



FINE NEEDLE ASPIRATION CYTOLOGY OF THYROID LESIONS: INSIGHTS AND CLASSIFICATION WITH THE BETHESDA SYSTEM

Pathology

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ABSTRACT

Background: Thyroid disorders are common endocrine diseases, especially in countries like India with low dietary iodine, making thyroid nodules frequent. Any thyroid enlargement, diffuse or nodular, requires evaluation to rule out neoplasm. FNAC is a sensitive and accurate outpatient procedure for initial diagnosis, distinguishing benign from malignant lesions and guiding management. **Objectives:** To categorize FNAC results of thyroid lesions cytologically according to the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) – 3rd edition, examine cytomorphological characteristics, and differentiate benign and malignant lesions. **Method:** A retrospective observational study was conducted on 40 patients with thyroid lesions whose FNAC reports were available between January and March 2025. Morphological characteristics were analyzed. **Result:** Of 40 patients, most were females (37) and younger. Two cases (5%) were nondiagnostic, 27 (67.5%) benign, 2 (5%) atypia of undetermined significance, 4 (10%) follicular neoplasm, 2 (5%) suspicious for malignancy, and 3 (7.5%) malignant. Among 18 operated cases, 4 were malignant and 14 benign. FNAC showed high sensitivity and specificity in operated cases. **Conclusion:** FNAC is a rapid and cost-effective tool for thyroid evaluation. The Bethesda system standardizes reporting, improves diagnostic accuracy, and correlates well with histopathology, aiding early detection and management of thyroid malignancies.

KEYWORDS

Fine needle aspiration cytology (FNAC), Thyroid, Bethesda system

INTRODUCTION:

Thyroid nodules are quite common, with an estimated 4–7% of adults having noticeable thyroid enlargement, while impalpable nodules are found in about ten times as many individuals. These nodules are more prevalent in women, older adults, those with a history of head and neck radiation exposure, and individuals consuming a diet rich in goitrogens¹.

Any thyroid enlargement, whether it is diffuse or presents as a nodule, should be examined to exclude the possibility of neoplasm².

Fine Needle Aspiration Cytology (FNAC) is a widely recognized outpatient procedure used for the initial diagnosis of thyroid swellings. It is the most sensitive, accurate, and cost-effective approach for managing patients with thyroid nodules. Most thyroid nodules are benign, with malignant cases representing only about 1% of all detected lesions. Since FNAC effectively differentiates between benign and malignant lesions, it is the preferred preoperative screening method used globally³.

FNAC offers highly precise cytologic data, enabling the development of a definitive management plan, with sensitivity and specificity reaching up to 96%⁴.

The aims of this study were to categorize the FNAC results of thyroid lesions cytologically according to “The Bethesda system for reporting Thyroid cytopathology” (TBSRTC) – 3rd edition, to examine the cytomorphological characteristics of thyroid lesions, and differentiate benign and malignant lesions of thyroid gland.

Aims And Objectives Of The Study:

- To study the different morphological characteristics of thyroid lesions through fine needle aspiration cytology and to differentiate benign, inflammatory and malignant lesions of thyroid gland.

METHODOLOGY:

This is a retrospective observational study conducted in the Department of Pathology at K. H. Patil Institute of Medical Sciences (formerly Gadag Institute of Medical Sciences), Gadag. Data from patients presenting with thyroid lesions between January 2025 and March 2025 were analyzed. A total of 40 patients were included in the study.

Inclusion Criteria –

- All patients with palpable thyroid lesions who underwent FNAC between January 2025 and March 2025, irrespective of age and gender.
- Cases with complete cytology reports available for review.

Exclusion Criteria –

- Missing or incomplete FNAC reports.

FNAC was performed as per standard departmental protocol using a 22G needle under strict aseptic precautions. Material was transferred to clean glass slides. Air-dried smears were stained with Giemsa, and alcohol-fixed smears were stained with Hematoxylin and Eosin and Papanicolaou stains. Smears were examined under light microscopy for cytological evaluation.

FNAC results are categorized according to “The Bethesda system for reporting Thyroid cytopathology” (TBSRTC) – 3rd edition, into 6 categories as⁵:

Category I – Non diagnostic

Category II – Benign

Category III – Atypia of undetermined significance

Category IV – Follicular neoplasm

Category V – Suspicious for malignancy

Category VI – Malignant

RESULTS:

A total of 40 thyroid FNAs were performed between January 2025 to March 2025, with the majority of patients belonging to the 20–50 age group.

Out of 40 patients, Majority were females (37) and in the younger age group. **Table 1**

Among the 40 cases, the FNA sample was inadequate and categorized as nondiagnostic in 2 cases due to a haemorrhagic aspirate and aspiration of only cyst fluid.

2 cases (5%) were non-diagnostic for reporting, 27 cases (67.5) were benign, 2 cases (5%) were categorized under atypia of undetermined significance, 4 cases (10%) were reported as follicular neoplasm, 2

cases (5 %) were reported as suspicious for malignancy and 3 cases (7.5%) were reported as malignant. **Table 2**

Out of 18 operated cases, 4 were malignant and 14 were benign. FNAC demonstrated perfect sensitivity and specificity in the operated cases. Of the three malignant cases, all were diagnosed as Papillary thyroid carcinoma.

DISCUSSION:

Thyroid nodular disease encompasses a broad range of conditions, including solitary nodules, multinodular goiter, nodular goiter associated with autoimmune thyroiditis, and thyroid neoplasms⁶. Fine needle aspiration cytology of the thyroid is considered a valuable tool for preoperative screening in the diagnosis of thyroid nodules. In adults, FNAC has become an integral part of the routine assessment of thyroid nodules^{7,8}.

In the present study, the most common complaint among patients was swelling in the front of the neck, consistent with findings from other studies.

In our study, patient ages ranged from 20-60 years, with the highest number of cases occurring in the third and fourth decades of life. Thyroid nodules were more prevalent in females than in males, consistent with findings from other studies^{9,10}.

The Non- diagnostic (Category I) rate in our study was 5.0%. Ali recommended that the rate of nondiagnostic tests should remain below 10%¹¹.

Diagnosing inflammatory conditions like thyroiditis does not require a minimum follicle cell count. Similarly, colloid nodules with abundant thick colloid do not need a cell count threshold. However, solid nodules with fewer follicular cells should have at least 6 groups of ten cells, ideally on a single slide¹². Benign smears (Category II) made up the majority, totaling 27 cases, consistent with the findings of studies conducted by Salma et al¹³. **Fig 1,2**

The Atypia of undetermined significance (Category III) comprised 2 cases (5%), aligning with the findings of Basak et al. and Salma et al¹⁴. **Fig 3**

Smears displaying microfollicular, crowded three-dimensional, and trabecular patterns, along with cytologic features such as clumpy or mildly hyperchromatic chromatin, inconspicuous nucleoli, absence of nuclear clearing, nuclear grooves, and intranuclear pseudoinclusions, are classified as follicular neoplasm¹⁵ **Fig 4**. In our study, 4 cases (10%) were categorized as follicular neoplasm (Category IV). These findings were consistent with those of Theoharis et al¹⁶.

Suspicious for malignancy (Category V) was used for aspirates suggesting malignancy but lacking sufficient material for a definitive diagnosis. In our study, 2 case (5%) was diagnosed as suspicious for malignancy, aligning with findings from Kantola et al. and Bhagat et al^{17,18}. **Fig 5**

Malignant (Category VI) was assigned to cellular aspirates with clear evidence of malignancy. Three cases (7.5%) tested positive, closely matching Yasmin et al.'s findings¹⁹. **Fig 6,7**

PTC diagnosis was based on follicular cells arranged in papillae and flat sheets, displaying nuclear crowding, overlapping, irregular contours, and intranuclear cytoplasmic inclusions.

The goal of thyroid FNA is to offer clinically relevant information to determine the need for surgery, requiring an adequate sample to ensure a low false-negative rate. Accurate diagnosis depends on proper sampling from a representative site²⁰.

The third edition of the Bethesda System for Reporting Thyroid Cytopathology simplifies classification by assigning a single name to each category and providing accurate diagnosis and interpretation for each.

CONCLUSION:

Fine Needle Aspiration Cytology (FNAC) is a rapid, simple, and cost-effective diagnostic tool for evaluating thyroid lesions. Its high sensitivity, specificity, and accuracy make it an excellent first-line

method for assessing the nature of thyroid lesions. Being minimally invasive and easy to perform with low complication rates, FNAC remains a reliable technique for diagnosing thyroid malignancies and other thyroid disorders. The Bethesda system further enhances the diagnostic value of FNAC by providing a standardized and reproducible framework for reporting, thereby improving consistency and clinical decision-making.

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Disclosures: Nil

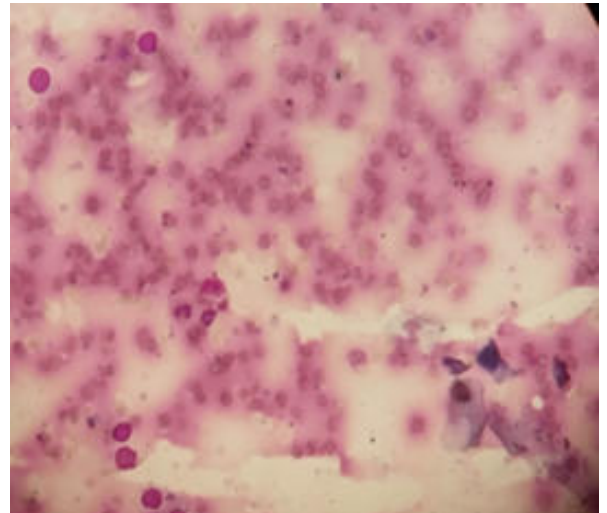


Fig.1 – H&E - 100x– Category II – Colloid nodule

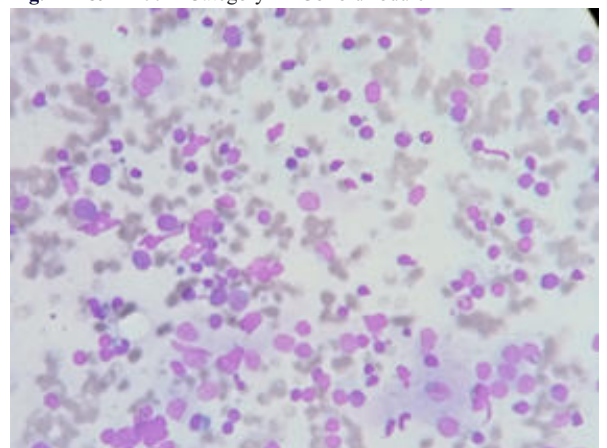


Fig. 2 – Leishman stain -100x – Category II –Hashimoto's Thyroiditis

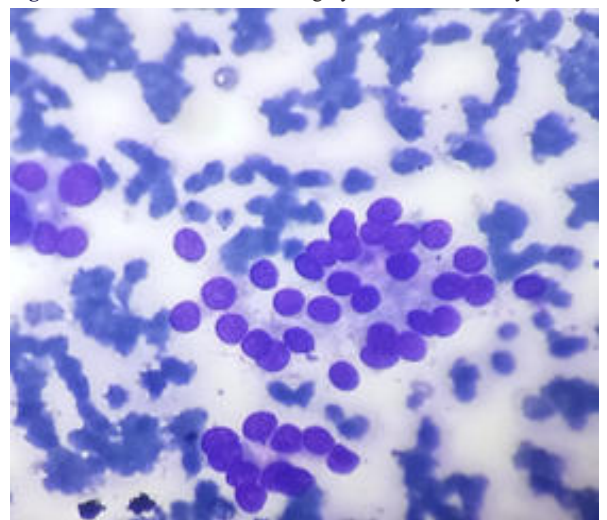


Fig. 3 – Leishman stain - 100x– Category III - Atypia of undetermined significance

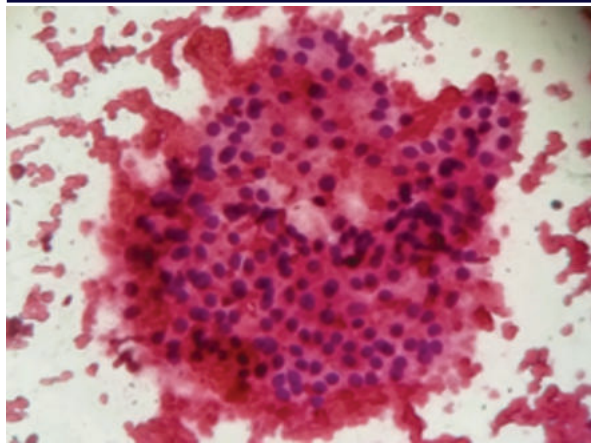


Fig. 4 – H&E – 100x - Category IV - Follicular neoplasm

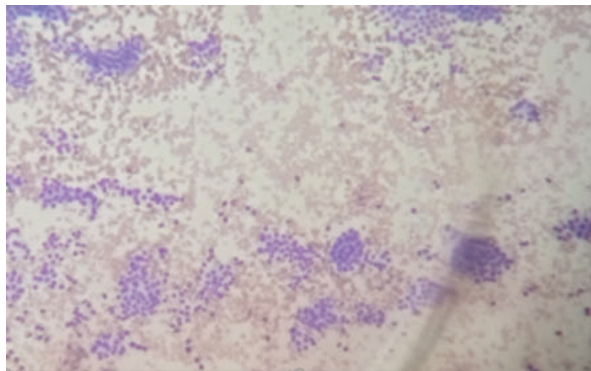


Fig. 5 – Leishman stain - 40x – Category V – Suspicious for malignancy

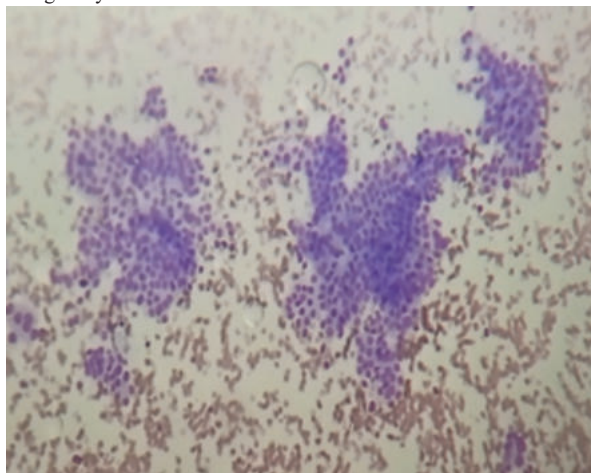


Fig. 6 – Leishman stain – 40x- Category VI - Malignant

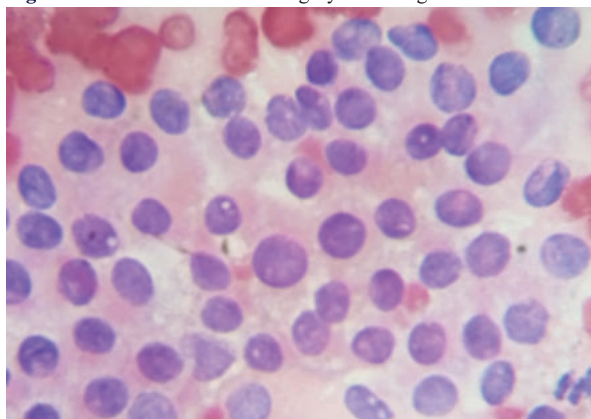


Fig. 7 – H&E – 100x - Category VI – Malignant – Papillary thyroid carcinoma

Table 1:

Male	3	7.5%
Female	37	92.5%

Table 2:

Diagnostic category	Number of cases	Percentage
Non-diagnostic	2	5%
Benign	27	67.5%
Atypia of undetermined significance	2	5%
Follicular neoplasm	4	10%
Suspicious for malignancy	2	5%
Malignant	3	7.5%

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