

## The Bethesda System for Reporting Thyroid Cytopathology and its Histopathological Correlation

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### Abstract

**Background:** Fine needle aspiration cytology, is an initial investigation in evaluation of thyroid lesions. Due to lack of standardized system for reporting thyroid lesions in cytology in 2007, “The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC)” was introduced. It is a six tier system.

**Aim:** To classify thyroid FNACs based on “The Bethesda system” and to compare the results with histopathology.

**Objectives:** To analyse thyroid cytology through TBSRTC and analyse distribution of lesions in various categories and to correlate the same with histopathology.

**Material and Methods:** The study is a cross sectional study done in Department of Pathology, Sri Krishna Medical College, Muzaffarpur, Bihar from September 2021 to July 2022.

**Results:** Total of 143 cases were studied, 108 were females and 35 males. Age of patients ranged from 9 to 80 years. Majority in 31- 40 years. Adequacy rate was 96%. 119 cases were non – neoplastic, 19 cases were neoplastic, and 5 cases -unsatisfactory. Category II had maximum number of cases (119) majority was colloid goiter (70 cases). No cases in the category III. Category IV - 13 cases, among them 7 cases benign in histopathology, 4 cases - Papillary carcinoma, 1 case each of Follicular carcinoma and Lymphoma. Category V - 3 cases, among them one each was MNG, Follicular carcinoma and Follicular variant of Papillary carcinoma in histopathology. Category VI had 3 cases of Papillary carcinoma and had 100 % correlation in histopathology. The Sensitivity and specificity of The Bethesda system was 20% and 100 % respectively. The PPV - 100% and NPV - 91.1%.

**Conclusion:** Further studies with larger sample size recommended overcoming the low sensitivity rate in the present study.

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## Background

Fine needle aspiration cytology (FNAC) considered one of the initial diagnostic investigations in the evaluation of thyroid lesions. The easily available screening test is FNAC. It can effectively categorise patients with neoplastic and non-neoplastic thyroid nodules as whether they require surgery or not. Due to lack of standardized system for reporting thyroid lesions in cytology, interpretation of cytology of thyroid reports was difficult for the referring clinicians.

The Bethesda System for Reporting Thyroid Cytopathology is the system used to report whether the thyroid cytological specimen is benign or malignant on fine-needle aspiration cytology (FNAC). It can be divided into six categories: Non diagnostic/Unsatisfactory is category I, Benign is category II, Atypical Follicular Lesion of Undetermined Significance (AFLUS) is categorised as category III, Suspicious for Follicular Neoplasm comes under category IV, suspicious for malignancy is classified as category V and malignant lesions come under category VI. Every diagnostic category has its own risk of malignancy, thereby influencing the management protocol. The present study aims at classifying the thyroid fine needle aspirations based on the Bethesda system for reporting thyroid cytopathology and to compare the results with histopathology wherever surgery was done.

## Materials and methods

The Cross sectional study was conducted at Department of Pathology, Sri Krishna Medical College, Muzaffarpur, Bihar from September 2021 to July 2022.

## Inclusion criteria

Fine needle aspiration of patients with thyroid lesions at the Department of Pathology, SKMC, Muzaffarpur, Bihar who

subsequently underwent thyroidectomy at our institution during the study period were included.

## Exclusion criteria

- a. Fine needle aspirations of thyroid without further thyroidectomy
- b. Thyroidectomy specimens without previous fine needle aspirations

## Methodology

Study done in Department of Pathology, SKMC, Muzaffarpur, Bihar. After obtaining detailed clinical history and getting informed consent, the site is cleansed with spirit and fine needle aspiration was done using 21 to 26 gauge needle and 20ml syringe. Aspirate obtained is immediately spread on to a glass slide.

One slide is air dried for Giemsa stain and other slide fixed in isopropyl alcohol for 15 minutes. After Alcohol fixation smears are stained with Papanicolaou stain. The smears are examined and cytological diagnosis is made and categorized according to The Bethesda system.

Thyroidectomy specimens are fixed in 10% buffered formalin overnight. Appropriate bits are taken the next day. Processing was done, blocks made, sections are cut with microtome in 5  $\mu$  thickness. Sections are stained with Hematoxylin and Eosin stain and studied and histopathological diagnosis made.

## Study Variables

- i. FNA diagnosis
- ii. Histopathological diagnosis

## Statistical Analysis

Statistical analysis performed using SPSS version 20.0 (statistical package for social sciences). Results were interpreted using tables. Descriptive statistics like mean,

median, standard deviation, and range were also calculated.

## Results

143 cases of thyroid fine needle aspirations

were collected and categorized according to

The Bethesda system of reporting thyroid cytopathology, and it was correlated with the histopathological diagnosis.

**Table 1: Distribution of patients according to age (N=143)**

Age (in years)	Number	Percent (%)
1-10	1	0.69
11-20	7	4.89
21-30	23	16.08
31-40	50	34.96
41-50	39	27.27
51-60	12	8.39
61-70	8	5.59
71-80	3	2.09
Total	143	100
Mean $\pm$ SD= 32.77 $\pm$ 7.284, Median (IQR) =32.5(9-80)		

Major proportion of the patients (34.96%) belonged to age group of 31-40 years.

**Table 2: Distribution of patients according to gender (N=143)**

Gender	Number	Percent (%)
Male	35	24.47
Female	108	75.53
Total	143	100.0

Majority of the patients (75.53%) were females.

**Table 3: Distribution of patients according to Adequacy rates in cytology (N=143)**

Adequacy rates	Number	Percent (%)
Satisfactory	138	96.5
Non Satisfactory	5	3.5
Total	143	100

Majority of the patients (96.5%) presented with satisfactoryadequacy rates in cytology.

**Table 4: Distribution of patients according to Neoplastic & Non neoplastic lesions (N=138)**

Type	Number	Percent (%)
Neoplastic	19	13.7
Non Neoplastic	119	86.3
Total	138	100

Majority of the patients (86.3%) presented with Non Neoplastic lesions.

**Table 5: Distribution of patients according to Bethesda system (N=143)**

Categories	Number	Percent (%)
Category I	5	3.49
Category II	119	83.21
Category III	0	0

Category IV	13	9.09
Category V	3	2.09
Category VI	3	2.09
Total	143	100

Majority of the patients (83.21%) presented with Category II lesions.

**Table 6: Distribution of patients according to Category II (N=119)**

Categories	Number	Percent (%)
Colloid goitre	70	58.8
Colloid goitre with cystic degeneration	40	33.6
Hashimotos' Thyroiditis	4	3.36
Hyperplastic nodule	5	4.20
Total	119	100

Majority of the patients (58.8%) presented with Colloid goiter.

**Table 7: Distribution of patients according to Neoplastic lesions (N=19)**

Type	Number	Percent (%)
Atypia of undetermined significance (Category III)	0	0
FN/SFN (Category IV)	13	68.4
Suspicious for malignancy (Category V)	3	15.8
Papillary Carcinoma (Category VI)	3	15.8
Total	19	100

Majority of the Neoplastic lesions (68.4%) were of Category IV (FN/SFN).

**Table 8: Distribution of FN/SFN (Category IV) in Histopathology (N=13)**

Categories	Number	Percent (%)
Adenomatous goiter	4	30.7
Hashimoto's Thyroiditis	2	15.4
Nodular goiter	1	7.7
Follicular carcinoma	1	7.7
Papillary carcinoma and its follicular variant	4	30.7
Lymphoma	1	7.7
Total	13	100

Majority of FN/SFN (Category IV) in Histopathology were both adenomatous goiter and papillary carcinoma each constituting 30.7% of cases.

**Table 9: Distribution of Suspicious for malignancy (Category V) in Histopathology (N=3)**

Categories	Number	Percent (%)
Multinodular goiter	1	33.3
Follicular variant of Papillary carcinoma	1	33.3
Follicular carcinoma	1	33.3
Total	3	100

Of the 3 cases of Suspicious for malignancy (Category V) in histopathology, one is Multinodular goiter (33.3%), second is Follicular variant of Papillary carcinoma (33.3%) and other is Follicular carcinoma (33.3%).

**Table 10: Distribution of Category VI in Histopathology (N=3)**

Categories	Number	Percent (%)
Papillary carcinoma	3	100
Total	3	100

All the 3 cases of (Category VI) in histopathology are papillary carcinoma (100%).

**Table 11: Distribution of patients according to diagnosis in Histopathology (N=143)**

Categories	Number	Percent (%)
Colloid goiter	72	50.3
Colloid goiter with cystic degeneration	4	2.8
Adenomatous goiter	23	16.1
Hashimoto's Thyroiditis	17	11.9
Follicular Adenoma	12	8.4
Follicular carcinoma	2	1.4
Papillary carcinoma	10	7.0
Follicular variant of Papillary carcinoma	2	1.4
Lymphoma	1	0.7
Total	143	100

Majority of patients in histopathology (50.3%) presented with Colloid Goitre.

**Table 12: Malignancy rate of each Bethesda category**

Bethesda category	Malignancy rate (%)
I	0
II	3.4
III	0
IV	46
V	66
VI	100

**Table 13: 2 x 2 Contingency table comparing Bethesda system with Histopathology (N=138)**

Bethesda system	Histopathology		Total
	Carcinoma	Benign	
Carcinoma	3 (TP)	0 (FP)	3
Benign	12 (FN)	123 (TN)	135
TOTAL	15	123	138

Indicators	Percentage
Sensitivity = $TP/(TP+FN)$	20%
Specificity = $TN/(TN+FP)$	100%
Positive Predictive Value = $TP/(TP+FP)$	100%
Negative Predictive Value = $TN/(TN+FN)$	91.1%

## Discussion

The mean age of presentation of patients in present study was  $32.77 \pm 7.284$ . The mean age of study of Gupta *et al* [1] (38.7) and

Naz *et al* [2] (39.7) was comparable to the current study (32.7) The mean age of Ji Hye

Park *et al* [3] (50) study was higher than the present study.

The Female to male ratio obtained in the present study is 3:1. Thyroid lesions are more prevalent in females, this is seen in present study and it was comparable with studies of Naz *et al* [2] Ji Hye Park *et al* [3] and Melo Uribe *et al* [4]. In the study of Melo Uribe *et al* [4] the ratio of female to male ratio was higher.

The adequacy rate of the present study was 96%. The adequacy rate of the current study was comparable with studies of Melo Uribe *et al* [4] Naz *et al* [2] and Handa *et al* [5].

Non neoplastic lesions were common in the present study, this was in concordance with study by Handa *et al*. 68 The studies of Tabaqchali *et al* [6] and Melo uribe *et al* [4] had nearly equal incidence of non-neoplastic and neoplastic lesions, this may be probably because of the studies being conducted in oncology institutes.

The incidence of lesions in all categories of present study was comparable with the study of Mondol *et al* [7] Incidence of category I lesions were far lower than the studies of Ji Hye Park *et al* [3] and Vickie Y Jo *et al* [8] owing to the repetition of FNA if they are inconclusive. There were no lesions in category III in the present study.

The incidence of malignancy rates according to the Bethesda system for category II is 0-3%, category III is 5-15%, category IV is 15-30%, category V is 60-75%, category VI is 97-99%. The percentage of occurrence of malignancies in each category of the present study was in concordance with all categories except category IV.

In category IV, present study had higher incidence of malignancy, probably of missing Follicular variant of papillary carcinoma which was thought to be as Follicular neoplasm.

In the present study specificity, positive predictive value and negative predictive value were all in concordance with studies of Gupta *et al* [1] Handa *et al* [5] and Tabaqchali *et al* [6] Even the specificity and positive predictive value were 100% which implies the efficacy of the FNA performed in our institution.

The low rate of sensitivity may be due to small sample size, smaller size of malignant lesion in a large gland.

### Conclusion

Thyroid swellings are still an enigma to the surgeon and the pathologist. Diagnostic accuracy of cytopathology is proven by the present study with 100% specificity and 100% PPV. Thus, as a screening test before surgery, FNAC still needs to be followed as a routine procedure for successful patient management.

Adequacy rate of the present study is 96%. This can be further enhanced by further imaging technique like ultrasound.

Category I and II in the non-neoplastic category of The Bethesda system have more accurate categorization index. Similarly category V and VI had precision in the diagnosis. This indicates that there are clearcut distinctions between the two ends of the spectrum of non-neoplastic and neoplastic lesions.

However category III had no cases and category IV had high discordant rate. This suggests that there is need of further clarity for diagnostic categorization in this grey zone. It could be further refined by applying more advanced immunocytochemical and molecular genetic analysis to these patients falling in the grey zone.

Further studies involving larger sample size and with specialized techniques is the need of the hour for patients with thyroid swelling.

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