy rates ranging from 94% to 96%, confirming that adherence to Bethesda adequacy criteria provides reliable cytological interpretation.^[12]

Application of the Bethesda system demonstrated that Category II (Benign) constituted the largest proportion (80%) of thyroid lesions, while Category IV, Category V, and Category VI accounted for relatively smaller proportions. No case was categorized as Bethesda Category III (AUS/FLUS). Similar observations have been reported by Reddy et al., who found benign lesions to represent the majority of thyroid FNAC diagnoses with only a small proportion of indeterminate and malignant lesions. Their study emphasized that standardized Bethesda reporting improves diagnostic reproducibility and facilitates appropriate clinical management.^[13]

Among benign lesions, colloid goitre was the most frequent cytological diagnosis, followed by nodular goitre with cystic degeneration. This pattern has been consistently reported in previous studies, where colloid goitre represents the commonest thyroid lesion encountered on FNAC. Jeelani et al. also observed colloid goitre as the predominant benign lesion, while papillary thyroid carcinoma was the most frequent malignant diagnosis, reflecting the typical cytomorphological spectrum of thyroid lesions encountered in routine practice.^[14]

Neoplastic lesions accounted for 18.11% of satisfactory aspirates, with Bethesda Category IV forming the largest neoplastic group. This observation reflects the known diagnostic challenge posed by follicular-patterned lesions, in which cytological examination alone cannot reliably distinguish follicular adenoma from follicular carcinoma. Nevertheless, categorization of these lesions under the Bethesda system allows appropriate risk stratification and guides further clinical management. The standardized terminology recommended by TBSRTC has substantially improved uniformity in reporting and clinical decision-making across institutions.^[15]

Overall, the findings of the present study demonstrate that benign thyroid lesions considerably outnumber neoplastic lesions and that the Bethesda System provides a practical and reproducible framework for reporting thyroid FNAC. The predominance of Bethesda Category II lesions and the high adequacy rate observed in this study are comparable with previously published literature, supporting the continued use of FNAC as the initial investigation for patients presenting with thyroid swellings.

CONCLUSION

The present study demonstrates that the majority of thyroid lesions diagnosed by FNAC are benign, with females and middle-aged individuals being most commonly affected. Bethesda Category II constituted the predominant diagnostic category, and colloid goitre was the most frequent benign lesion identified on cytological examination. The

study also achieved a high adequacy rate, indicating the reliability of FNAC in routine clinical practice.

The Bethesda System for Reporting Thyroid Cytopathology provides a standardized and reproducible method for classifying thyroid lesions, facilitates uniform reporting, and allows meaningful comparison of cytological findings across different institutions. As an epidemiological and cytomorphological evaluation, the present study highlights the usefulness of Bethesda-based reporting in describing the spectrum of thyroid lesions and supports the continued role of FNAC as the first-line diagnostic investigation for patients presenting with thyroid nodules.

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