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# CYTOMORPHOLOGICAL STUDY OF 270 CASES OF THYROID GLAND LESIONS ACCORDING TO THE BETHESDA SYSTEM FOR REPORTING THYROID CYTOPATHOLOGY

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## ABSTRACT

**Background:** Thyroid disorders are the most common endocrine disorders worldwide, including India. FNAC (Fine needle aspiration cytology) is considered one of the best initial diagnostic investigation and screening test in the evaluation of thyroid gland lesions, which is a safe, simple, minimally invasive, readily available, reliable, rapid and an easy to perform outdoor procedure. The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) is a six-category system of thyroid cytopathology reporting. These include nondiagnostic, Benign, Atypia of Undetermined Significance, follicular neoplasm, Suspicious for malignancy and Malignant. Each category has an implied cancer risk, which ranges from 0% to 3% in the benign category and 100% in the malignant category. This study conducted in department of pathology, at Government Medical College, Surat, aims to study cytomorphological features of various lesions of thyroid gland and classify them according to TBSRTC, correlate these with histopathological findings whenever possible. **Result:** FNAC was performed on total 270 patients. M: F ratio was 1: 8. TBSRTC categories includes 4.5% nondiagnostic, 87.00% Benign, 3.70% Atypia of undetermined significance, 1.80% Follicular Neoplasm, 1.50% Suspicious for malignancy and 1.50% Malignant. Subsequent histopathological correlation was possible in 12 cases. **Conclusion:** The true strength of FNAC lies in its synergy with TBSRTC, which allows for the rapid and reliable assessment of thyroid nodules with high accuracy and high sensitivity, offering clinicians the ability to make decisions regarding the need for further diagnostic tests, follow-up care, or surgical intervention.

**KEYWORDS:** Bethesda System, Fine Needle Aspiration Cytology, Histopathology.

## INTRODUCTION

Thyroid disorders are the most common endocrine disorders worldwide, including India.[1] Thyroid gland is affected by a wide range of disorders like developmental, inflammatory, noninflammatory, hyperplastic and neoplastic disorders. The incidence of palpable thyroid swelling is 4-7%.[2] Women seem to have a higher prevalence of thyroid nodules.[3]

Fine-needle aspiration cytology (FNAC) is a safe, simple, minimally invasive, readily available, reliable, rapid and an easy to perform outdoor procedure. It doesn't need any prior preparation of the patients and anaesthesia.[4] Because of this, FNAC is considered one of the initial diagnostic investigation and screening test in the evaluation of thyroid gland lesions.[5] Its utility has increased significantly with increased availability of ultrasound-guided techniques, particularly in case of smaller, non-palpable and deep-seated nodules.[6] The main purpose of FNAC is distinguish benign (mostly managed non-surgically/ clinically) from malignant (mostly managed surgically) nodules of thyroid and reducing unnecessary surgery.[7]

The FNAC provide highly accurate cytologic information, which helps in planning of definitive management. It has high sensitivity and specificity approaching to 96%.[2] Even after the development of advanced radiologic and molecular techniques, fine needle aspiration (FNA) still regarded as the single most accurate and cost-effective diagnostic approach.[8]

It is important that cytopathologists communicate thyroid FNA interpretation to referring physicians in terms that are clear, uniform, unambiguous and clinically helpful. However, due to lack of a standardized system of

reporting, using different terminologies and diagnostic criteria by pathologists. This led to confusion among clinicians in the correct interpretation of the report and planning definitive clinical or surgical management.[9] To achieve standardization of diagnostic terminology, morphologic criteria, and risk of malignancy for reporting of thyroid FNA, in 2007, the National Cancer Institute (NCI) organised The Thyroid Fine Needle Aspiration State of Science Conference in Bethesda, Maryland, to address terminology and other concerns about thyroid FNA. NCI subsequently released a monograph named "The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC)".[10,11]

TBSRTC is a six-category system of thyroid cytopathology reporting. These include nondiagnostic, Benign, Atypia of Undetermined Significance, follicular neoplasm, Suspicious for malignancy and Malignant. Each category has an implied cancer risk which ranges from 0% to 3% in the benign category and 100% in the malignant category.[12]

Considering the important role of FNAC in diagnosing thyroid lesions, this study done to assess the clinical characteristics and demographics of patients with thyroid abnormalities, study cytomorphological features of thyroid gland lesion and classify these lesions using the Bethesda system, and evaluate the frequency of malignancy among different patient groups.

## MATERIAL AND METHOD

The present study (cross sectional observational) was undertaken to evaluate cytomorphology of thyroid gland lesions in outdoor and indoor patients presenting with palpable thyroid lesions during the period of July 2022 to June 2024 (2 years duration), in department of pathology, Government medical college, Surat. Histopathological correlation was done for cases whenever specimen received for histopathological examination.

### Inclusion Criteria

a. Patient of all ages and either gender, indoor and outdoor patient presenting with palpable thyroid gland swelling referred to cytology section for FNAC in new civil hospital, Surat.
b. Patient who are willing to participate.

### Exclusion Criteria

a. Patient with Neck swelling other than Thyroid Gland.
b. Patient who are unwilling to FNAC.

Patient's clinical data like detailed clinical history, radiological data and other investigations was recorded. Details of the procedure were explained to the patients and written consent of patient was taken.

After careful examination and palpation of the thyroid, FNAC was done under aseptic precautions. Aspirated material will be smeared on several clean labelled glass slide. Few slides were immediately fixed in 95% ethyl alcohol, stained by routine Hematoxylin and Eosin (H&E) stain and Papanicolaou stains (PAP) stain, other were air dried and stained with May-Grunwald-Giemsa (MGG) stain.

Entire smears spread on the slide was screened under microscope without leaving a single area. The cytological features were evaluated, and the reporting was done according to The Bethesda System for Reporting Thyroid Cytology. All the data recorded in Microsoft excel sheet.

Specimen of thyroid received after surgery for histopathological examination processed as per standard method. Correlation of cytological and histopathological findings was performed. Sensitivity, specificity, positive predictive value and negative predictive value were calculated using histopathology diagnosis as gold standard.

## RESULT

In the present study, FNAC was performed on total 270 patients who were presented with thyroid nodule or swelling during period from July 2022 to June 2024 at pathology department, Government medical college, Surat. Out of 270 cases, 30 (11.10%) cases were male and 240 (88.90%) cases were female with M: F ratio was **1: 8**. The age ranged from 7 to 90 years with mean age of 38 years. Most common affected age group was 21-40 years with total 151 (55.9%) cases.

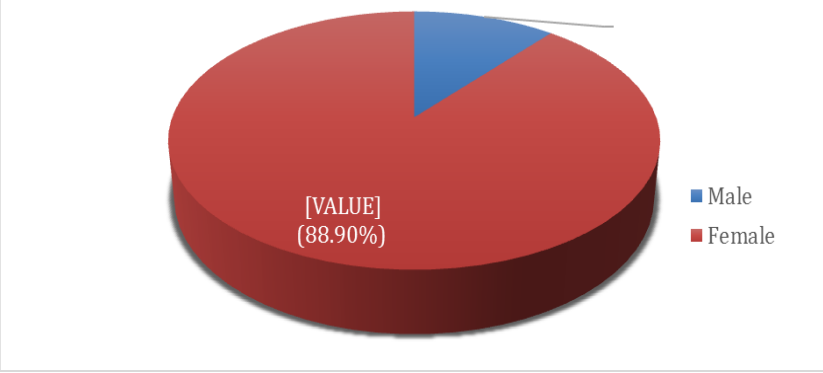


**Figure 1: Thyroid gland lesions according to gender.**

**Table 1: Categorization of thyroid gland lesions according to the TBSRTC Categories.**

| TBSRTC categories | Male | Female | No. of Cases | Percentage |
|---|---|---|---|---|
| I- Nondiagnostic | 1 | 11 | 12 | 4.50 |
| II- Benign | 26 | 209 | 235 | 87.00 |
| III-Atypia of undetermined significance | 0 | 10 | 10 | 3.70 |
| IV-Follicular Neoplasm | 0 | 5 | 5 | 1.80 |
| V-Suspicious for malignancy | 1 | 3 | 4 | 1.50 |
| VI-Malignant | 2 | 2 | 4 | 1.50 |
| **Total** | **30** | **240** | **270** | **100.00** |

In present study, out of 270 cases, maximum 235 (87.00 %) cases were of category II, followed by 12 (4.50%) cases were of category I, 10 (3.70%) cases were of category III, 5 (1.80%) cases were of category IV, least 4 (1.50%) cases were of category V and 4 (1.50%) cases were of category VI.

In present study, total 12 cases were of Category I, out of which 3 (1.10%) cases showed Cyst fluid only, 4 (1.50%) cases showed Virtually acellular smear and rest of 5 (1.80%) cases showed Blood only.

Total 135 cases were included in category II, out of which, maximum 123 (45.60%) cases were of Follicular nodular disease, followed by 69 (25.60) cases were of colloid goiter, 6 (2.20%) cases were of colloid goiter with cystic changes and 7(2.60%) cases were of adenomatoid goiter and 30 (11.0%) cases showed Lymphocytic (Hashimoto's) thyroiditis.

Total 10 (3.70%) cases were included in category Ill and total 5 (1.85%) cases were included in category IV.

Total 4 cases were included in category V, out of which 3 (1.10%) cases showed Suspicious for Papillary thyroid carcinoma and 1 (0.40%) case showed Suspicious for medullary thyroid carcinoma.

There were 4 (1.50%) cases of category VI (Malignant) and all were of Papillary thyroid carcinoma.

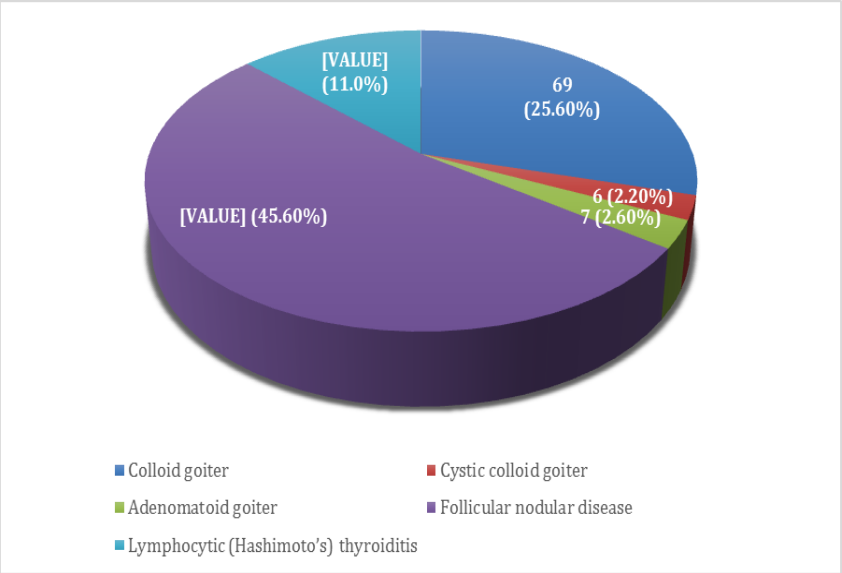


**Figure 2: Subcategorization of benign thyroid lesion.**

**Table 2: Age wise distribution of Thyroid lesions according to TBSRTC categories.**

| TBSRTC Categories | Age (years) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1-10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | >70 | Total |
| I | 0 | 1 | 3 | 2 | 2 | 2 | 1 | 1 | 12 |
| II | 2 | 19 | 69 | 64 | 42 | 23 | 10 | 6 | 235 |
| III | 0 | 1 | 2 | 2 | 0 | 3 | 2 | 0 | 10 |
| IV | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | 5 |
| V | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 4 |
| VI | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 4 |
| **Total** | **2** | **23** | **77** | **74** | **44** | **28** | **15** | **7** | **270** |
| **Percentage** | **0.7** | **8.5** | **28.5** | **27.4** | **16.3** | **10.4** | **5.6** | **2.6** | **100** |

Out of 270 cases of thyroid FNAC, total 12 surgical specimen were received for histopathological examination in our department. Among benign category, surgical specimens of 10 cases were received. Histopathologically, 8 cases were diagnosed as colloid goiter, 1 case as follicular adenoma of thyroid and 1 case as Adenomatoid goiter.

Among malignant lesion, out of 4 cases of papillary thyroid carcinoma, surgical specimen of 2 cases were received and confirmed histopathologically as papillary carcinoma- classic subtype and papillary thyroid carcinoma- follicular variant.

**Table 3: Correlation between cytodiagnosis and histodiagnosis.**

| **Cytological Diagnosis** | **Histological diagnosis** | **No. of case (12)** | **Remarks** |
|---|---|---|---|
| Adenomatoid Goiter | Adenomatoid Goiter | 1 | True Negative=10 |
| Adenomatoid Goiter | Colloid Goiter | 1 | |
| Colloid Goiter | Colloid Goiter | 2 | |
| Cystic Colloid Goiter | Colloid Goiter | 1 | |
| Follicular Nodular disease | Colloid Goiter | 4 | |
| Follicular Nodular disease | Follicular adenoma of thyroid | 1 | |
| Papillary thyroid carcinoma | Papillary thyroid carcinoma- Classic subtype | 1 | True Positive=2 |
| Papillary thyroid carcinoma-Follicular variant | Papillary thyroid carcinoma- Follicular variant | 1 | |

**IMAGES**

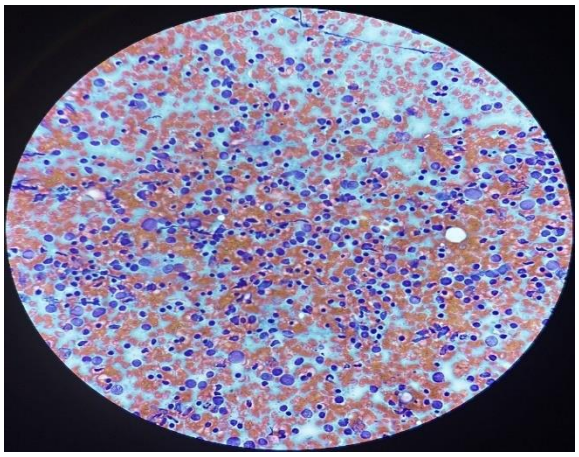

**Figure 3: Lymphocytic (Hashimoto's) thyroiditis (Category II): Benign follicular cells studded with lymphocytes (PAP stain, 10x).**

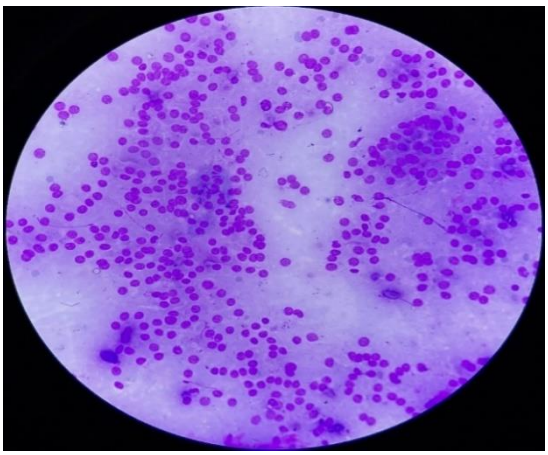

**Figure 4: Follicular neoplasm (Category IV) (MGG stain, 40x).**

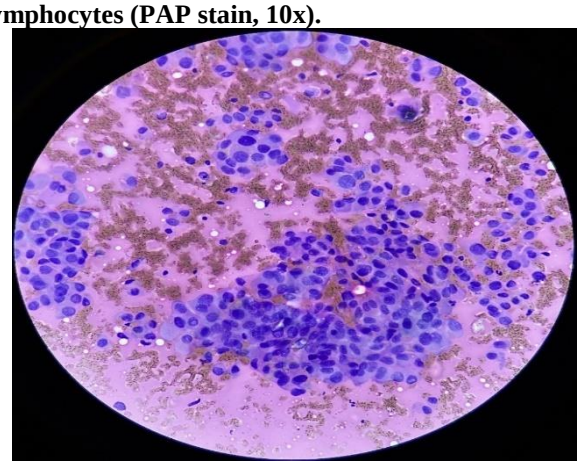

**Figure 5: Papillary thyroid carcinoma (category VI): This Monolayer sheets with a syncytial-like appearance comprised of cells with irregular nuclei that show focal moulding (Pap stain, 40x).**

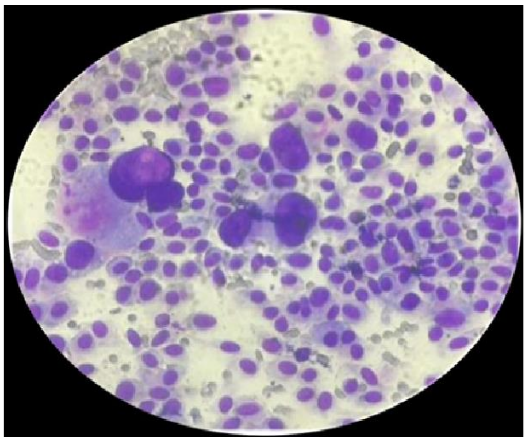

**Figure 6: Suspicious for medullary thyroid carcinoma (Category V) (MGG stain, 40x).**

## DISCUSSION

Thyroid swellings are a common clinical problem, with an estimated prevalence of palpable nodules ranging from 4-8%. Most of the thyroid nodules are benign with small fraction of them (5%) are malignant. Thyroid cancer accounts for only 0.4% of all cancer deaths.[13] FNAC, in combination with a proper clinical history, thorough physical examination, ultrasonography, and thyroid function profile, is the mainstay for diagnosing thyroid lesions.[14]

Until recently, there were no uniform criteria established for the various diagnostic categories and specimen adequacy. Various terminologies like "atypical," "indeterminate," and "suspicious for malignancy," were used.[15] To solve this issue, The Bethesda System for Reporting Thyroid Cytopathology was developed as a standard terminology to bridge the gap between diagnosticians and referring physicians for interpreting thyroid lesions.[14] It improves communication between the pathologist and clinician in deciding the treatment plan for the patients and reduces unnecessary surgeries. It also provides an estimate malignant potential of each category.[16,17]

During the present study, no complication like hematoma, transient laryngeal nerve palsy or perforation of trachea was noted. Out of 270 cases, histopathological correlation was done in 12 cases.

In our study, there were 240 (88.89%) female and 30 (11.11%) males, with M:F ratio of 1:8 which was correlated with the studies done by Barman et al. (2023)[14] and pagalla et al. (2024).[18] Overall, all studies showed female preponderance.

Present study showed maximum no of cases in 21-40 years age group with 55.9% which was compatible with study done Smita et al. (2020)[19], Patel et al. (2021)[20] and Gowardhan et al. (2024)[3] with 52.72%, 42.60 % and 56.70 % respectively.

**Table 4: Comparison of thyroid gland lesion distribution according to Bethesda system with various studies.**

| TBSRTC category | Ruparelia et al.[21] (2020) | Patel et al.[20] (2021) | Naik et al.[22] (2022) | Kumar et al.[23] (2022) | Barman et al.[14] (2023) | Singha et al.[24] (2024) | Pagalla et al.[18] (2024) | Present study |
|---|---|---|---|---|---|---|---|---|
| I | 13 (5.20%) | 7 (2.5%) | 7 (2.02%) | 7 (4.4%) | 11 (1.9%) | 4 (3.33%) | 13 (4.3%) | 12 (4.50%) |
| II | 219 (87.60%) | 237 (85.9%) | 307 (88.72%) | 112 (70.0%) | 68 (62.9%) | 103 (85.83%) | 233 (80.0%) | 235 (87.00%) |
| III | 7 (2.80%) | 11 (4.0%) | 3 (0.86%) | 6 (3.7%) | 10 (9.2%) | 1 (0.83%) | 13 (4.4%) | 10 (3.70%) |
| IV | 6 (2.40%) | 9 (3.2%) | 19 (5.49%) | 10 (6.4%) | 4 (3.7%) | 5 (4.17%) | 28 (9.6%) | 5 (1.80%) |
| V | 4 (1.60%) | 6 (2.2%) | 5 (1.44%) | 15 (9.4%) | 5 (5.5%) | 2 (1.67%) | 6 (1.7%) | 4 (1.50%) |
| VI | 1 (0.40%) | 6 (2.2%) | 5 (1.44%) | 10 (6.4%) | 8 (7.4%) | 5 (4.17%) | 10 (3.4%) | 4 (1.50%) |
| Total | 250 (100%) | 276 (100%) | 346 (100%) | 160 (100%) | 108 (100%) | 120 (100%) | 303 (100%) | 270 (100%) |

In present study, maximum no. of cases 235(87.00%) was of category II (Benign), similar results found in studies conducted by Naik et al. (2022)[22] (88.72%), Singha et al. (2024)[24] (85.83%) and Patel et al. (2021)[20] (85.9%).

Second highest cases were of category I (nondiagnostic), it comprised 12 (4.50%) cases. Smears that are inadequate for reporting, cystic fluid or blood only smears are categorised as non-diagnostic (ND). Non-diagnostic rates are influenced by factors like operator skill, nodule characteristics (size, cystic content, calcification, vascularity etc.), criteria used to judge adequacy of the smears and rapid onsite sample evaluation (ROSE). According to Bethesda system, category III (atypia of undetermined significance) should not exceed more than 7%. In our study, there were 7 (3.70%) cases, which was within defined limit.

## CONCLUSION

FNAC allows for the rapid and reliable assessment of thyroid nodules with high accuracy and high sensitivity. The true strength of FNAC lies in its synergy with the Bethesda System for Reporting Thyroid Cytology (TBSRTC). This six-tiered standardized reporting system has significantly advanced the field of thyroid cytology by providing a structured framework for classifying thyroid lesions and predicting the risk of malignancy. Unlike previous diagnostic systems, the Bethesda system minimizes confusion and ensures a consistent and clear understanding between pathologists, clinicians, and surgeons. Each category in the Bethesda system not only aids in the interpretation of FNAC results but also offers valuable management guidelines, indicating whether further diagnostic tests, repeat aspiration, or surgical intervention is necessary.

As a result, FNAC combined with the Bethesda system has significantly contributed to decreasing the number of thyroid surgeries performed, while simultaneously increasing the proportion of malignant lesions that are correctly identified and surgically resected.

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