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ORIGINAL RESEARCH

Bethesda System Based Classification of Thyroid Lesions Diagnosed By FNAC

Jyothi Boda[1], N Praneetha[2], Manasa Takkallapelli [3], Mamula Shaik[4]

[1,2,3&4]Assistant Professor, Department of Pathology, Kakatiya Medical College, Hanamkonda

ABSTRACT

Background: The objective of this study was to analyse the thyroid cytology smears by The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), to determine the distribution of diagnostic categories and subcategories, to analyse cytological feature, and to correlate cytopathology with histopathology wherever surgery was done.

Materials and Methods: In an institution based cross sectional study of FNAC done on 200 patients at pathology department at CAIMS, Karimnagar, 2017 to 2019 presenting with thyroid lesion were examined and categorized as per TBSRTC.

Observation and Results:

FNAC was done on 200 patients with thyroid lesions studied over a period of 2 years. Majority of patients were females accounting for 82 % and males were 18 %.Among the total thyroid lesions, Non- neoplastic constituted 92 %, neoplastic lesions were 3 % and 5 % were Non-diagnostic.

Conclusions: TBSRTC is an excellent reporting system for thyroid FNA. It also provides clear management guidelines to clinicians to go for follow up FNA or surgery and also the extent of surgery.

Keywords: TBSRTC- The Bethesda system of reporting thyroid cytopathology, FNAC.

Corresponding Author: Dr Manasa Takkallapelli, Assistant Professor, Department of Pathology, Kakatiya Medical College, Hanamkonda. Email id: manasarao257@gmail.com

INTRODUCTION

One of the common conditions seen in medical practice is thyroid lesions. Fine needle aspiration cytology (FNAC) is frequently regarded as the preferred diagnostic method for evaluating thyroid abnormalities. It is an excellent fine line diagnostic test because it is easy and little painful.[1,2]

India has a population of 42 million people that are affected by thyroid conditions. Nearly 12.2% of people have a palpable thyroid nodule. Thyroid cancer has an incidence of 1.78% and a fatality rate of 0.71%, according to GLOBOCON 2018. For proper care, it is crucial to differentiate between benign and malignant nodules. A crucial first-line diagnostic technique has emerged: fine needle aspiration cytology (FNAC).

Historically, the use of various nomenclature and diagnostic criteria has made it difficult for clinicians to understand thyroid cytopathology results, which prevented them from providing effective care.[3,4]

Evaluation of inflammatory, viral, and neoplastic diseases is substantially aided by the thyroid FNAC. It is very helpful to differentiate between benign and malignant swellings. Its use has reduced the frequency of surgeries performed for benign lesions and increased the percentage of cancers in thyroids that have undergone surgical resection.

The terminology employed in the past to describe the cytopathology of thyroid lesions varied greatly from one laboratory to another, which occasionally led to confusion. The National Cancer Institute (NCI) held "The thyroid FNA state science conference" in 2007 to address this issue as well as for consistent language and clarity of communication. The six-tiered "The Bethesda System for Reporting Thyroid Cytopathology" was proposed at this NCI meeting (TBSRTC).[5,6]

The International Congress of Cytology in Yokohama, Japan, amended the Bethesda System for Reporting Thyroid Cytopathology 2007 (TBSRTC) in 2016. The original system was established in Bethesda, Maryland. It comprises the report format, sample suitability, diagnostic classification, cancer risk, and suggested clinical care. A standardised and clinically relevant reporting nomenclature is provided by TBSRTC, which standardises the cytology reporting for thyroid lesions.

Table 1: TBSRTC: suggested diagnostic categories, suggested clinical care, and inferred risk of malignancy

Diagnostic category	Risk of Malignancy (%)	Usual management
Nondiagnostic or unsatisfactory	1-4	Repeat FNAC with ultrasound guidance
Benign	0-3	Clinical follow up
Atypia of undetermined significance or follicular lesion of undetermined significance	5-15	Repeat FNAC
Follicular neoplasm or suspicious for follicular neoplasm	15-30	Surgical lobectomy
Suspicious for malignancy	60-75	Near-total thyroidectomy or surgical lobectomy
Malignant	97-99	Near total thyroidectomy

This highlights the need of thyroid cytopathology for diagnosis and the Bethesda System for Reporting Thyroid Cytopathology (TBSRTC). This evaluates TBSRTC's accuracy. The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), developed by the National Cancer Institute (NCI), classifies thyroid lesions into 6 diagnostic groups.

Each report starts off with six main diagnostic categories, six of which have two alternate names. Some categories also have varying degrees of subcategorization. Each of the categories is connected to a sensible clinical management recommendation by an estimated cancer risk (ranging from 0% to 3% for the benign category to almost 100% for the malignant category).

MATERIALS AND METHODS

This prospective study was conducted from pathology department at CAIMS, Karimnagar, during January 2017 to June 2019 across a two-year period. The study included 100 patients who had been recommended by the departments of surgery, medicine, and ENT and who had a history of thyroid enlargement.

The patients underwent a thorough clinical examination, and the thyroid was painstakingly palpated to help determine precisely where to perform aspiration. All patients undergoing FNAC of thyroid lesions had the specifics of the procedure described to them, and they all provided written consent after receiving this information. After hyperextending the neck with

a pillow under the shoulder to make the thyroid conspicuous, the FNAC was carried out in the supine position while taking the necessary aseptic precautions. Aspiration was carried out using a standard approach with a 10 ml syringe and a 19–24 G needle. The patient was told not to swallow while the treatment was being done following the aspiration of material onto a glass slide with a clean label. Depending on the quantity and quality of the aspirate material recovered, the same operation was repeated at a different location. 90% alcohol will be used to cure and stain half of the smears. The remaining half will be cured by air drying and stained with Giemsa. Where clinically necessary, FNAC was performed under ultrasound guidance. Out of the 200 patients, 21 underwent surgical excision of the lesion, and the department received the specimens in jars with 10% formalin solution. Sections from representative locations were collected for paraffin embedding after a thorough physical examination. Later, correlations between the findings of cytological and histological tests were made to assess the effectiveness of FNAC**.**

RESULTS

Over a two-year period, 200 patients with thyroid lesions underwent FNAC. In our study, the following conclusions were drawn. Patients' ages ranged from 16 to 80, with a mean age of 48.52 years. In the current study, thyroid lesions were shown to occur more frequently in people aged 21 to 35 (88 cases), and less frequently in people aged 71 to 80 (8 instances). Female patients aged 16 and 78 made up the patient population. Patients made up 82% of the population who were female, with men making up 18%. Ninety two percent of all thyroid lesions were non-neoplastic, three percent were cancerous, and five percent were non-diagnostic. The commonest cytological diagnostic category was benign follicular nodule followed by Benign-Hashimoto’s thyroiditis.

Table 2: shows distribution of cases in each TBSRTC category

S. No	Category	Number of cases	Percentage (%)
1	Non-diagnostic/unsatisfactory	10	5.0%
2	Benign	170	85.0%
3	AUS/FLUS	4	2.0%
4	FN/SFN	8	4.0%
5	Suspicious of malignancy	2	1.0%
6	Malignancy	6	3.0%
	Total	200	

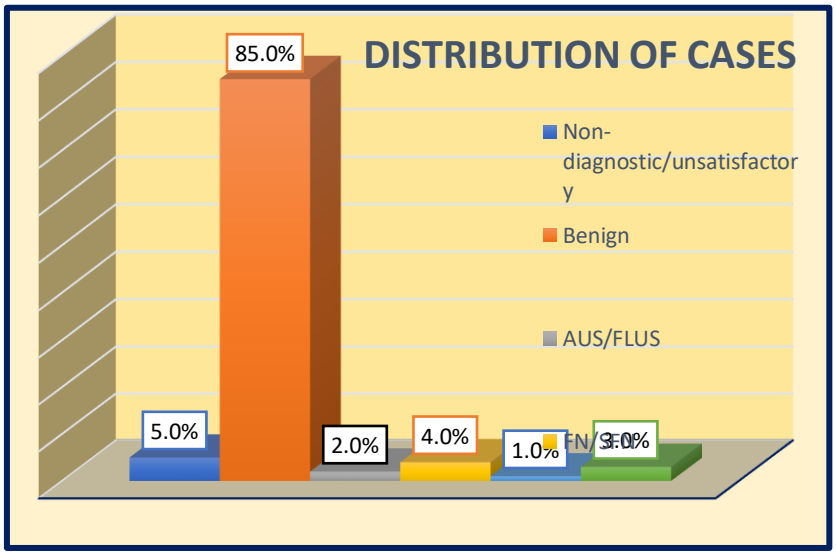

Figure 2: Distribution of Cases

Nodular goitre, which was detected in 40 instances, was the most frequent lesion, and Grave's disease, which was found in one case, was the least frequent. There were 6 cases of malignant lesions out of 200 cases in FNAC. On FNAC, six incidences of malignancy were identified. There were two occurrences of follicular neoplasm and four cases of papillary carcinoma on FNAC. Since follicular carcinoma tumour cells exhibited abnormal characteristics such pleomorphism, prominent nucleoli, hyperchromasia, and capsular invasion, they were classified as neoplastic/malignant. Follicular carcinoma of the thyroid and two cases of papillary carcinoma of the thyroid were verified by histological analysis. With the exception of one incidence of papillary carcinoma in a male, all neoplastic cases were primarily seen in females.

In our study, the age range of 41 to 50 years had a significant frequency of neoplastic tumours. In the younger age group, it was low.

Using the TBSRTC classification system, the lesions in this study were divided into the following categories: 5% non-diagnostic, 85% benign, 2% AUS/FLUS, 4% follicular neoplasm, 1% suspected for malignancy, and 3% malignant.

Out of the initial 10 non-diagonistic/unsatisfactory instances, 4 patients received repeat FNAC guided by ultrasound and were found to have colloid goitre, placing them in the benign category (category-2). 3 instances, however, remained undiagnosed and in category 1. Less than six groups of benign follicular cells were present in each of the two cases that could not be diagnosed, and one case only had cyst fluid and a few benign-appearing follicular cells.

Histopathological Diagnosis of the Lesions

42 individuals underwent surgery and histopathological case diagnosis in the current analysis of 200 instances. In the current investigation, cytohisto-histopathological association was identified in 21 patients. 18 of the non-neoplastic lesions identified by cytology could be studied histopathologically. While histology was performed in 3 cases of malignant patients. On comparison, all malignant lesions were appropriately identified cytologically and histopathologically in the current investigation. Among non-neoplastic lesions, one patient had a cytological diagnosis that was wrong. 100% of cases with malignancy and 92% of cases without malignancy had accurate diagnoses made by FNAC. The FNAC's overall accuracy in the study is 96%.

Non-Diagnostic

There were 10 cases with inadequate or non-diagnostic results. 4 smears were not properly produced or revealed hidden follicular cells; as a result, the patients underwent repeat FNAC guided by ultrasound and were identified as having colloid goitre, which was classified as benign (category-2). Only cyst fluid and fewer than six groups of ten benign follicular cells were visible in the remaining three cases. In the end, the three instances remained in our study's Non-diagnostic category (Category-1) because they did not undergo reaspiration.

Confluent Goiter In this study, colloid goitre was diagnosed cytologically in 42 patients. Two cases had non-diagnostic or poor results; as a result, they received repeat FNAC with ultrasound guidance and were later identified as having colloid goitre.

Table 1: Characteristics of colloid goitre cases with cytological diagnoses

S No.	Cytological features	Number of aspirates
1	Groups of follicular cells	68
2	Disorganised clusters or cells	10
3	Mixed pattern	18
4	Macrophages	05
5	Moderate colloid	08
6	Abundant colloid	05
7	RBCs, sparse lymphocytes	40

Out of the 68 cases of colloid goitre identified by FNAC or cytological testing, 28 cases underwent histopathology testing, and the diagnosis of colloid goitre was confirmed in those cases.

Goiter nodules

On the basis of thyroid aspirates, nodular goitre was diagnosed in 42 patients.

Table 2: Features in cytologically diagnosed cases of nodular goiter

S. No.	Cytological features	Number of aspirates
1.	Clusters of follicular cells	42
2.	Singly lying cells	34
3.	Macrophages	8
4.	Scanty colloid	4
5.	Moderate –Abundant colloid	30
6.	Absent colloid	02
7.	RBCs, lymphocytes	12

Table 3: Details of benign (TBSRTC primary category ii)

S. No	Subcategory	Number of cases	Percentage (%)
1	Consistent with benign follicular nodule (includes adenomatoid nodule, colloid nodule, etc.)	102	60.0%
2	Consistent with lymphocytic (Hashimoto) thyroiditis in the proper clinical context	32	18.8%
3	Consistent with granulomatous (subacute) thyroiditis	6	3.5%
4	Other	30	17.6%

Table 4: Specifics of tumours classified as possibly cancerous (TBSRTC primary category V)

S. No	Subcategory	Number of cases	Percentage (%)
1	Suspicious for papillary carcinoma	2	50%
2	Suspicious for medullary carcinoma	1	25%
3	Suspicious for metastatic carcinoma	1	25%
4	Suspicious for lymphoma	0	0%
5	Other	0	0%

Table 5: Details Of lesions categorized as malignant (TBSRTC primary category VI)

S. No	Subcategory	Number of cases	Percentage (%)
1	Papillary thyroid carcinoma	4	66.7%
2	Poorly differentiated carcinoma	0	0.0%
3	Medullary thyroid carcinoma	1	16.7%
4	Undifferentiated (anaplastic) carcinoma	1	16.7%
5	Squamous cell carcinoma	0	0.0%
6	Carcinoma with mixed features	0	0.0%
7	Metastatic carcinoma	0	0.0%
8	Non-Hodgkin lymphoma	0	0.0%
9	Other	0	0.0%

Grave's disease: A 35-year-old woman was diagnosed with the condition in one occasion. Follicular cells were seen in sheets and clusters in the cytology. Tall cells have basal nuclei, flame cells (which resemble fire flares), marginal vacuoles, and highly granular cytoplasm.

Hashimoto's/Lymphocytic Thyroiditis

In this study, 15 subjects had lymphocytic thyroiditis confirmed by cytological analysis. In each case, clusters of follicular and hurthle cells were visible. Cells were arranged in a pattern of thin sheets and weakly cohesive clusters. In both instances, the colloid was sparse. The development of lymphoid follicles was accompanied by the background appearance of dispersed lymphocytes.

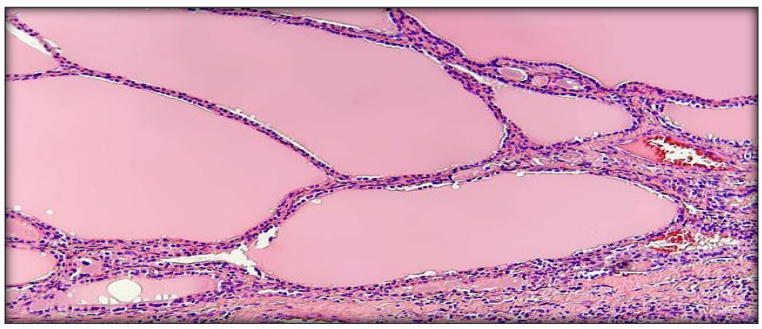

Figure 1: Histopathology showing Colloid Goiter with grouped follicular cells with thin colloid (100 X) (H&E stain).

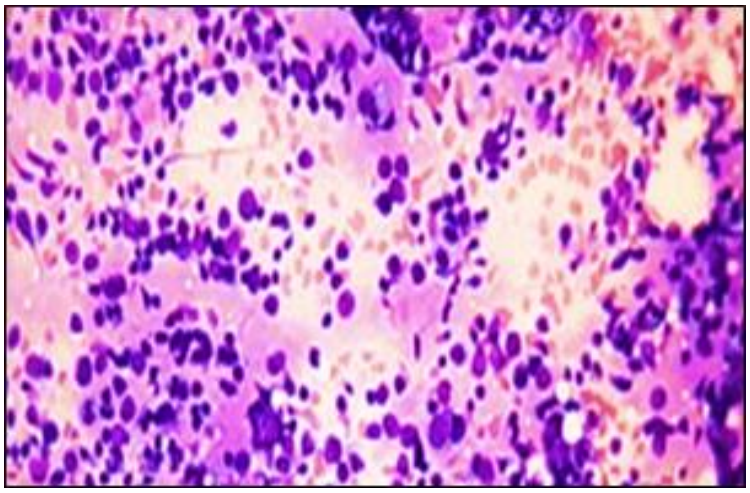

Figure 2: Histopathology showing Lymphocytic thyroiditis: Hurthle cells can be seen anisonucleosis with granular cytoplasm (400X)

Follicular Neoplasm: One instance had a cytological diagnosis of follicular neoplasm. Compact microfollicular cell clusters were seen in the smears, which were cellular in nature. Also observed were sheets and groupings of follicular cells. Nuclear hyperchromasia and mild to severe nuclear enlargement were seen. There was nuclear overlapping. The chroma was rough. A histological study of the patient supported the follicular cancer diagnosis.

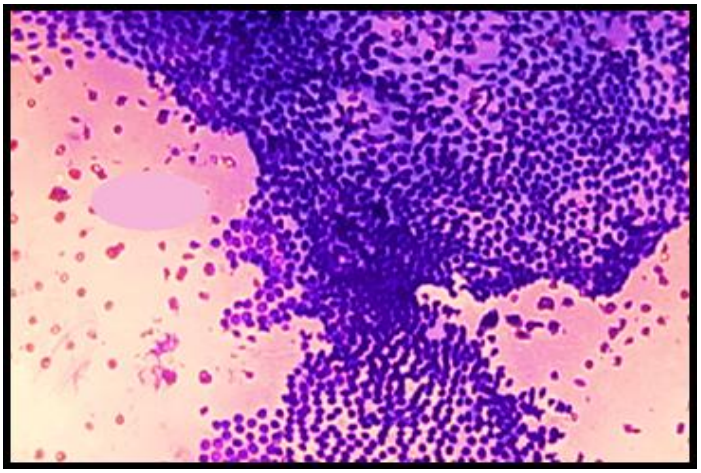

Figure 3: Histopathology of Follicular Neoplasm: Follicular Cluster of Cells Can Be Seen. (100X)(MGG)

Papillary Carcinoma: On cytological aspiration, papillary cancer was identified in four cases. Smears revealed papillary remnants and many follicular cells organised in sheets. Pleomorphic, anisonucleosis-positive, and with coarse chromatin, these cells have little cytoplasm. In every instance, nuclear overlapping was seen. Also observed was a sparse stringy colloid. In certain instances, psammoma bodies and intranuclear inclusions were visible [Figure 4]. Histopathological analysis of one case (involving a 45-year-old female) proved it to be differentiated encapsulated papillary carcinoma.

Medullary Carcinoma: Medullary cancer was reported in one instance. We saw single cells alternating with synytial-like clusters. Plasmacytoid and polygonal cells were seen. There was some moderate pleomorphism. Few cells had noticeable nucleoli. Chromatin had a "salt and pepper"-like granular look. Amyloid wasn't there. There were no metastatic tumours. It was determined by a histopathological analysis to be thyroid medullary cancer.

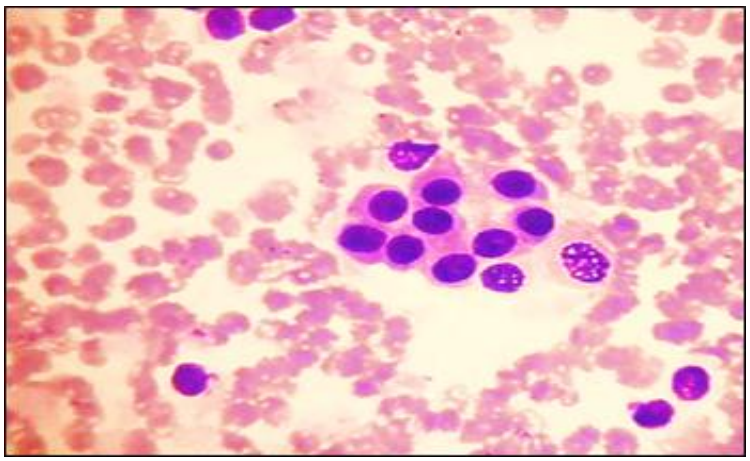

Figure 4: Histopathology Showing Medullary Carcinoma with Loose Cluster of Plasmacytoid and Spindle Shaped Cells. (400x)(MGG)

DISCUSSION

Over the course of two years, 200 individuals with thyroid lesions underwent FNAC. In our study, the following conclusions were drawn. Patients' ages ranged from 16 to 80, with a mean age of 48.52 years. In the current study, thyroid lesions were shown to occur more frequently in people aged 21 to 35 (88 cases), and less frequently in people aged 71 to 80 (8 instances). Female patients aged 16 and 78 made up the patient population.

Patients made up 82% of the population who were female, with men making up 18%. Ninety two percent of all thyroid lesions were non-neoplastic, three percent were cancerous, and five percent were non-diagnostic.

The age distribution in this study was similar to that in other studies. According to a study by Rahman MA, the third decade had the highest frequency of patients (36.11%), which was followed by the fourth decade (24.07%).[5]

Similar results were found in the current study; the majority of patients (30%) and fourth decade (27%) of life were in the third decade. Comparable to Nandekar et al(2008), [8] Mandal et al(2007),[7] and Bamanikar et al (2006),[6] investigations. Thyroid lesions are most frequently found in middle-aged females, as is widely known. The lesions' gender distribution was comparable to that of the other investigations. The current study found that 5% of aspirates were nondiagnostic, which is comparable to findings by Bhatta et al.[15] and Nayar and Ivanovic (5%) 18 poor smears, respectively. The majority of the study participants had euthyroid conditions. Neck swollen was the most frequent presenting ailment. The observations made in this regard were analogous to Chetna J. Mistry's study.[9]

Table 6: Comparative incidence of non-neoplastic and neoplastic lesions

Studies	Non neoplastic	Neoplastic	Ratio
Das DK et al,[11]	89.44%	10.56%	8.47:1
Bommanahalli et al,[12]	92.1%	7.9%	11.66:1
Htwe et al,[20]	93.3%	6 .7%	13.9:1
Present study	92%	3%	31:1

Using TBSRTC, the lesions in this study were categorised as 85% benign, 2% AUS/FLUS, 4% follicular neoplasm, 1% suspected for malignancy, and 3% malignant. In this investigation, nodular goitre (42) and colloid goitre were the two thyroid lesions that were most frequently found. Nodular goiter's cytological manifestations are as diverse as its

histology. Most of the lesions contained colloids. 15% of the cases had lymphocytes. This lesion's major cell arrangement type was normo/macrofollicular and characterised by disorderly clusters. According to a study by Basavaraj P. Bommanahalli et al,[12] nodular goitre and follicular neoplasm were the most frequent differential diagnoses for smears with a predominately normo/macrofollicular pattern.

According to Chetna J. Mistry et al. [9] and Neiki et al,[10] monolayered sheets with degenerative alterations and an abundance of colloid may be indicative of a non-neoplastic lesion. In this study, 15 subjects had lymphocytic thyroiditis confirmed by cytological analysis. The smears included monomorphic follicular cells and were colloid-rich. Histopathology analysis of 17 patients revealed a diagnosis of colloid goitre in those cases. In the study by Das DK et al,[11] background colloid, hyperplastic nodule/follicular neoplasm, hyperplastic nodule/cellular adenomatoid nodule, and follicular neoplasm constitute a continuous spectrum in terms of cellularity and presence of micro follicles in increasing order. In the current investigation, there was just one case of follicular neoplasm. The majority of individuals showed up with a nodular swelling. In each of these cases, aspirates were cellular, and compact microfollicular cell clusters with groups of follicular cells were seen.[12] microfollicular pattern was primarily observed in follicular neoplasm in P. Bommanahalli's study. To differentiate between neoplastic and non-neoplastic follicular lesions, cellularity, nuclear size, pleomorphism of cells, and amount of colloid are useful. 296 cases (17.81%) in a research by Heydar Ali Esmaili,[13] were categorised as Follicular Neoplasm, which cannot be separated from nodular hyperplasia. Papillary carcinoma was the most prevalent malignant lesion seen both on FNAC and histopathologically. Papillary carcinoma was the most frequently seen malignant lesion in studies by Tabaqchali et al,[14] Bhatta S et al,[15] and other researchers.

Papillary carcinoma was the most frequent malignant lesion found in the current investigation, accounting for four cases, one of which only underwent surgery and was histopathographically verified. One case of thyroid medullary cancer was documented. Cells were organised in syncytial aggregates that were loose. There were a few plasmacytoid cells and spindle-shaped cells. There was no evidence of pinkish acellular amorphous amyloid material.

Table 7: Comparison of diagnostic accuracy

Studies	Diagnostic accuracy %
Goswami et al,[16]	93.33%
Bhartiya R et al,[17]	97.1%
Present study	96%

The FNAC's overall accuracy in the study is 95.23%. This was comparable to studies by Goswami et al,[16] and Bhartiya R et al,[17] both of which reported overall diagnosis accuracy of 93.33% and 97.1%, respectively. Due to stringent adherence to diagnostic criteria and sparing use of AUS/AFLUS, 2% of patients fell within the category of AUS/AFLUS. AUS/AFLUS was also reported by Mondal et al. to be 1%. According to Nandekar et al,[8] and Nayar et al,[18] 0.49% of thyroid lesions were classified as suspicious for cancer. 1.71% of the patients in the current study fell into the malignant group, which is similar to Nandekar et al1.98%,[8] and Mehra et al2.2%.[19]

CONCLUSION

TBSRTC is an excellent reporting system for thyroid FNA. It also provides clear management guidelines to clinicians to go for follow up FNA or surgery and also the extent of surgery.

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