

Cytological Analysis of Thyroid lesions According to the Bethesda System for Reporting Thyroid Cytology and their Correlation with Histopathology: A Prospective Study

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Abstract

Introduction: Fine-needle aspiration cytology (FNAC) has a crucial role in differentiating between non-neoplastic and neoplastic lesions of the thyroid. It is a quick outpatient department (OPD) procedure. It greatly affects the treatment decision. The current study was done to evaluate the role of FNAC as a diagnostic tool in thyroid lesions and establish a clinico-cytological and histological correlation.

Aim: To study efficacy of Bethesda system for reporting (TBSRTC) FNAC of thyroid in view of offering guidance for patient management, for review of distribution of diagnostic categories and correlation with histopathology.

Materials and Methods: It is a prospective study of thyroid lesions carried out at the Department of Pathology, CAIMS, Karimnagar over a period of 3 years (January 2020 to January 2023) A total of 303 patients of neck swelling (thyroid), with satisfactory cases on 290 patients in cytology were undertaken for histopathology. Their clinico-cytological, biochemical, and histological correlation was done only in 133 patients only. Their statistical analysis was done.

Results: Majority of cases were non neoplastic. The accuracy of cytodiagnosis was 89.3% and overall malignancy rate on histopathology was 16% (37 cases).

Conclusion: FNAC of lesions in thyroid gland has a high accuracy in differentiating between malignant and benign lesions. It is safe cost effective, minimally invasive, and OPD procedure. Using FNAC as the first line of investigation which streamline the reporting terminologies and the number of surgeries on thyroid lesion has reduced greatly.

Keywords: Fine needle aspiration cytology, goiter, Hashimoto's thyroiditis, FA (follicular adenoma), PTC (papillary thyroid carcinoma), medullary carcinoma.

Introduction

Incidence of clinically apparent thyroid swellings in general population is 4% - 5%¹.

Majority of these swellings are benign nature, in which goiter is most common. Thyroid fine-needle aspiration cytology (FNAC) was introduced in 1950

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and became popular worldwide in 1980². Today it is a well-established technique for preoperative diagnosis of thyroid pathologies. Thyroid lesions may cause signs and symptoms of hypothyroidism or hyperthyroidism and also have malignant potential.³ Therefore, accurate evaluation of thyroid lesions is difficult.

Various non-invasive methods used for diagnosis of thyroid lesions do not make a definitive diagnosis of malignant lesions. FNAC has now replaced many other tests which are used for pre-operative diagnosis of thyroid lesions. Now a days, most clinicians rely solely on FNAC for making a diagnosis of benign lesions. As a result, the incidence of malignancy in thyroidectomy patients has increased from 10% to 30-50% in recent years.⁴ In spite of the first choice of investigation in thyroid lesions, it also has some limitations. The observed difficulties are largely linked to sampling methodology, aspiration expertise, sample adequacy, pathologist experience in analysing the aspirate, and overlapping cytological features between benign and malignant follicular neoplasms.^{5,6}

FNAC is safe relatively simple and cost effective for evaluation of thyroid patients. This procedure provides a tool for detecting thyroid malignancies in an early stage, resulting in a better outcome of patients.

In this study effectiveness of FNAC is evaluated in the clinical management of thyroid disease and also to reduce the rate of surgery in benign cases.

Materials and Methods

This is a prospective study of thyroid lesions carried out at Department of Pathology and were taken from ENT, General surgery and Medicine OPD for FNAC. 303 FNACs were done during this period. Patients of all ages and both the sexes were included in the study. Out of 303, 290 patients are evaluated and histological correlation was available in 230 cases. A sample of histopathology was collected from our own surgical department as well as from the surgeries done outside. Methods

used in this study included clinical presentation, thyroid function tests, FNAC, and histopathology. Signs and symptoms related to thyroid gland were solitary nodule, multinodular, and diffuse goiter. Signs of compression, hoarseness of voice, cough, pain, dysphagia, and symptoms related with hypo functioning or hyper functioning of thyroid gland. Thyroid function test was used to determine the level of free T₃, T₄ and free T₄, and thyroid stimulating hormone.

All FNAC were done as the outpatient procedure; Ultrasound guided FNAC was also done whenever needed. Air dried smears were stained with May-Grunwald-Giemsa, and wet smears were stained with papanicolaou and hematoxylin and eosin stain. The results of FNAC were compared with histopathology in 230 cases. The cytological results were also correlated with clinical features and thyroid function tests. The statistical analysis included sensitivity, specificity, positive predictive value, negative predictive value, accuracy.

Ethical Approval:

This study was reviewed and approved by institute ethics committee, CAIMS, karimnagar. Informed consent was taken from all the Patients.

Results

FNAC performed in 303 patients of which 90.36% (253cases) were female, and 27 cases (9.64%) were male. So male: female ratio is 1:9.37. Most of the patients were in the age group of 21-50 (table 1). Most common presenting symptom was painless solitary nodule, diffuse nodular enlargement.

In the present study cases were categorized according to Bethesda system of reporting thyroid cytology based on morphology divided into six categories.

Out of 290 cases 13 cases (4.29%) were category 1, 233 cases (80%) were category 2, 13 cases (4.4%) were category 3, 28 cases (9.6%) were category 4, 6 cases (1.7%) were category 5, 10 cases (3.4%) were in category 6 (Table 3).

Table 1: Age Distribution of Thyroid Patients.

Age Group in Years	Number of Patients	Percentage %
0-20	45	14.85 %
21-40	173	57 %
41-60	69	22.77 %
61-80	16	5.28 %
TOTAL	303	100 %

Table 2: Statistical Analysis (%)^{21,22}

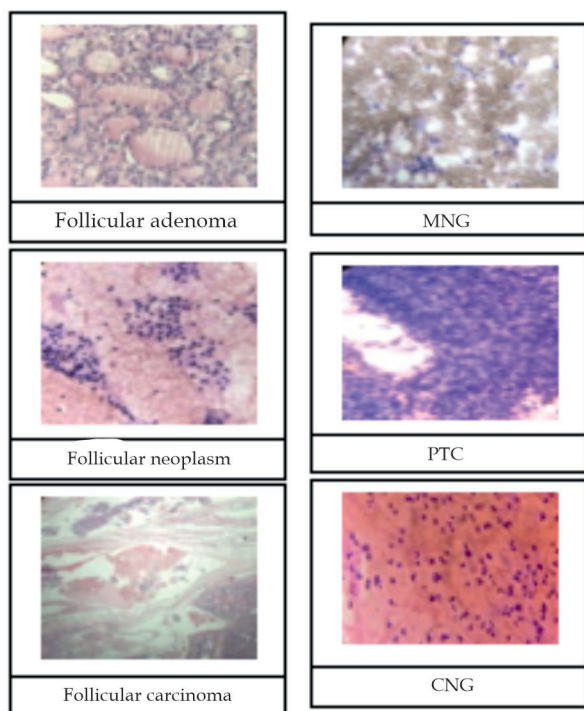
Sensitivity	79.30%
Specificity	100%
Positive Predictive Value	100%
Negative Predictive Value	17.81%
Accuracy	80.20%

Table 3: Distribution of Cases According to The Bethesda System of Reporting Thyroid Cytology.

Category	No of cases	%
Category 1	13	4.29 %
Category 2	233	80 %
Category 3	13	4.4 %
Category 4	28	9.6 %
Category 5	06	1.7 %
Category 6	10	3.4 %
Total	303	100

Table 4: Cases with Histopathology Correlation According to Bethesda System of Reporting Thyroid Lesions.

Category	Sub Category	No of Cases	Cytology diagnosis		Histopathology Diagnosis		Diagnosed	Not Correlated
			Benign	Malignant	Benign	Malignant		
1	ND	13 (4.3%)	0	0			Thyroglossal fistula, Parathyroid lesions,etc.,	
2	MNG HT FA with Cystic Degeneration PTC with Cystic Degeneration	180 (78.2%)	166 (92.2%)	10 (5.5%)	166 (92.2%)	10 (5.5 %)	FA	04 (2.2%)
3	AUS OR FLUS	13 (5.6%)	06 (46.15%)	03 (23%)	06 (46.1%)	03 (23 %)	MNG Lymphocytic Thyroiditis	04 (30.7%)
4	Benign Follicular Nodule	21 (9.1%)	11 (52.38%)	09 (42.85%)	11 (52.3%)	09 (42.8 %)	MNG with secondary changes on HPE	01 (4.76%)
5	Suspicious For Malignancy	6 (2.6%)	01 (20%)	05 (80%)	1 (16.6%)	5 (83.3 %)	FA	0
6	Malignancy	10 (10.43%)	0	10 (100%)	0	10 (100 %)		0
	Total	230	184 (80 %)	37 (16 %)	184 (80 %)	37 (16 %)		09 (3.9 %)



Category 1: Lesions are non-diagnostic and are not included in histopathological comparison. Out of 303 cases, 13 cases (4.3 %) were not correlated which were diagnosed as thyroglossal fistula, parathyroid lesion and MNG.

Category 2: Out of 180 (78.2 %) cases, 64 cases (75.29%) were benign and are correlated with histopathological diagnosis. 10 cases (5.5%) were malignant and are diagnosed as PTC, FVPTC. 4 cases (2.2%) were not correlated.

Category 3: Out of 13 (5.6 %) cases, 6 cases (46.1%) were benign and 3 cases (23%) were malignant, which were follicular carcinoma. 4 cases (30.76%) were diagnosed as MNG and lymphocytic thyroiditis.

Category 4: Out of 21 (9.1%) cases, 11 cases (53.26%) were benign (Benign follicular nodule) and 9 cases (42.85%) were malignant. 1 case (4.76%) is not correlated which was diagnosed as MNG with secondary changes on HPE.

Category 5: Out of 6 (4.34%) cases, 2 cases are (33.3%) benign (FA) and 4 cases (66.3%) were malignant (suspicious for follicular neoplasm) and all are correlated.

Category 6: Out of 10 cases (4.34%), all were malignant (PTC-6 cases 60%, FC-3 cases 30% and

MC-1 cases 10%) and are correlated (table 4).

Discussion

Thyroid enlargement is the most frequent condition in India's sub-Himalayan region; FNAC has high patient acceptance and no side effects. It is an easy and low-cost effective test used in the diagnosis of the thyroid nodules.^{5,7,8} FNAC of thyroid nodule has decreased the rate of thyroid surgery.⁹

The value of any test depends on its ability to detect the presence of disease (sensitivity) and to verify the absence of disease when it is not presence (specificity). The sensitivity of thyroid FNAC ranges from 92.24% to 98.08% and specificity ranges from 84.76% to 98.27%.^{10,11} In our study, sensitivity was 79.30%, and specificity was 100%, which correlates with other studies.^{12,14-19} This shows that FNAC is more sensitive. There as on for the wide range of sensitivity and specificity is the difference in the way of categorization of lesions by a different cytopathologist. Also, the perspective study on evaluation of malignancy rate of non-diagnostic category of Bethesda system for reporting thyroid in cytopathology can be considered¹³. Inadequate sample, inexperienced cytopathologists, and difficulty distinguishing between benign and malignant follicular lesions all reduce the efficiency of thyroid FNAC. Large areas of sclerotic, calcified, or cystic degeneration may result in inadequate sample.

The solitary thyroid nodule is less likely to be malignant. In our study, out of 230 patient's benign follicular nodule, 180 cases confirmed with cytodagnosis, 10 cases differ which were papillary carcinoma on FNAC and 4 were not correlated and are diagnosed as follicular adenoma and adenomatous nodule on HPE which correlates with others studies.^{13,14}

Most common age group in our study was the 21-50 years, with median age of 32., which is accordance to the study of Bukhari *et al.* and Khanzada *et al.* Most of the malignant patients presents after 5th decade of life. Medullary carcinoma which is usually seen in late ages, in this study, the age of medullary carcinoma was 39 years.

In our study, there was 253 (81%) female and 27 (19%) male, with a male to female ratio of 4.2 : 1 which correlates with the study of Sharma.²⁰ In this study, rate of false negative was 4.7% and false positive rate was 4.76% which was accordance with the study of Sharma.²⁰ In previous studies, false negative rate were reported between 1% and 7% and false positive rate 1-11%.^{5,8,10} Wide range of false negative and false positive may be due to sampling error and cytological interpretation. False negative FNAC occurred in two cases. Both cases were diagnosed as adenomatoid goiter on histopathological examination both were confirmed as follicular carcinoma. False positive was only one case which was diagnosed as Hurthle cell neoplasm on cytology, but on histology it was confirmed as Hurthle cell change in hyperplastic goiter.

Comparative study with other authors with median age of 8 - 8.5 years in tabaqchali et al and in present study 10-12%, comparison of sex with tabaqchali et al is 1:82 and in present study 4.2: 1 male: female ratio.

Comparison with authors in Bethesda system is 4.3% in present study with category 1 and comparison with Vickie Y Jo et al²¹ with 18.6% Yang et al 10.4% in category 2 present study 78.2% which in comparison with Vickie Y Jo et al²¹ 59% Nayar and Ivanovic²² 64% in category 3 present study shows 5.6% which in comparison with Vickie Y Jo et al²¹, Nayar and Ivanovic²² 3.4% and 4% respectively. In category 4 present study 9.1% which in comparison category 4²¹ 9.7% in category 5 is 4.34% and in category 6 in present study shows 2.6% in each which is in comparison with Vickie Y Jo et al²¹, Yang et al²³, Nayar and Ivanovic²¹, Yassa et al⁹ - 2.9%, 2.6% .5% and 5% respectively (table 2).

Conclusion

In our study cytology and histopathology correlation was highest in category 2. Our findings suggest that categorising thyroid lesions as atypical follicular lesions of unknown importance will be useful in triaging patients with thyroid nodules.

FNAC is a quick, easy, cost-effective, and minimally invasive diagnostic procedure used to screen patients with thyroid nodules prior to

surgery. By adopting this method, unnecessary thyroid surgeries for benign lesions can be avoided. Classification of FNAs of thyroid lesions using the proposed standardised nomenclature produces similar results for the risk of malignancy as previously described. The associated risks found for atypical follicular lesion of undetermined significance (5.6%), suspicious for follicular neoplasm (9.1%) suspicious for malignancy (83.5%), confirmed the importance of these categories in a six-tier diagnostic system. The widespread use of new standardised diagnostic categories for reporting thyroid FNA results has the potential to improve interlaboratory agreement in thyroid lesion diagnosis and lead to more consistent management and approaches.

Conflicts of Interest: Nil

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