Fine needle aspiration cytology of thyroid nodules using The Bethesda system for reporting thyroid cytopathology.

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Abstract:

Background: The objective of this study was to analyze the thyroid cytology smears by The Bethesda system for reporting thyroid cytopathology (TBSRTC), to determine the distribution of diagnostic categories and subcategories, to analyze accuracy rates and to correlate the cytopathology with histopathology, wherever surgery was done. **Materials and methods:** This is a retrospective study of 130 cases of Fine needle aspiration cytology (FNAC) for thyroid swellings. The reporting of thyroid lesions is carried out using the Bethesda system for reporting of thyroid lesions and correlated when surgical was available. **Results:** Out of 130 cases studied 9 (6.9%) cases are of Bethesda Category I ; 114 (87.69%) patients showed category II lesion; Benign follicular lesion, 2 (1.54%) patients showed follicular neoplasm, category IV lesion and 5 (3.85 %) patient showed category VI - malignant lesion. The accuracy rate of FNAC on histopathological correlation in diagnosis for category II (Benign follicular lesion), category IV (Follicular Neoplasm) and category VI, (Malignant) lesions were 93.22 %, 100 % and 80 % respectively. **Conclusions:** Thyroid FNA using the Bethesda system for reporting of thyroid lesions will facilitate communication among cytopathologists, endocrinologists, surgeons, radiologists, and other health care providers; facilitate cytologic-histologic correlation for thyroid diseases; facilitate research into the epidemiology, molecular biology, pathology, and diagnosis of thyroid diseases; and allow easy and reliable sharing of data from different laboratories.

Key Words: Folllicular neoplasm, Goiter, Malignant, The Bethesda System for Reporting Thyroid Cytopathology, Thyroid lesions, Thyroiditis.

Introduction:

Thyroid cancer, a common malignancy of head and neck, has a high incidence of 56 cases per 100,000 persons that, ranks first in systemic endocrine tumors, and its incidence in females is higher than that in males [1]. As a minimally invasive procedure, FNAC permits nonoperative management of most thyroid nodules, with a low risk of complications, primarily neck hematoma [2]. The vast majority of these nodules are nonneoplastic lesions or benign neoplasms. However, the distinction of these benign lesions from a malignancy cannot be based reliably on the clinical presentation only. Several diagnostic tests, such as radionuclide scanning, high-resolution ultrasonography, and fine-needle aspiration (FNA) have been

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used to select the patient population requiring surgical intervention. Recent studies have demonstrated that among all these diagnostic modalities, FNA is the most accurate, cost-effective, and simplest screening test for rapid diagnosis of thyroid nodules [3]. TBSRTC (The Bethesda System for Reporting Thyroid Cytopathology) has been used in our institution during the study interval[4]. The purpose of the present study is to examine the outcome of TBSRTC for FNA of thyroid nodules.

Materials and Methods:

A present study consists of 130 cases from January, 2019 to November, 2019 to determine the diagnostic accuracy of FNAC for thyroid swellings, in pathology department of our hospital. Detailed clinical history, physical examination, thyroid function test were obtained in each case. Ultrasonographic examination was carried out as and when required. Aspiration was performed by 23-24 gauge needle. The smears were fixed with 95 % ethyl alcohol and stained by Haematoxyline and eosin stain and Papanicolau's stain. The reporting of thyroid lesion is carried out using the Bethesda system for reporting of thyroid lesions 2012. Out of 130 patients, only 70 patients were operated and evaluated histopathologically. Two examiners who were unaware of each other's diagnosis analyzed cytology and histology specimens.

FNAC results were classified into six groups according to Bethesda categories:

1. Category 1- Nondiagnostic or Unsatisfactory

2. Category 2- Benign (Thyroiditis, Benign Follicular Nodule)

3. Category 3- Atypia of Undetermined Significance or Follicular Lesion of Undetermined Significance

4. Category 4- Follicular Neoplasm or Suspicious for a Follicular Neoplasm (follicular neoplasm, hurthle cell neoplasm)

5. Category 5- Suspicious for Malignancy

6. Category 6- Malignant

Histology specimens were classified as non-neoplastic and neoplastic. FNAC diagnosis was compared with final histological diagnosis and diagnostic accuracy was calculated.

Results:

A total of 130 patients with various thyroid lesions were diagnosed and treated at our hospital during the period of January, 2019 to November, 2019, who were taken into consideration. In all the cases, pre-operative FNAC was done and diagnosis was recorded. Out of 130 cases, 70 cases were operated and histopathological correlation was done.

Most of the cases were presented between the 2nd to 5th decades of life (84.8%). The youngest patient in our study was 11 year old male; while oldest is a 75 year old woman.

Table 1: Age & Sex wise distribution of Thyroid lesions

Age group	Female cases	Male cases	Total No. of cases
11-20 years	14	01	15
21-30 years	28	05	33
31-40 years	28	08	36
41-50 years	19	01	20
51-60 years	11	06	17
61-70 years	05	03	08
>70 years	01	00	01
TOTAL	106	24	130

Table 2 – FNAC diagnosis of Thyroid lesions according to Bethesda category

Thyroid lesion			No. of cases in FNAC			Percentage (%)
			Female	Male	Total	
Category 1	Nondiagnostic or Unsatisfactory		05	00	05	3.85
	Cyst fluid only		02	02	04	3.08
Category 2	Benign follicular Lesion	Benign follicular lesion	21	01	22	
		Adenomatoid nodule	24	04	28	
		Colloid nodule	23	07	30	
		Lymphocytic thyroiditis	19	03	22	
		Hashimoto thyroiditis	04	01	05	
		Autoimmune Thyroids	03	00	03	
		Diffuse Toxic Goiter	01	03	04	
			95	19	114	87.69
Category 3	Atypia of Undetermined Significance	Follicular Lesion of Undetermined Significance	00	00	00	
Category 4	Suspicious for a Follicular Neoplasm	Follicular Neoplasm	00	02	02	1.54
Category 5	Suspicious for Malignancy		00	00	00	
Category 6	Malignant	Papillary thyroid carcinoma	04	00	04	3.08
		Medullary thyroid carcinoma	00	01	01	0.77
Total			106	24	130	

Out of 130 cases studied, 106 (84.8%) patients were female while 24 (18.46%) patient were male. Thus the thyroid lesions showed female predominance- with the female to male

ratio 4.4:1. Out of 130 cases studied 9 (6.9%) cases are of Bethesda Category I (smears were unsatisfactory for evaluation in 05 cases and in 04 cases only cyst fluid was aspirated) ; 114 (87.69%) patients showed category II lesion; Benign follicular lesion, 2 (1.54%) patients showed follicular neoplasm, category IV lesion and 5 (3.85 %) patient showed category VI - malignant lesion.

Goiter was the most common category II lesion, which represent 26.32% (30 cases) followed by Nodular goiter 24.56% (28 cases), Benign follicular lesion 19.30% (22 cases) and Lymphocytic thyroiditis 19.30% (22 cases). Follicular Neoplasm was the least common 1.54 % (2 cases). The incidence of papillary carcinoma was 3.08 % (4 cases) while medullary carcinoma was 0.77% (1 case).

Out of 130 cases, 70 patients were operated and histopathological correlation was made.

Table 3 shows correlation between FNAC and histopathology examination.

Thyroid lesion		No. of cases in FNAC	Histopathological Correlation			Accuracy rate(%)
			Total	Correla ted	Non-corre lated	
Category 1	Nondiagnostic or Unsatisfactory	05	00	00	00	
	Cyst fluid only	04	04	03	01	75
Category 2	Benign follicular lesion	22	14	12	02	85.71
	Adenomatoid nodule	28	10	09	01	90
	Colloid nodule	30	22	21	01	95.45
	Lymphocytic thyroiditis	22	06	06	00	100
	Hashimoto thyroiditis	05	03	03	00	100
	Autoimmune Thyroids	03	00	00	00	
	Diffuse Toxic Goiter	04	04	04	00	100
Total category 2		114	59	55	04	93.22
Category 4	Follicular Neoplasm	02	02	02	00	100
Category 6	Papillary thyroid carcinoma	04	04	03	01	75
	Medullary thyroid carcinoma	01	01	01	00	100
Total of category 6		05	05	04	01	80
Total		130	70	66	04	94.29

Out of 30 cases of colloid goiter; 22 were histopathologically evaluated– 21 cases were correlated and 01 case was diagnosed as– papillary carcinoma during histopathological examination. Four cases of cystic fluid aspiration were correlated histopathologically. A case of medullary carcinoma was confirmed on histopathological examination. A case of papillary carcinoma on FNAC examination, showed Noninvasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP).

The accuracy rate for colloid goiter was 95.45% and for Benign follicular lesion was 85.71 %.

Out of 30 cases of thyroiditis, only 9 cases were histopathologically correlated, remaining patients had been treated medically.

4 patients had been diagnosed as benign cystic lesion of thyroid on FNA. Out of them 3 cases were correlated, while a papillary focus surrounded by a large cyst is identified in a remaining 1 case with the histology of papillary carcinoma of thyroid. Thus the diagnostic accuracy of cystic lesion of thyroid was 75 %.

Two cases showed follicular neoplasm on FNA. Both were correlated histopathologically.

Total 05 cases were diagnosed as malignant, category VI lesion among them 4 were Papillary carcinoma and 1 was Medullary carcinoma on FNA. Out of 4 cases of papillary carcinoma 3 were correlated histopathologically while 1 case was Noninvasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP) on histopathological examination. Accuracy rate was 75 % and 100 % respectively for papillary carcinoma and medullary carcinoma.

The accuracy rate of FNAC in diagnosis for category II (Benign follicular lesion), category IV (Follicular Neoplasm) and category VI, (Malignant) lesions were 93.22 %, 100 % and 80 % respectively.

Discussion:

FNA had been considered as a presurgical, gold standard method in the detection of thyroid carcinoma. Nevertheless, in recent years, FNA has become very popular in the evaluation of single thyroid nodules, because it is fast, simple, cost effective and accurate outpatient method with high sensitivity and specificity.[5] In the present study, there is a significant female preponderance (81.52%), which was correlated with Siadati et al. [5]

In published series, the sensitivity and specificity values of thyroid FNA vary from 65% to 98% and from 73% to 100%, respectively.[3] In the present study, overall sensitivity to detect thyroid lesions was 94.29 %.

The main reason for such a wide range of sensitivity and specificity is how cytopathologists handle the category of ''suspicious'' and how they define the false-positive and false-negative results. Some authors include follicular lesion in the malignant/neoplastic category. Others categorize them in the negative group, whereas some exclude them from the calculations altogether. [3].

Table 4- Comparison of accuracy rate with different authors

Lesions	Author	No of cases in HP Examination	Histopathological correlation		Accuracy Rate (%)
			Correct	Incorrect	
Colloid Goiter	Silverman et al[6] (1986)	11	5	6	45.5
	Y.M.Sirpal et al[7] (1996)	49	28	21	59.2
	U. R. Parikh et al [8] (2012)	64	58	6	90.63
	Present study	22	21	1	95.45
Thyroiditis	N. Dorairajan et al[9] (1996)	5	5	0	100
	Y.M.Sirpal et al[7] (1996)	14	14	0	100
	U. R. Parikh et al [8] (2012)	9	9	0	100
	Present Study	9	9	0	100
Benign Cystic Lesion	Kenneth C. Suen et al[10](1983)	4	3	1	75
	Silverman et al[6] (1986)	2	1	1	50
	Y.M.Sirpal et al[7] (1996)	15	15	0	100
	U. R. Parikh et al [8] (2012)	9	8	1	88.89
	Present Study	4	3	1	75
Follicular Neoplasm	Kenneth C. Suen et al[10] 1983)	41	37	4	90.2
	N. Dorairajan et al[9] (1996)	75	73	2	97.3
	U. R. Parikh et al [8] (2012)	9	6	3	66.7
	Present Study	2	2	0	100
Papillary Carcinoma	Silverman et al[6] (1986)	1	1	0	100
	N. Dorairajan et al[9] (1996)	4	4	0	100
	Y.M.Sirpal et al[7] (1996)	7	7	0	100
	U. R. Parikh et al [8](2012)	5	5	0	100
	Present Study	4	3	1	75

Table 4 shows comparison of accuracy rates achieved by various authors. In the present study, the accuracy rate of goiter was 95.45 %. Compared to this, Silverman et al[6](1986) found the accuracy rate was only 45.5%. He found 6 out of 11 cases were misinterpreted as follicular neoplasm while 1 case was misdiagnosed as Hurthle cell neoplasm. Y.M.Sirpal et al[7] (1996) has found an accuracy rate of 59.2%. While Parikh et al[8] found the accuracy rate was 90.63 %. The differences in the percentage of accuracy rate are mainly due to technical errors, some faulty scanning technique as well as unsatisfactory material. The accuracy rate of thyroiditis was 100 % in the present study, which was comparable with other studies. In the present study, total 4 cystic lesions went for operation. One out of 4 cases was papillary carcinoma of thyroid with cystic change on histopathological examination. Thus the accuracy rate for benign cystic lesion was 75 % which was quite comparable with the study Kenneth C. Suen et al[10] (1983). One out of the 4 cases was incorrect; that was papillary carcinoma. Follicular adenoma and carcinoma can not be differentiated on FNA; and so it was reported as follicular neoplasm. In the present study, the accuracy rate of follicular neoplasm was 100 % while the accuracy rate for papillary carcinoma was 75 %. One of the papillary carcinoma shows all nuclear features on FNA examination, which on histopathological examination shows follicular arrangement with

nuclear feature of papillary carcinoma and so labeled as Noninvasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP). And so it is considered as incorrect diagnosis. In the present study; the inadequate sample (Category I) was received in 5.62 % of cases (9 cases), out of them 4 showed only fluid aspiration. The most important factors include experience of the person who is doing aspiration and the criteria used to define a satisfactory sample.

FNAC has higher sensitivity for detection of malignancy compared with ultrasonography and radioisotope scans.[8] False negative result is expected particularly with small tumors and when there is associated degenerative or inflammatory change in adjacent thyroid tissue. There is a group of lesions which overlap benign and malignant features. For instance, the distinction between a cellular colloid goiter and a follicular lesion may be impossible. Cytological diagnosis of follicular carcinoma is not possible on FNA and diagnosis is dependent on histological assessment for capsular or vascular invasion.[8]

Conclusion:

Fine needle aspiration (FNA) is the most cost effective and safest primary diagnostic method in pre-surgical assessment of thyroid nodules. Along with this adoption of the Bethesda system for reporting of thyroid lesions will facilitate communication among cytopathologists, endocrinologists, surgeons, radiologists, and other health care providers; facilitate cytologic-histologic correlation for thyroid diseases; facilitate research into the epidemiology, molecular biology, pathology, and diagnosis of thyroid diseases; and allow easy and reliable sharing of data from different laboratories.

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