Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/qst1nf34

FINE NEEDLE ASPIRATION CYTOLOGICAL STUDIES OF THYROID LESIONS AND THEIR CLASSIFICATION BY BETHESDA SYSTEM OF REPORTING.

Dr. Sheetal Balaji Gajale[1*], Dr. Kedarnath V. Kute[2], Dr. Prashant R. Shinde,[3] Dr. Shivaji Birare [4], Dr. P. N. Kadam [5]

[1*]Senior Resident at Dept. of Pathology at Dr. Shankarrao Chavan Government Medical College & Hospital - Vishnupuri, Nanded, Email id- gajalesheetal25@gmail.com
[2]Assistant Professor at Dept. of Pathology at Dr. Shankarrao Chavan Government Medical College & Hospital - Vishnupuri, Nanded, Email id- kedar.kute@gmail.com
[3]Senior Resident at Dept. of Surgery at Government Medical College, Parbhani, Email id – ps744992@gmail.com
[4]Professor at Dept. of Pathology at Government Medical College & Hospital - Sindhudurg, Email id – birareshivaji@yahoo.co.in
[5]Associate Professor at Dept. of Pathology at Dr. Shankarrao Chavan Government Medical College & Hospital - Vishnupuri, Nanded, Email id – drpankajkadam@yahoo.co.in

***Corresponding Author:** Dr. Sheetal Balaji Gajale
*Senior Resident at Dept. of Pathology at Dr. Shankarrao Chavan Government Medical College & Hospital - Vishnupuri, Nanded, Email id- gajalesheetal25@gmail.com

Abstract:
Background: Thyroid lesions are commonly encountered in clinical practice, and the differentiation between benign and malignant nodules is crucial for appropriate management. Fine Needle Aspiration Cytology (FNAC) is a widely used diagnostic tool to evaluate thyroid lesions due to its minimally invasive nature, accuracy, and cost-effectiveness. The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) provides a standardized approach to classify thyroid FNAC results, enhancing communication between pathologists and clinicians. The aim of this study was to evaluate the utility of FNAC in the diagnosis of thyroid lesions and to classify them according to the Bethesda system, assessing its impact on patient management.
Methodology: This retrospective study was conducted over a period of one year and included 150 patients who underwent FNAC for thyroid lesions at a tertiary care center. FNAC specimens were collected from patients with clinically suspicious thyroid nodules, and cytological findings were categorized based on the Bethesda System, which includes six diagnostic categories: non-diagnostic, benign, atypia of undetermined significance (AUS), follicular neoplasm, suspicious for malignancy, and malignant.
Results: In the present study, 199 cases of thyroid FNAC were received during the 2 years of study. These were categorized according to the Bethesda system of reporting thyroid cytology in to 6 categories. The distribution of FNAC findings was as follows; 70.8% benign, 4.5% AUS, 13% follicular neoplasm, 3.01% suspicious for malignancy, and 2.01% malignant. The Bethesda system allowed for better risk stratification and management decisions.
Conclusion: FNAC, when coupled with the Bethesda System for Reporting Thyroid Cytopathology, is an effective and reliable tool for evaluating thyroid lesions. The Bethesda classification helps

stratify patients based on the risk of malignancy and guides clinical decision-making, reducing unnecessary surgeries while ensuring prompt management for patients with malignant nodules.

Keywords: Thyroid lesions, Benign, Malignant, FNAC, BSRTC,

Introduction:

Thyroid lesions are a common clinical concern, with a varied spectrum of pathological presentations ranging from benign nodules to malignant neoplasms.[1] The increasing incidence of thyroid diseases, particularly thyroid nodules, has led to the need for accurate diagnostic modalities. Among these, FNAC stands out as a pivotal tool due to its high sensitivity, cost-effectiveness, and minimally invasive nature.[2] FNAC allows for the assessment of thyroid nodules, aiding in the differentiation of benign and malignant lesions, which is crucial for timely intervention and management.[3]
The BSRTC has provided a standardized framework for classifying thyroid lesions based on FNAC findings. This system, which categorizes thyroid lesions into six diagnostic categories, has become an essential tool in clinical practice worldwide.[3,4] It not only aids in diagnosis but also helps to guide management decisions by stratifying the risk of malignancy, facilitating better patient counseling, and informing the need for further investigations or surgical intervention.

In India, the incidence of thyroid disorders has risen in recent decades, with thyroid nodules being increasingly detected due to widespread use of ultrasonography and enhanced public awareness.[5,3] The prevalence of a palpable thyroid nodule in the community is about 12.2%, according to a recent Indian study. [6] However, thyroid cancer is quite rare, and the incidence is 8.7 per 100000 people per year, though this seems to be increasing over the years. [7] These statistics highlighted rising trend among the varied populations. Therefore, early and accurate diagnosis is crucial for effective management and treatment of these challenging conditions.

FNAC continues to be the gold standard for the initial evaluation of thyroid nodules, particularly in regions with limited access to advanced diagnostic tools.[3] Previous studies have demonstrated that FNAC offers highly accurate cytological data, facilitating the development of a definitive management plan, with sensitivity and specificity approaching 96%.[8] However, variability in the interpretation of FNAC results and the associated risk of malignancy persists. In many parts of India, the Bethesda System is not yet fully integrated into routine practice. Therefore, the present study aims to evaluate the role of FNAC in the diagnosis and classification of thyroid lesions in India, using the Bethesda System for Reporting Thyroid Cytopathology.

Methodology:

The present study was conducted in the Department of Pathology at a tertiary health care centre, Maharashtra, India after obtaining approval from the Institutional Ethics Committee. This was a two-year prospective study conducted over the duration of two years.
In this study, a total of 199 patients presenting with thyroid nodules or thyroid swelling who were referred for thyroid FNAC; Patients of all age groups and both sexes, were included. Neck swellings other than thyroid swelling; Patients with non-bleeding diathesis; Patients with hyperthyroid thyroid function test (TFT) status; Patients who did not provide consent for the procedure were excluded.

Cytological Procedure

Clinical details, examination findings, and procedural aspects were recorded for each patient. After explaining the procedure and obtaining informed consent, a local thyroid examination was performed to locate the swelling. Patients were positioned in Rose's position (supine with a pillow under the shoulders) for prominent visualization or upright for diffuse swellings. FNAC was performed using a 25–26-gauge needle, employing either aspiration or non-aspiration techniques, depending on the

swelling's nature. Ultrasound-guided FNAC was conducted for difficult-to-localize lesions, with radiological assistance.
Aseptic conditions were maintained, and clear communication addressed patients' concerns about discomfort. Ethical considerations, including privacy and confidentiality, were prioritized. The pathologist ensured transparency and patient understanding throughout the process.

Ultrasound-Guided FNAC
Ultrasound guidance aided sample collection in challenging cases, such as small, cystic, posteriorly located nodules or suspicious nodules within multinodular thyroids, enhancing precision.

Sample Handling and Staining
Aspirated material was smeared, fixed with ethanol for Papanicolaou staining or air-dried for May-Grünwald Giemsa staining. Samples from various sites were transported to the cytology lab, where staining and same-day reporting were performed by the cytopathologist.

Statistical analysis:
The data were entered into Microsoft Excel and presented in both tables and graphs. Frequency and percentage were used to describe qualitative variables, and the normality of the variable distribution was assessed.

Results:
This study analyzed 199 cases, in which 27 (13.56%) were males with an average age of 46.2 ± 9.24, as shown in Table 1.

Table 1: Demographic characteristics in the study group

Variables	**No of cases**	**Percentage**
Age (Mean ± SD)	46.2 ± 9.24	
Gender		
Female	27	13.56%
Male	172	86.43%

Table 2: Presenting complaints

Complaints	**No of cases**	**Percentage**
Swelling in Anterior Neck	199	100%
Dyspnea	5	2.5%
Hoarseness	8	4.02%
Dysphagia	18	9.04%
Weight gain	18	9.04%
Weight loss	7	3.51%
Palpitation	3	1.50%
Pain & Tenderness	9	4.6%
Weakness	2	1.01%
Fever	8	4.02%

Pain over Ear, Shoulder	3	1.50%
Exophthalmos	1	0.51%
Cold intolerance	5	2.6%
Sweating	5	2.6%
Numbness in hands & feets	1	0.51%

Most Common presentation is swelling in the neck in all (100%) case followed by Dysphagia andweight gain in 18 cases each and rest of the cases mentioned in Table 2.

Table 3: Duration of Thyroid Swelling:

Duration	Cases	%
0-3 months	78	39.2
4-6 months	37	18.5
7-9 months	10	5.02
9 months- 1 year	14	7.03
>1 year	60	30.15

In majority of the cases the duration of swelling- was 0-3 months in 78 cases i.e. 39.2% followed by>1 year in 60 cases i.e. 30.15%, as represented in Table 3.

Table 4: Location of Thyroid Swelling:

Location of swelling	**Cases**	**Percentage**
Both Lobes	60	30.15
Right lobe	76	38.19
Left lobe	55	27.63
Isthmus	19	9.5

According to Table 4, isthmus was involved along with involvement of either or both the lobes. Right lobe involvement was the most common presentation i.e. in 76 cases in 38.19%.

Table 5: Nature of Thyroid Swelling:

Nature of Thyroid Swelling	**Cases**	**%**
Soft	76	38.19
Soft to firm	81	40.12
Firm to Hard	36	18.06
Hard	6	3.01

In the Table 5, most common presentation of consistency in thyroid swellings - soft to firm in 81 i.e. 40.12%.

Nature of Aspirate:

Dark Brown-79 cases i.e. 39.7%. Hemmorhagic-120 cases i.e. 61.3%. Ultrasound Guided FNAs:-

Type of FNA
US guided FNAs 02 FNAs were done with US guidance rest 197 were done by direct FNAtechnique.

Table 6: Thyroid Function Tests details

TFT status	Case	Percentage
Euthyroid	125	80.00%
Hypothyroid	31	20.00%

Thyroid Function Tests details were available in 156 cases out that 125 i.e. 80% cases were Euthyroid, as represented in Table 6.

Table 7: Categorization According to Bethesda system

Bethesda Category	Diagnoses	No of cases	Percentage
Category I	Unsatisfactory/Non-Diagnostic	26	13.06%
Category II	Benign	141	70.8%
Category III	AUS/FLUS	9	4.5%
Category IV	FN/SFN/FNHCT/SFNHCT	13	6.5%
Category V	Suspicious of Malignancy	6	3.01%
Category VI	Malignant	4	2.01%

The results of the present study show that, 26 cases (13.06%) were classified as Bethesda Category I, indicating unsatisfactory or non-diagnostic samples. A majority of the cases, 141 (70.8%), were categorized as Bethesda Category II, denoting benign diagnoses. Nine cases (4.5%) were classified as Bethesda Category III, suggestive of atypia of undetermined significance or follicular lesion of undetermined significance (AUS/FLUS) rest of the cases mentioned in the above table 7 and Figure A to F.

Discussion:
In the current study, the age of the patients varied from 0 to over 60 years, with a mean age of 46.2 years. This age distribution and mean incidence were consistent with the findings of several previous studies. Specifically, Jamaiyar A et al. (2023),[9] Sinna EA et al. (2012) [10] and Al Maqbali T et al. (2012) [11] reported similar age ranges and mean ages in their respective cohorts. These findings suggest a comparable demographic profile across these studies, emphasizing the generalizability of the present results.

The findings of the present study revealed that, the most prevalent complaint among patients were dysphagia, which occurred in 9.04% of cases, followed by pain and tenderness, which was reported in 4.6% of cases. Other complaints are detailed in Table 2. These results are consistent with those reported by Eng OS et al. (2014), [12] who identified dysphagia as the most common symptom in their cohort, affecting 80% of patients. This was followed by globus sensation (69%), choking (49%), and dyspnea (32%). Additionally, the present findings similar with those of Banks CA et al. (2012), [13] who also highlighted dysphagia as a predominant symptom in their study population.

Our study demonstrated that, in the majority of cases, the duration of thyroid swelling was observed to be between 0 to 3 months in 78 cases, accounting for 39.2% of the total cohort. This was followed by a duration of greater than 1 year, which was noted in 30.15% of cases. These findings were

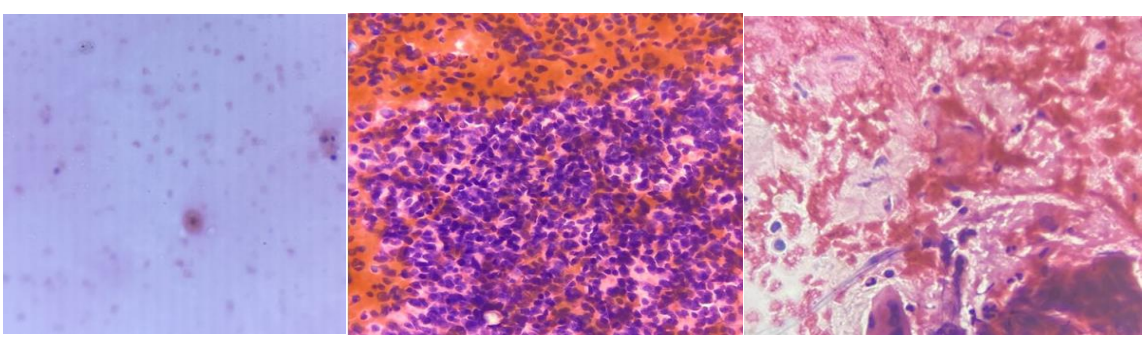
consistent with those reported in previous studies, including the research done by Sengupta A et al., [14] who also observed similar patterns in the duration of thyroid swelling.
The findings of the present study showed that, thyroid swelling was most commonly observed in the right lobe, affecting 38.19% of cases. This was followed by involvement of both the right and left lobes in 30.15% of cases, the left lobe alone in 27.63%, and the isthmus in 9.5% of patients. These results were consistent with the study by Patel et al. (2019), [15] which reported that 46% of thyroid lesions were located on the right side, 32% on the left, and 22% involved both lobes. Thus, in the current study, the right lobe was found to be the most commonly affected.

Regarding the consistency of the thyroid swellings, the majority of participants (40.12%) presented with a soft to firm consistency, followed by soft (38.19%), firm to hard (18.06%), and hard (3.01%) swellings. These findings were concordance with Kumari et al. (2023), [16] who observed a soft consistency in 10% of cases, while hard swellings were noted in 12% of cases, most of which were diagnosed as malignant.
In this study, Table 6 presents the details of thyroid function tests, where 125 cases (80.00%) were classified as euthyroid, and 31 cases (20.00%) were classified as hypothyroid. Similar results are reported by previous literature. [17,2] [Michimi Daimary,][Puri R]

Comparison of the distribution of cases according to TBSRTC:

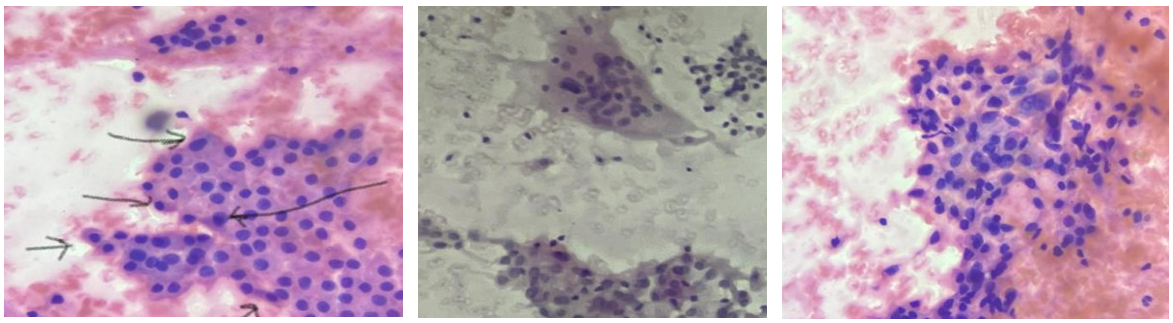
Sr. No.	Name	Year	Category I	Category II	Category III	Category IV	Category V	Category VI
1	Mehar et al [18]	2019	5.2	79.2	5.6	1.6	1.4	7
2	Munavarah et al [19]	2019	5.5	77.7	3.7	7.4	3.7	1.84
3	Shrivastav et al., [20]	2020	2.9	76.7	0.9	7.7	0	11.6
4	Choden et al., [21]	2021	6.0	82.0	1.4	3.8	2.4	4.4
5	Daimary M, et al., [17]	1. 2023	18.86	43.39	16.98	15.09	3.01	2.01
6	The present study		13.06	70.8	4.5	6.5	3.01	2.01

Papillary Carcinoma of Thyroid was the most common malignant lesion encountered in the present study with two cases. Follicular cells were arranged in sheets and papillary fragments on smears. Nuclear overlapping was observed in both cases. Scant stingy colloid was also seen. Few follicular cells in one case revealed presence of intracytoplasmic pseudoinclusions in our study. These intranuclear vacuolations were first noted by Soderstrom to be an important criterion of malignancy in FNAC smears of thyroid lesions. 83 Metastases in Thyroid are very rare in spite of its rich vascular and lymphatic supply but in rare cases metastases are found in thyroid mainly from organs viz., Breast, Liver or Kidney. In our study one case of metastasis in thyroid gland from epithelial origin probably from breast malignancy was reported. One case of Anaplastic/ Undifferentiated carcinoma was diagnosed on cytology during this study. Smear showed presence of round-polygonal epitheloid neoplastic cells arranged isolated or in variable size groups.



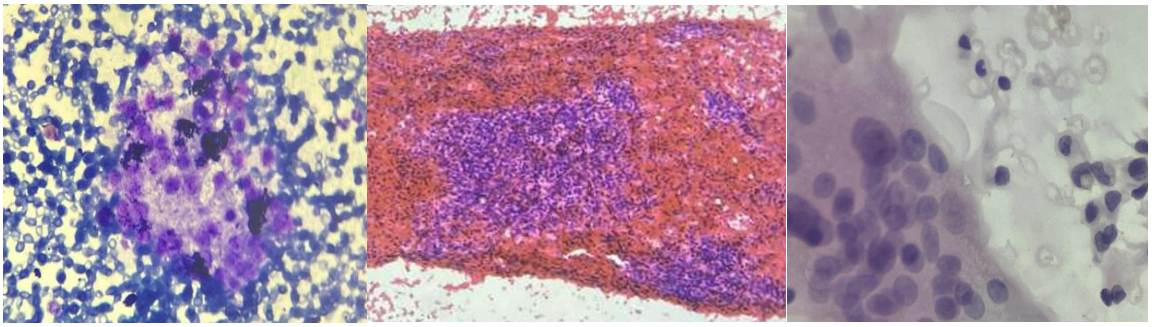
A **B (a)** **B (b)**

Figure A: Showing Bethesda Category I- Cyst Fluid only Showing Cyst macrophages in the background of Colloid. Figure B (a): Bethesda Category II- Lymphocytic Thyroiditis 10x and 40x showing Granuloma; (b): Bethesda Category II- Granulomatous Lymphadenitis under 10x and 40x.



C **D (a)** **D (b)**

Figure C: Showing Bethesda Category III- Atypia/Follicular Lesion of Undetermined Significance. Figure D (a): Bethesda Category IV- Follicular Neoplasm 10x and 40x Showing crowding of cells in a hypercellular smear with follicle formations; (b): Bethesda Category IV- Follicular Neoplasm with Hurthle cell Change –Hurthle cells focused.



E **F (a)** **F (b)**

Figure E: Showing Bethesda Category V- Suspicious of Malignancy (Papillary Type) Suspicious of Malignancy (Papillary Type); Figure F (a): Bethesda Category VI- Anaplastic Carcinoma 10x and 40x Anaplastic Carcinoma 10x and 40x; (b): Bethesda Category VI- Papillary Carcinoma 40x and 100x Follicular cells showing Intranuclear pseudoinclusions surrounded by ropy colloid.

FNAC of thyroid gland is an important and widely accepted cost-effective safe and accurate method for triaging patients with thyroid nodules. There are rarely any difficulties in diagnosing most of the thyroid lesions and overtly malignant lesions. Diagnostic challenges arise when aspirate samples are quantitatively for qualitatively suboptimal to reliably exclude a neoplastic process. Furthermore, the management of such lesions was complicated in the past by the lack of universal terminology; to cater to these needs Bethesda system of reporting was introduced.

This system was undertaken to classify the thyroid lesions based on Bethesda system of reporting thyroid cytopathology, thereby providing data that would help in planning prognostic and therapeutic approach in patients with thyroid swelling, but this system of reporting is a comprehensive system for cytological diagnosis of thyroid lesions and with strict diagnostic criteria for each category predicting risk of malignancy and guidelines for planning for further management thus establishing an excellent clinicopathological correlation providing clinicians with clear and comprehensible reports.

Conclusion:

The Bethesda system is very useful for standardizing system for thyroid cytopathological reporting. Best communication between clinicians and cytopathology just leading to more consistent management approaches. The result of present study recommends the use of Bethesda system for reporting thyroid cytopathology in a tertiary care hospital in future.

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