



Research Article

Evaluation of Bethesda System for Reporting Thyroid Cytology with Histopathological Correlation

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Abstract

Background: *The Bethesda system of reporting thyroid cytopathology is a standardised system, improving communication between cytopathologists and clinicians, leading to more consistent management approaches. The aim of the research work was to study the utility of Bethesda system in reporting thyroid cytology with histopathological correlation of all the cases undergoing surgical resection.*

Methods: *We studied all the thyroid cytology cases received between January 2017 to June 2018, and classified them according to the Bethesda system. Histopathological correlation was done for all the cases which underwent surgical resection with evaluation of cyto-histological discrepancies.*

Results: *Out of 423 cases studied on FNAC, 152 cases available for histopathological follow-up, cyto-histological discrepancies were noted in 11 cases. 132 (86.84%) were benign lesions, 13 (8.55%) were Follicular neoplasm/Suspicious for neoplasm, 3 (1.97%) were suspicious for malignancy, and 04 (2.63%) were malignant, 0 case in Unsatisfactory/ Non diagnostic & Atypia of undetermined significance. Statistical analysis of the present study showed that cytological analysis of thyroid lesions by Bethesda system has got high sensitivity (73.68%), high specificity (95.48%) with a positive predictive value of 70% and negative predictive value of 96.24% and a high efficacy (97.55%).*

Conclusions: *Reviewing the thyroid FNAs (fine needle aspirates) using Bethesda system allowed a more specific cytological diagnosis with better inter laboratory agreement. As evidenced by its high sensitivity and specificity, Bethesda system has proven to be a very effective guide for the clinical management of thyroid nodules.*

Keywords: *Bethesda, Cytology, Thyroid.*

Introduction

Fine needle aspiration (FNA) of the thyroid gland has proven to be an important and widely accepted, cost-effective, simple, safe, and accurate method for triaging patients with thyroid nodules.

Fine needle aspirations provide information that guides the management of patients with thyroid nodules by identifying patients who require

surgical resection and patients who require no further interventions.⁽¹⁾

Thyroid cytopathology practice requires communication and collaboration among pathologists and primary clinicians, endocrinologists, radiologists, and surgeons, as well as correlation with surgical pathology interpretations.

Therefore, consistent diagnostic terminology is imperative. While there are minimal difficulties in diagnosing most benign and overtly malignant lesions, diagnostic challenges arise when aspirate samples are quantitatively or qualitatively suboptimal to reliably exclude a neoplastic process.

The management of these types of lesions has been further complicated by the historic lack of universal terminology. Multiple organizations have proposed diagnostic guidelines for reporting thyroid FNA cytology results, including the Papanicolaou Society of Cytopathology Task Force and American Thyroid Association, although none have been necessarily universally accepted.⁽¹⁾

Throughout 2007, the National Cancer Institute (NCI), organized the NCI Thyroid Fine Needle Aspiration State-of-the-Science Conference.

The Bethesda System describes 6 diagnostic categories of lesions which have individual implied risks of malignancy that influence management paradigms.

The present study was done to interpret the thyroid FNAC as per Bethesda system and to evaluate its efficacy by taking histologic findings as standard.

Methods

Source of Data

All the cases of thyroid lesions received in the cytology section of the department of pathology, GMC, Nanded for FNAC; during the period of January 2017 to June 2018 (one and half year of prospective study).

Method of collection of data

In all the patients with thyroid lesions, clinical history, physical findings and probable diagnosis were noted. FNAC was performed by a pathologist either by conventional method of palpation using a 22gauge needle. Direct smears were prepared and were either air dried and fixed in alcohol and stained with 'haematoxylin and eosin'.

Procedure of thyroid FNA

The FNA was done with a 22-23gauge needle disposable needle attached to a 20ml plastic disposable syringe mounted on a handle (syringe holder) for single-hand grip.

The patient was made to lie down in supine position with neck hyper-extended. Extension of the neck was facilitated by avoiding a pillow under the head, and keeping under the neck to further extend the cervical spine and expose the gland more prominently.

The patient was asked to refrain from swallowing during the procedure which takes about 5-20sec.⁽²⁾

The skin overlying the swelling was cleaned thoroughly with alcohol. The needle is inserted into the nodule and plunger is retracted to create a vacuum in the syringe. The needle is then moved back and forth and from side to side gently within the lesion, all the time maintaining the negative pressure in the syringe. The plunger was then released.

The needle with syringe was then withdrawn from the thyroid. The needle was quickly detached from the syringe and the plunger was retracted to allow air to fill the syringe barrel.

The needle was then re-attached to the syringe and the contents ejected on to a glass slide by pushing down the plunger.^(2, 3)

Direct smears were prepared and were either air dried and fixed in alcohol and stained with 'haematoxylin and eosin'.

Thyroid specimens received were fixed in 10% formalin for 12 to 24hrs after recording the gross morphological features.

The specimens were routinely processed, embedded in paraffin wax and sections were cut at 3 to 6µm thickness. Sections were stained routinely with H and E stain. Special stains like Congo red were employed wherever indicated.

Inclusion Criteria

Patients presenting with thyroid nodule or swelling & those who are referred from ENT & Surgery OPD for thyroid FNA.

Exclusion Criteria

- Patients with bleeding diathesis.

- Recurrence after treatment of primary thyroid malignancy
- Patients in whom only HPE done without prior FNAC done in our OPD.

- Negative predictive value

Statistical Analysis

- Sensitivity
- Specificity
- Positive predictive value

Results

Total number of cases studied on FNAC were 423. The maximum number of cases were in the age group of 21-30years. Out of the total 423 cases, 390 cases were females (92.19%) and 32 cases were males (7.80%)

Chart No. 1:- Percentage distribution of the sample according to age (n=423)

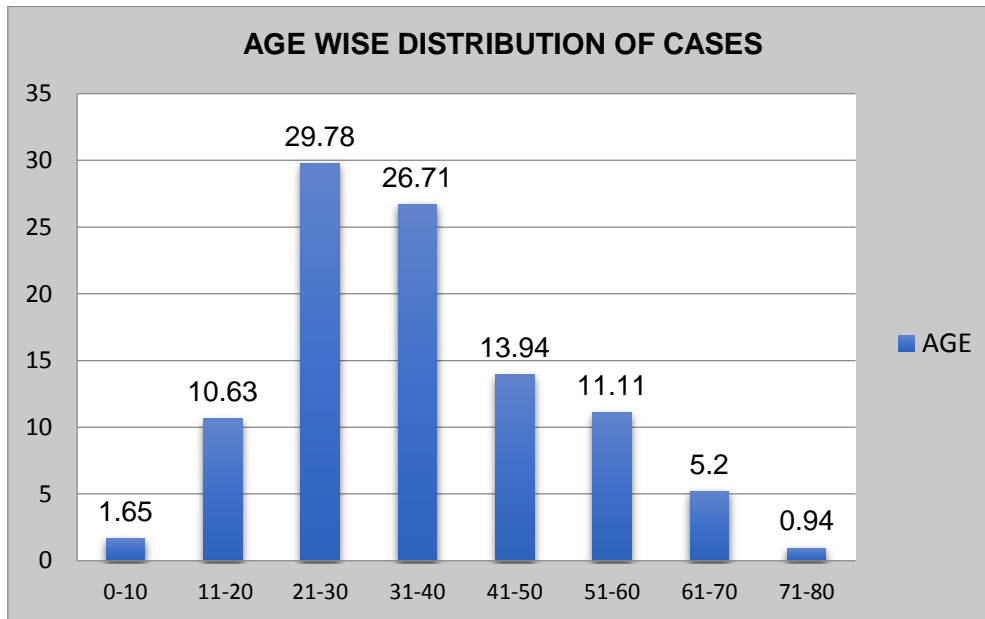
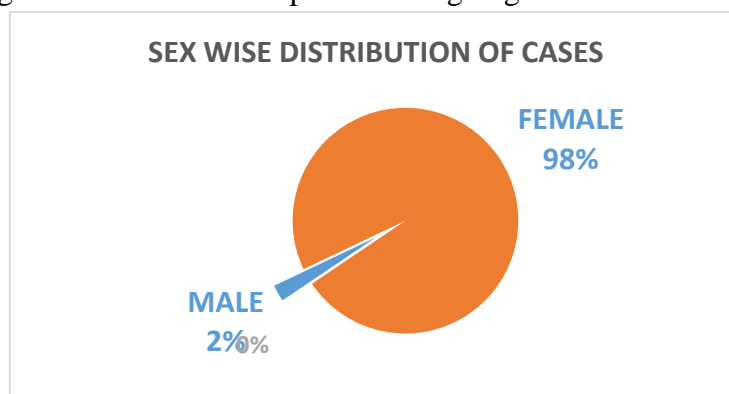


Chart No. 2:- Percentage distribution the sample according to gender



Out of 423 cases, 391 (92.43%) were benign lesions, 4 (0.94%) were malignant, 0 (0%) were Unsatisfactory/ Non diagnostic, 25 (5.91%) were Follicular neoplasm/Suspicious for neoplasm, 3

(0.7%) were suspicious for malignancy, and 0 (0%) case was reported as Atypia of undetermined significance.

Table 1: Cytological diagnosis as per the Bethesda system

Cytological diagnosis	No. of cases	Percentage(%)
Unsatisfactory/ Non Diagnostic	0	0
Benign	391	92.43
Atypia Of Undetermined Significance	0	0
Follicular Neoplasm/Suspicious For Neoplasm	25	5.91
Suspicious For Malignancy	03	0.70
Malignant	04	0.94
Total	423	100

The Fine needle aspiration smears which were adequate for evaluation were categorized into non neoplastic and neoplastic lesions. The Non neoplastic lesions included colloid goitre, colloid goitre with cystic degeneration, hyperplastic nodule, and Hashimoto’s thyroiditis. They come under category II of The Bethesda system.

The Neoplastic lesions comprise of “Follicular neoplasm or suspicious for follicular neoplasm, “suspicious of papillary carcinoma”, and “Suspicious for malignancy”.

Table No. 2 Distribution of patients according to Non neoplastic lesions On FNAC (n=391)

Sr No.	Lesions	No. of cases	Percentage (%)
1	Colloid Goitre	250	63.93
2	Thyroid cyst	15	3.83
3	Colloid Goitre with cystic change	50	12.78
4	Hashimoto’s thyroiditis	10	2.55
5	Lymphocytic Thyroiditis	36	9.20
6	Acute thyroiditis	09	2.30
7	Granulomatous thyroiditis	14	3.58
8	Hyperplastic nodule	06	1.53
	Total	391	100

Table 3: Cytological diagnosis of Neoplastic lesions on FNAC (n=32).

Sr. No.	Lesions	No. of cases	Percentage (%)
1	Follicular neoplasm/ Suspicious for follicular neoplasm	25	78.12
2	Papillary carcinoma	03	9.37
3	Undifferentiated carcinoma	01	3.12
4	Suspicious for malignancy	03	9.37
	Total	32	100

Out of 423 total number of thyroid FNAC only 152 underwent surgery and correlated with FNAC findings. Due to conservative management in most of the cases and further referral to higher

centres. Various specimen received are studied and distribution of patients according to diagnosis in Histopathological diagnosis was given

Table No 4: Histopathological Distribution of patients according to Bethesda system (n=152)

Sr. no	Categories	No. of cases	Percent (%)
1	Category I	0	0
2	Category II	132	86.84
3	Category III	0	0
4	Category IV	13	8.55
5	Category V	03	1.97
6	Category VI	04	2.63
	TOTAL	152	100

Table No 5: Comparison of incidence of Bethesda categories

Study	Bethesda I	Bethesda II	Bethesda III	Bethesda IV	Bethesda V	Bethesda VI
Vickie Y. Jo et al ⁽⁸⁵⁾ (2010)	18.6%	59%	3.4%	9.7%	23%	7%
Mondol et al ⁽⁷⁹⁾ (2013)	1.2%	87.5%	1%	4.2%	1.4%	4.7%
Ji Hye Park et al ⁽⁷⁶⁾ (2014)	13.3%	40.6%	9.1%	0.4%	19.3%	17.3%
Present study	0%	86.34%	0%	8.55%	1.97%	2.63%

Table No 5: Cytological - Histological diagnosis correlation

Cyto pathological correlation	No. of cases where surgical specimens were received (n=152)	% of the category	Cytological diagnosis	Histopathological diagnosis	No. of cases
ND/UNS (n=0)	0	0	-	-	0
Benign (n=391)	132	92.43	Colloid goitre (n=101)	Colloid goitre	97
				Adenomatous goitre	1
				Multinodular goitre	1
				Follicular variant of PTC	2
			Colloid goitre with cystic change (n=19)	Colloid goitre with cystic change	17
				Follicular variant of PTC	1
				Follicular Carcinoma	1
			Hashimoto's thyroiditis (n=6)	Hashimoto's thyroiditis	4
Multinodular goitre	2				
Hyperplastic nodule (n=6)	Adenomatous goitre	5			
	Follicular adenoma	1			
AUS/FLUS (n=0)	0	0	-	-	0
FN/SFN (n=25)	13	5.91	Suspicious for follicular Neoplasm (n=13)	Adenomatous goitre	2
				Follicular adenoma	3
				Follicular carcinoma	3
				Follicular variant of PTC	4
				MTC	1
SFM (n=3)	3	0.70	Suspicious for malignancy (n=3)	Multinodular goitre	1
				Follicular variant of PTC	2
Malignant (n=4)	4	0.94	Papillary thyroid carcinoma (n=3)	Papillary thyroid carcinoma	3
			Undifferentiated carcinoma (n=1)	Anaplastic carcinoma	1

Color Plate

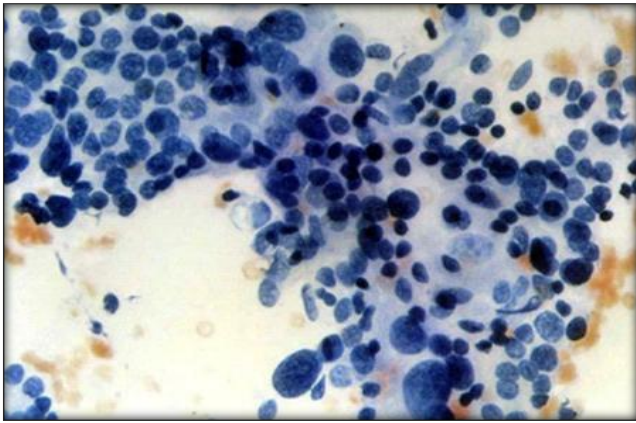


Figure 1. Follicular neoplasm - Photomicrograph: FNAC showing syncytial aggregates of cells showing variation in size, nuclear crowding and nuclear overlapping. (MGG, x 40)

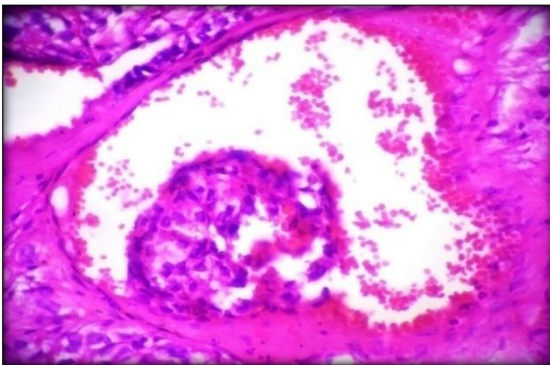


Figure 2. Follicular carcinoma- Photomicrograph: Vascular invasion (arrow) in Follicular carcinoma (40X), H&E stain.



Figure 3. Papillary thyroid carcinoma- Photomicrograph Gross: Resected specimen on cut surface showing partly encapsulated brown coloured tumour mass with papillary excrescences

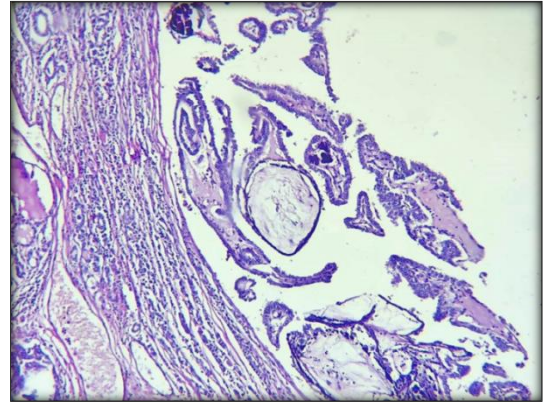


Figure 4. Papillary thyroid carcinoma: Photomicrograph showing papillae with fibrovascular core and nuclear crowding, overlapping, and psammoma bodies (arrow). (H&E, x 10)

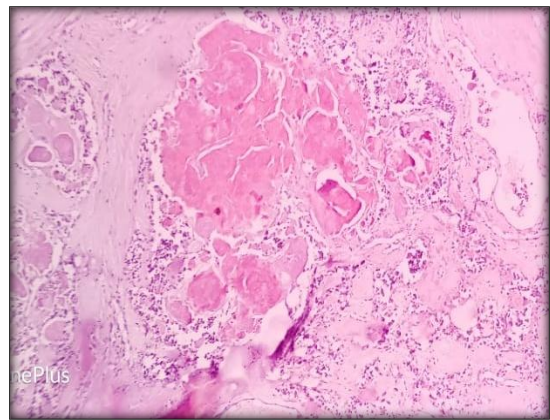


Figure 5. Medullary thyroid carcinoma- Photomicrograph: Tissue section showing dispersed tumour cells and acellular homogeneous eosinophilic material (amyloid, arrow). (Congo red, x 10)

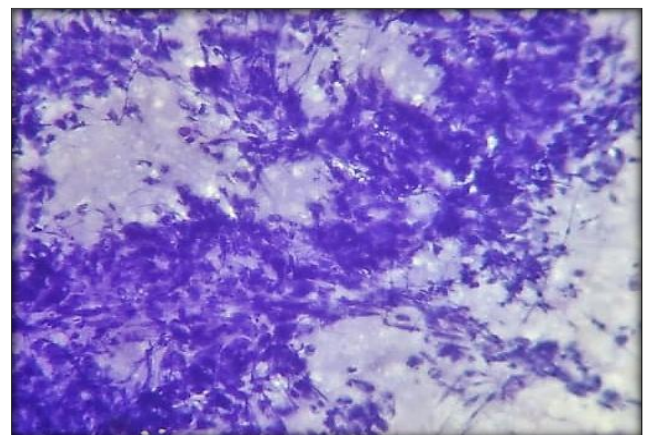


Figure 6. Anaplastic thyroid carcinoma- Photomicrograph: FNAC showing highly pleomorphic anaplastic tumour cells with coarse chromatin. (H&E, x 40)

Discussion

FNAC is the first line diagnostic test for evaluating thyroid nodules. FNAC can effectively triage patients with neoplastic thyroid nodules as to who require surgery and who do not. However, due to the lack of a standardized system of reporting, pathologists have been using different terminologies and diagnostic criteria, thereby creating confusion among referring clinicians in the interpretation of the cytopathology report, ultimately hindering a definitive clinical management. Reviewing the thyroid FNAs with the Bethesda system allowed a more specific cytological diagnosis.⁽⁴⁾

In this study, an attempt was made to report the thyroid FNAs as per the Bethesda system and also to assess the efficacy by comparing with the histopathological diagnosis wherever possible. Out of the 432 cases in the present study, 152 cases were operated. 0% were unsatisfactory, 86.8% were benign follicular lesion, 0% were AUS/FLUS, 8.55% were FN/SFN, 1.97% were SFM, and 2.63% were malignant. We compared the results obtained in the present study with the studies of **Ji Hye Park et al**⁽⁵⁾, **Mondol et al**.⁽⁴⁾, **Vickie Y Jo et al**⁽⁶⁾

The incidence of lesions in all categories of present study was comparable with the study of **Mondol et al**.⁽⁴⁾ Incidence of category I lesions were far lower than the studies of **Ji Hye Park et al**⁽⁵⁾ and **Vickie Y Jo et al**⁽⁶⁾, owing to the repetition of FNA if they are inconclusive. There were no lesions in category III in the present study.

Most common age group in which thyroid lesions were found was **21-30** years comprising 126 cases (**29.78%**) of total patients, followed by **31-40** years which contains 113 cases (**26.71%**) of total patients, least common was in **71-80** years containing only 4 cases (**0.94%**) of total patients. The youngest patient in present study was of age 7yr and oldest patient was 80yr of age. Mean age was found to be **36.8** years.

Out of the 423 patients with thyroid lesions **390** were females and **32** were males. Female to male

ratio is **12:1**. The youngest patient was 6 years old female child and the eldest was 80 year old female.

FNAC is a highly sensitive and specific method of evaluating thyroid nodules for malignancy. FNAC of thyroid nodule is reported to have sensitivity ranges from 65-98% and specificity of 72-100%. In present study Sensitivity, Specificity, Positive predictive, Negative predictive value and accuracy are **73.68%**, **95.42%**, **70%**, **96.2%** and **97.55 %** respectively and is comparable with Afroze N et al (2002)⁽⁷⁾ Tabaqchali et al⁽⁸⁾

Conclusion

The Bethesda system is a very useful standardised system of reporting thyroid cytopathology, improving communication between cytopathologists and clinicians, and inter laboratory agreement, leading to more consistent management approaches. As evidenced by its high sensitivity and specificity, Bethesda system has proven to be an effective guide for clinical management of thyroid nodules.

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