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RESEARCH ARTICLE



The Cytomorphological Appraisal of Fine- Needle Aspiration of Thyroid Gland Lesions utilizing The Bethesda System for Reporting Thyroid Cytopathology

Shrikant Ovhar¹ | Shalaka Tupkari^{2*}**Abstract**

Background: Thyroid nodules are most commonly encountered endocrine abnormalities and Fine Needle Aspiration Cytology (FNAC) has emerged as the first-line diagnostic modality in the evaluation. To avoid confusion and to standardize the reporting system National Cancer Institute (NCI) proposed The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC). TBSRTC helps in better understanding of the borderline cases where decision of surgical intervention over medical management is crucial.

Aim: To evaluate the distribution of thyroid lesions according to The Bethesda System for Reporting Thyroid Cytopathology. To correlate the cytomorphological spectrum of thyroid lesions with histopathological findings.

Material and Methods: This retrospective study included 96 cases presented in cytology section with thyroid nodule were subjected to FNAC using 22-gauge needle under all aseptic precautions. Detailed clinical history was taken. FNAC smears were reported using TBSRTC. The histopathology correlation was available for 35 cases. The cytological diagnosis was compared with histopathological diagnosis and diagnostic performance was assessed.

Result: In present study, female preponderance is noted with female-to-male ratio of 3:1. The most common age group was 3rd decade followed by 4th decade. The most common category according to TBSRTC was Cat II Benign (76.2%) followed by Cat VI malignant (6.1%) followed by Cat V (5.4%), I (4.8%), IV, (4.7%) III (2.8) respectively. Cytomorphological and histopathological correlation was seen in 33 cases of total 35 cases. While the 02 cases were cytomorphological features are not correlating with histopathology findings were included in discordant cases. We have reported Sensitivity: 92.31%, Specificity:95.45%, PPV:92.31%, NPV:95.45%, Diagnostic accuracy of the test:94.29%.

Conclusion: The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) is simple, has clear diagnostic criteria hence provides uniformity of reporting by cytopathologist and increases the understanding and uniformity in assessment by the treating clinician which help in improving the communication between cytopathologist and treating clinician which in turns help in better and appropriate treatment of patient.

Key words: Fine Needle Aspiration Cytology (FNAC), Thyroid nodule, Cytopathology, Histopathology

1 | INTRODUCTION:

The thyroid a small butterfly-shaped gland located in the anterior aspect of neck¹. Thyroid disorders are among the most prevalent endocrine disorders and estimated 42 million people

affected in India by thyroid disorders, second only to diabetes mellitus^{2–3}.

In India, the burden of thyroid dysfunction is enormous — affecting nearly one in ten adults, making it a major public-health concern. The disorders range

¹ Associate Professor, Department of Pathology, Parbhani Medical College RP Hospital & Research Institute, Parbhani, Maharashtra, India.

² Assistant Professor, Department of Pathology, ASPL'S CSMSS Medical College & Hospital Limbejalgaon, Aurangabad, Maharashtra, India.

Address correspondence to: Shalaka, Tupkari, Assistant Professor, Department of Pathology, ASPL'S CSMSS Medical College & Hospital Limbejalgaon, Aurangabad, Maharashtra, India,

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from iodine deficiency goitre and hypothyroidism to hyperthyroidism, thyroiditis, and carcinoma².

Thyroid nodules represent one of the most frequently encountered endocrine abnormalities. and substantially higher rates detected through high-resolution ultrasonography⁴. While most thyroid nodules are benign, the critical challenge lies in accurately identifying the subset that harbours malignancy, necessitating timely and appropriate intervention⁵.

Fine Needle Aspiration Cytology (FNAC) has emerged as the first-line diagnostic modality in the evaluation of thyroid lesions, owing to its simplicity, cost-effectiveness, and high diagnostic yield in differentiating benign from malignant nodules⁶.

Various terminologies used in reporting FNA have created confusion among surgeons, endocrinologists and radiologists. To overcome this confusion and to standardize the reporting system National Cancer Institute (NCI) proposed TBSRTC⁷.

Classification based on The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) helps in better understanding of the borderline cases where decision of surgical intervention over medical management is crucial⁸.

The present study was undertaken to determine the frequency of thyroid gland lesions and to assess the cytomorphological spectrum of thyroid gland lesion. We highlighted the diagnostic utility of FNAC by calculating sensitivity, specificity and diagnostic accuracy of cytopathology of thyroid gland lesion.

Aims and objectives

The aims of the study were as follow:

- 1: To categorize thyroid FNA using TBSRTC
- 2: To calculate sensitivity, specificity and diagnostic accuracy of cytopathology of thyroid gland lesion.
- 3: To correlate the cytomorphological spectrum of thyroid lesions with histopathological findings whenever possible

2 | MATERIALS AND METHODS.

All the patients present with thyroid nodule came to cytopathology section of outpatient patient department willing to give written informed consent were

included on study from duration of 01 Jan 2025 to 31December 2025 were included in study.

Types of study: This was a retrospective cross-sectional study conducted in the cytopathology section of department of pathology

Inclusion criteria: All the patients presented with thyroid lesion/nodules to cytopathology section of outpatient department who provided written informed consent were included in study.

Exclusion criteria: Patients with haemorrhagic or inadequate aspirates and those who were unwilling to provide written informed consent were excluded from study.

Patients presented for thyroid gland FNAC during the period mentioned above were included. Relevant clinical details along with ultrasonography (USG) report were taken into account whenever available. For FNAC, the patient was positioned comfortably with the neck adequately extended and was instructed to avoid talking or swallowing during the procedure. Under all the aseptic precautions, cleaning of overlying skin with spirit swab, direct per cutaneous fine needle aspiration was performed with 22-gauge needle. One or more passes were made depending upon the size, nodularity and consistency of the lesion. Smears were prepared from the aspirated material. The smears were immediately fixed with alcohol. The fixed smears were stained with Haematoxylin and Eosin stain (H&E). The cytological findings were evaluated by a cytopathologist and categorized according to TBSRTC criteria. Patients were followed up, and those who subsequently underwent thyroidectomy, were included for histopathological correlation. Resected specimens were received in 10% neutral buffered formalin. Gross examination was performed and representative tissue sections were submitted for processing. The tissue went through automatic tissue processor. Then paraffin blocks were prepared and tissue sections were cut by rotary microtome. These sections were stained with Haematoxylin and Eosin stain and reported by histopathologist. Correlation between cytological and histopathological diagnosis was checked for these patients. Statistical analysis executed using Microsoft Excel 2011 version

3 | RESULT:

A total of 96 cases of FNA thyroid were included in present study. Out of 96 cases 72 (75%) were females while 24 cases (25%) were males giving a female -to-male ratio of 3:1. There was a wide age group range from 10 years to 80 years. The most common age group was 3rd decade followed by 4th decade. The most common category according to TBSRTC was Cat II Benign (76.2%) followed by Cat VI malignant (6.1%) followed by Cat V, I, IV, III respectively. Histopathological examination (HPE) was available in 35 cases (36.46%) of total 96 cases. Cytopathology diagnosis correlates with histopathology diagnosis in 33 cases. There were 5 cases (4.8%) included in category I- Nondiagnostic but histopathology was not available for any case. A total of 73cases (76.2%) were categorized under benign Cat II histopathology was available for 18 cases. The most common diagnosis in Cat II Benign

was colloid nodule followed by goitre and thyroiditis. A total of 03 (2.8%) cases were categorized under Cat III- Atypia of Undetermined Significance (AUS). Histopathology was available for all 3 cases. Total of 4 cases (4.7%) were included in Cat IV- Follicular Neoplasm (FN). Histopathology diagnosis was available for 03 cases. There was total 05 cases (5.4%) in Cat V- Suspicious for Malignancy (SOM). Histopathological correlation was available for all the 05 cases. The most common diagnosis in cat V is suspicious of papillary carcinoma followed by suspicious of medullary carcinoma. A total of 6 cases (6.1%) were categorized in Cat VI- Malignant. The HPE was available in all the 06 cases. The most common findings in Cat VI includes, papillary carcinoma followed by medullary carcinoma and poorly differentiated carcinoma respectively. On histopathology there were 2 cases, where cytology diagnosis did not match with HPE diagnosis. These were labelled as discordant cases.

Table 1. Distribution & cytomorphological Spectrum of thyroid lesion according to Bethesda categories.

Bethesda Category	Bethesda Categories percentage% (No. of cases)	FNA diagnosis	Cases in percentage% (cases in number)
I	4.8 (05)	Scanty Cellularity	2.9 (03)
		Blood obscuring cell	1.9 (02)
		Colloid Nodule	43.81(42)
II	76.2(73)	Goitre	27.12(26)
		Thyroiditis	5.22(05)
III	2.8(03)	AUS	2.8 (03)
IV	4.7(04)	FN	4.7 (04)
V	5.4(05)	Suspicious of Papillary carcinoma	4.32(04)
		Suspicious of Medullary Carcinoma	1.08(01)
		Papillary Carcinoma	4.07 (04)
VI	6.1 (2)	Medullary Carcinoma	1.02(01)
		Poorly differentiated Carcinoma	1.02 (01)

Table 2. Histopathological correlation of thyroid lesion according to Bethesda categories.

Bethesda Category	HPE Total	HPE Benign	HPE Malignant
I	00	00	00
II	17	17	00
III	03	02	01
IV	03	02	01
V	05	00	05
VI	05	00	05
Total	33	21	12

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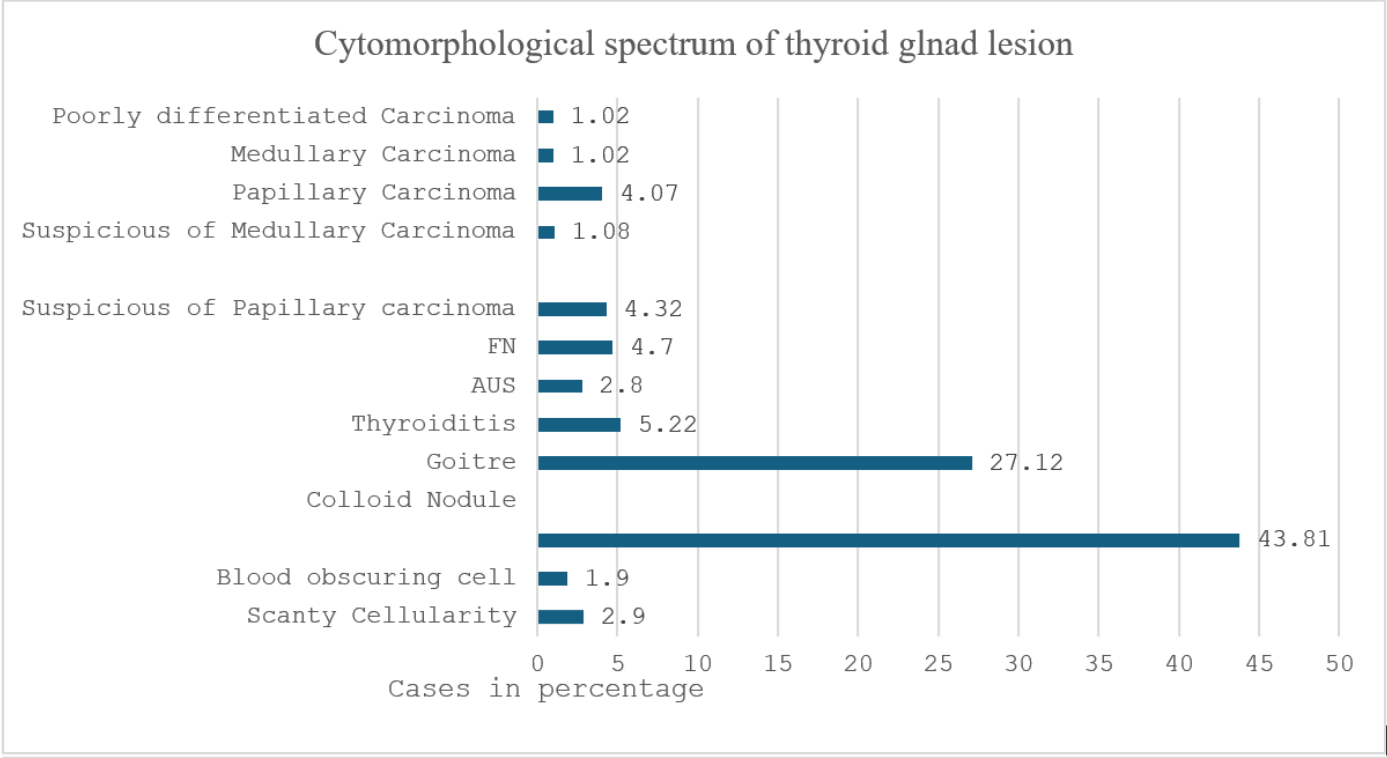


Fig. 1: Cytomorphological spectrum of thyroid gland lesion

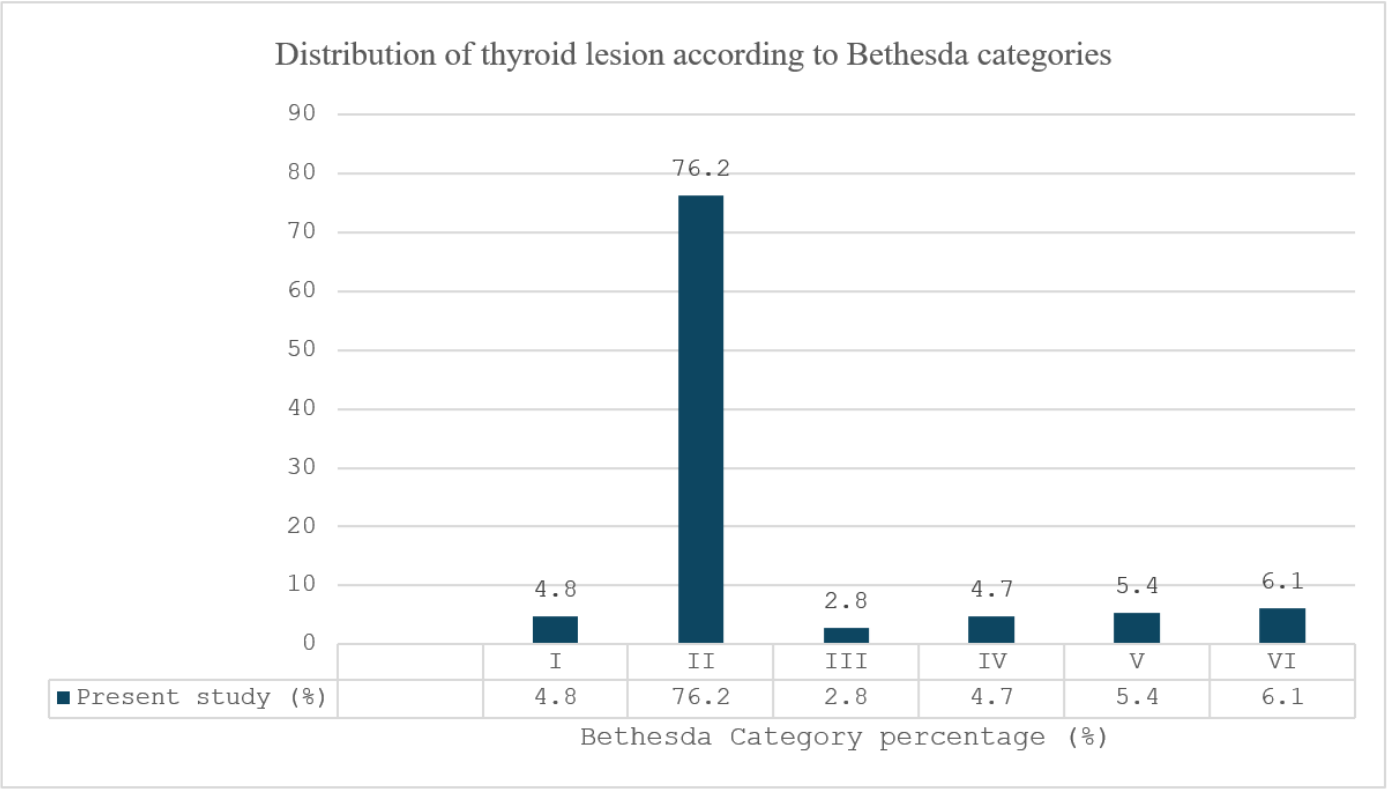


Fig. 2: Distribution of thyroid lesion according to Bethesda Categories

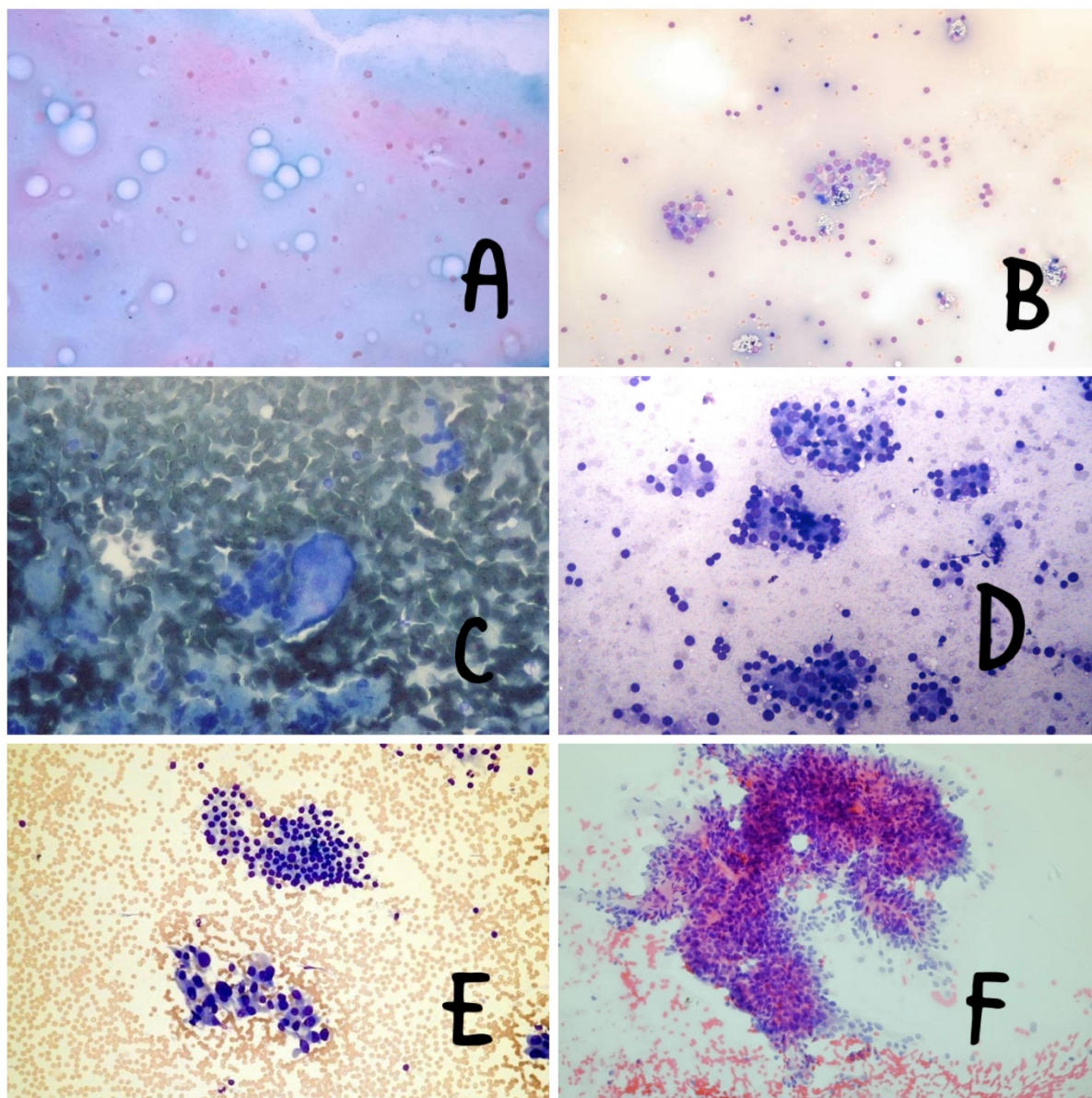


Fig. 3: Thyroid Fine-needle aspiration panel Fig A: Scant cellularity with colloid in background. TBSRTC Cat I Non-diagnostic (H &E x 40)

Fig B: Smear show abundant colloid with benign follicular cells- Colloid nodule-TBSRTC Cat II Benign (H &E x 40)

Fig C: Smear with follicular cells showing mild nuclear atypia on blood mixed colloid in background- AUS-TBSRTC Cat III (H &E x 40)

Fig D: Smear show follicular cells in repetitive microfollicular pattern with very scant colloid- TBSRTC Cat IV FN (H &E x 40)

Fig E: Smear show follicular cells with nuclear enlargement, overlapping, suspicious nuclear features – TBSRTC Cat V SOM (H &E x 40)

Fig F: Smear show papillary architecture with overlapping cells and characteristics papillary type nuclear features – TBSRTC Cat VI Malignant (H &E x 40)

In discordant case 1: FNA smear showed reactive follicular cells, with background containing numerous lymphocytes was reported as Bethesda Cat II- Lymphocytic thyroiditis. However, HPE subsequently revealed papillary thyroid carcinoma. The probable reason for this discrepancy may be attributed to sampling error, aspirated sample pos-

sible representing thyroiditis background rather than focal microcarcinoma. There might be chances that inflammatory cells obscured the characteristic papillary nuclear features. Careful morphological examination can help to arrive at correct diagnosis. We probably not miss the diagnosis on cytology.

In discordant case 2: FNA smear showed predom-

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inantly repetitive microfollicular pattern with scant colloid. So, we reported it as a Bethesda Cat IV (Follicular neoplasm). Histopathology subsequently revealed colloid goitre. The discrepancy may have been due to sampling of microfollicular nodule in nodular goitre. Repeat FNA from another area of the lesion may help to improve diagnostic accuracy.

In our study, we have reported:

Sensitivity: 92.31%

Specificity:95.45%

PPV (Positive Predictive Value):92.31%

NPV (Negative Predictive Value):95.45%

Diagnostic accuracy of the test:94.29%

4 | DISCUSSION:

It is estimated that 7% of adults have palpable nodules and up to 50% of adults have nodules detected by USG⁹. Only 5% of thyroid nodules are found to have malignant nature therefore surgical removal of each and every thyroid nodule is unnecessary, expensive and risky⁹. The assessments of these swellings are mainly concerned around differentiating benign from malignant ones to avoid unnecessary surgery⁹. Fine needle aspiration cytology is simple and affordable to assess thyroid nodules and is now considered as first line diagnostic tool¹⁰. However, despite its widespread use FNA creates reporting confusion due to lack of standard reporting system, only descriptive report and variable terminology used by pathologist¹¹. To solve this problem The Bethesda System for Reporting Thyroid Cytopathology (TBRTC) is the first reporting system established in non-gynaecologic cytopathology after the Bethesda System for Reporting Cervical Cytopathology¹². It is based on the same concept of providing a uniform reporting system for all pathologists and clinicians to follow in thyroid cytology¹². The reporting system is composed of six diagnostic categories¹².

In present study there was a preponderance of female gender than males which was comparable with Qureshi et al¹³ and Kamboj et al¹⁴ study. The age and gender distribution in our study showed more cases

in 3rd decade followed by 4th decade which is consistent with studies done by Gohil et al. 15 Jamaiyar et al¹⁶.

In present study majority of cases were from Cat II (Benign) 76.2% which was comparable to studies by pawar et al¹⁷, Reddy et al¹⁸, Sahana et al¹⁹, Neetha et al²⁰. HPE correlation was available for 18 cases. 17 cases turned out to be benign while 01 case was malignant which we included in discordant case.

The rate of Cat VI (Malignant) 6.1% which was in concordance with Reddy et al¹⁸, Sahana et al¹⁹. HPE correlation was available for 05 cases. All the 05 cases turned out to be malignant.

The Cat V (SOMS) includes 5.4% of cases which was in concordance with studies done by Reddy et al¹⁸, Sahana et al¹⁹. The HPE correlation was available for 05 cases. All the cases turned out to be malignant.

The non- diagnostic cases were 4.8% which was comparable with studies done by Reddy et al¹⁸, Neetha et al²⁰. Unfortunately, we haven't received HPE for any case in this category.

The Cat IV (FN) included 4.7% of cases which was comparable with Reddy et al¹⁸, Neetha et al²⁰. The HPE was available for 04 cases. 02 cases were reported as follicular adenoma while 01 case was reported as a follicular carcinoma on HPE. 01 cases which was reported as Cat IV on cytology was reported as a colloid goitre on HPE which was included in discordant case.

The Cat III (AUS) included 2.8% of cases which was comparable with studies done by Neetha et al²⁰. The HPE correlation was available for 3 cases. 02 cases were benign and 01 case was reported as malignant.

The distribution of cases according to Bethesda categories in present study showed some variation compared with other studies. This difference may be due to the variation in sample size, study population, selection criteria. There is some difference in the prevalence of benign and malignant cases, the difference may be attributed to geographical influence. Furthermore, interobserver variability and difference in the interpretation specifically for Cat II cat IV cases may contribute to the variation in category wise distribution with different studies.

Table 3. Comparison of Bethesda category- wise distribution in the present study with previous studies.

Bethesda Category	Pawar et al ¹⁷ (%)	Reddy et al ¹⁸ (%)	Sahana et al ¹⁹ (%)	Neetha et al ²⁰ (%)	Present study (%)
I	3.1	4.2	7.9	04	4.8
II	89.3	66.7	66.3	82	76.2
III	0.6	8.3	5.9	2.4	2.8
IV	1.25	6.7	9.9	5.4	4.7
V	3.4	5.8	05	1.7	5.4
VI	2.18	8.3	05	4.5	6.1

5 | LIMITATIONS OF STUDY:

The sample size is small and the cyto-histopathological correlation is available for 36.46% cases.

6 | CONCLUSION:

The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) is simple, has clear diagnostic criteria hence provides uniformity of reporting by cytopathologist and increases the understanding and uniformity in assessment by the treating clinician which help in improving the communication between cytopathologist and treating clinician which in turns help in better and appropriate treatment of patient.

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References

- Knight J, Andrade M, Bayram-Weston Z. Endocrine system 3: thyroid and parathyroid glands. *Nursing Times* [Internet]. 2021 Jun 28;117(7):46-50.
- Akunovich KZ, Chauhan AR. Thyroid disorders in India: epidemiology, pathophysiology, and management. *International Journal for Doctors and Medical Scientists (IJDMMS)*. 2026. doi:10.5281/zenodo.19708385.
- Das D, Banerjee A, Jena AB, Duttaroy AK, Pathak S. Essentiality, relevance, and efficacy of adjuvant/combinational therapy in the management of thyroid dysfunctions. *Biomed Pharmacother*. 2022 Feb; 146:112613. doi: 10.1016/j.biopha.2022.112613.
- Bhartiya R, Mallik M, Kumari N, Prasad BN. Evaluation of thyroid lesions by fine-needle aspiration cytology based on Bethesda system for reporting thyroid cytopathology classification among the population of South Bihar. *Indian J Med Paediatr Oncol*. 2016;37(4):265-270. doi:10.4103/0971-5851.195742.
- Hashmi SA, Aggrawal M, Pandey R, Gulati D, Khan ID. Evaluation of thyroid lesions by the Bethesda System for Reporting Thyroid Cytopathology. *J Mar Med Soc*. 2023;25(1):73-77.
- Jain D, Sharma R, Pachori G, Bayla T. Evaluation of thyroid lesions by fine needle aspiration cytology according to Bethesda system. *Indian J Otolaryngol Head Neck Surg*. 2023;75(2):457-462. doi:10.1007/s12070-022-03292-x.
- Prathima S, Suresh TN, Kumar MLH, Bhaskaran A. Impact of the Bethesda System in reporting thyroid cytopathology. *Thyroid Res Pract*. 2016;13(1):9-14. doi:10.4103/0973-0354.168900.
- Cibas ES, Ali SZ. NCI Thyroid FNA state of the science conference. The Bethesda system for reporting thyroid cytopathology. *Am J Clin Pathol*. 2009;132(5):658-665. doi:10.1309/AJCPHLMWI3JV4LA.
- Wu H, Swadley M. The Bethesda system for reporting thyroid cytopathology: into the clinic. *Pathology and Laboratory Medicine International*. 2025; 7:47-54.
- Cibas ES. Fine-needle aspiration in the work-up of thyroid nodules. *Otolaryngologic Clinics of North America*. 2010;43(2):257-71. doi: 10.1016/j.otc.2010.01.003
- Layfield LJ, Cibas ES, Baloch Z. Thyroid fine needle aspiration cytology: a review of the National Cancer Institute state of the science symposium. *Cytopathol*. 2010;21(2):75-85
- Han M, Fan F. Bethesda System for

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Reporting Thyroid Cytopathology—An Updated Review. *J Clin Transl Pathol.* 2023;3(2):84-98. doi:10.14218/JCTP.2023.00005.

13. Qureshi SY, Narkhede PP, Hashmi SF, Fatima T. Analysis of thyroid lesions cytology by the Bethesda system and its histopathological correlation. *Eur J Cardiovasc Med.* 2025;15(4):958-963.

14. Kamboj M, Mehta A, Pasricha S, Gupta G, Sharma A, Garima Durga. Cytomorphological Categorization of Thyroid Lesions according to The Bethesda System for Reporting Thyroid Cytology and Correlation with their Histological Outcome: An Indian Oncology Centre Experience. *Journal of cytology.* 2022; 39 (1): 44-50.

15. Gohil U, Bhatt P. A study of correlation between fine needle aspiration cytology and histopathological examination of thyroid swellings. *Int J Life Sci Biotechnol Pharma Res.* 2023;12(2):2390–2396.

16. Jamaiyar A, Yogesh K. How accurate is fine-needle aspiration cytology (FNAC) for thyroid lesion: A correlation of FNAC with histopathology. *Journal of Family Medicine and Primary Care.* 2023;12(1):15–20.

17. Pawar S, Chandan RH, Kolavi SS. Cytomor-

phological evaluation of thyroid lesions using the Bethesda system: a study of 320 cases. *ShodhKosh J Vis Perform Arts.* 2026;7(9s):522-529.

18. Reddy TR, Vani PG, K. KM, B.V.V.D. BK. Spectrum of Thyroid Lesions Evaluated by the Bethesda System for Reporting Thyroid Cytopathology in a Tertiary Hospital. *Journal of Contemporary Clinical Practice.* 2025 Jun;11(6):876-880.

19. Sahana SN, Balaji TG, Shashikala P. Cytological Study of Thyroid Lesions using the Bethesda System and Histopathological Correlation. *J Med Sci Health* 2025; 11(3):321-326.

20. Neethu GV, Preethi CR, Nikethan B, Banik A. Cytohistological correlation of thyroid fine-needle aspiration cytology with emphasis on discordant cases: a tertiary care center study. *Indian J Health Sci Biomed Res.* 2023;16(2)

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