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**Dr. Chita Subba**

Post-graduate Trainee, Tezpur  
Medical College and Hospital,  
Tezpur, Assam, India

**Dr. Barnali Das**

Professor, Tezpur Medical  
College and Hospital, Tezpur,  
Assam, India

**Dr. Amrit Sarmah**

Assistant Professor, Tezpur  
Medical College and Hospital,  
Tezpur, Assam, India

**Dr. Geetanjali Gogoi**

Professor, Tezpur Medical  
College and Hospital, Tezpur,  
Assam, India

**Dr. Priyanka Goutam**

Post-graduate Trainee, Tezpur  
Medical College and Hospital,  
Tezpur, Assam, India

**Dr. Akash Pradeep Bhuyan**

Assistant Professor, Tezpur  
Medical College and Hospital,  
Tezpur, Assam, India

**Corresponding Author:**

**Dr. Akash Pradeep Bhuyan**

Assistant Professor, Tezpur  
Medical College and Hospital,  
Tezpur, Assam, India

## Correlation of fine needle aspiration cytology with histopathological examination in the diagnosis of spectrum of thyroid lesions

**Dr. Chita Subba, Dr. Barnali Das, Dr. Amrit Sarmah, Dr. Geetanjali Gogoi, Dr. Priyanka Goutam and Dr. Akash Pradeep Bhuyan**

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### Abstract

Fine Needle Aspiration Cytology of the thyroid gland is a convincingly, determining test for the assessment of thyroid lesions and an efficient test for the preoperative diagnosis.

A hospital-based cross-sectional study was carried out at the Department of Pathology, Tezpur Medical College and Hospital, Assam over a period of 1-year. A total of 63 patients with thyroid lesions were undertaken for FNAC and HPE. Their cytological, and histopathological correlation was done. 15 True positive cases, 40 True negative cases, 4 False negative and 4 false positive cases were seen in FNAC with the sensitivity, specificity, and diagnostic accuracy of 78.9%, 90.9 % and 87.3% respectively.

FNAC was found to be highly sensitive and specific for diagnosing thyroid lesions, however, it depends on the efficiency and expertise of performing experts and the experience of the Pathologist in forming a definitive diagnosis. Therefore, careful procurement, appropriate sample preparation and accurate interpretation by pathologists are necessary.

**Keywords:** Fine needle aspiration cytology, thyroid, thyroid neoplasms

### Introduction

The thyroid is a unique endocrine gland which is superficially located, hence being the only gland that can be approached easily for direct cytological, histopathological as well as physical examination. It is also one of the largest endocrine glands in the human body and is prone to many developmental, inflammatory, neoplastic and hyperplastic lesions. Thyroid lesions are very common and usually present as a diffuse enlargement, solitary or multiple nodules <sup>[1]</sup>.

Arguably, thyroid diseases are the commonest disorders of endocrine system worldwide including India. Various studies done on thyroid disorders suggest that around 42 million people suffer from thyroid diseases in India out of which 4-5% suffer from clinically apparent thyroid swellings. Most of these swellings are benign in nature among which goitre is the commonest <sup>[2]</sup>.

Fine needle aspiration cytology (FNAC) is a well-established first line diagnostic procedure for diffuse as well as nodular thyroid lesions which confirms the presence of benign lesion hence reduces the risk of unnecessary surgeries. Considering the fact that thyroid nodules have a high prevalence combined with the impractical risks of surgical excision of all nodules, FNAC has a very vital role to play in the process of making the decision about which nodules need to be surgically removed <sup>[3]</sup>. FNAC is an excellent diagnostic test for thyroid lesions owing to its high specificity and sensitivity, it is a cost effective, simple and easy technique which is done on an outpatient basis and has good patient compliance <sup>[1]</sup>.

Earlier thyroid FNAC reporting was complicated because of multiple terminologies that were used to define the category of the lesions, hence “The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC)” was introduced in 2007 at “Thyroid Fine Needle Aspiration State of the Science Conference”. This system provides a uniform and tiered reporting system for thyroid FNAC specimens and by using this system the pathologist can provide concise, accurate and clinically significant FNAC reports to the clinician <sup>[4]</sup>.

Thyroid cytology also has a therapeutic function as in many cases the patients get relief from the compressive symptoms after the fluid is aspirated from the thyroid swellings.

FNAC can be used for the diagnosis of thyroid swellings that are diffuse, palpable, firm, solitary nodules, recurrent cystic nodules, dominant nodules of a multinodular goitre, nodules with suspicious clinical or ultrasonographic features and nodules that are associated with palpable lymph nodes [5].

The accuracy of FNAC depends upon many factors like the technique of withdrawing the fluid sample from the swelling, the amount of sample withdrawn, thyroid swelling vascularity and the experience of the pathologist examining and interpreting the specimen [6].

To provide a useful diagnosis for management of thyroid lesions, a fine-needle aspiration sample taken from a thyroid nodule should be prototypical of the primary lesion hence it is always recommended to perform an ultrasound guided FNAC for better results. It is to be noted that the adequacy of the procedure also depends upon the innate nature of the thyroid lesion that is being tested [4]. Keeping in view the above facts, the current study aims to evaluate the accuracy of FNAC in the diagnosis and correlation with histopathology for definite diagnosis and patient management.

**Aims and Objectives**

1. To evaluate the accuracy of FNAC in the diagnosis and correlation with histopathology for definite diagnosis and appropriate patient management.
2. To study the advantages and usefulness of FNAC in thyroid lesions.
3. To assess the diagnostic utility of the Bethesda System of Reporting Thyroid Cytology and to find out the accuracy of FNAC by correlating with histopathological examination

**Materials and Methods**

This is a hospital based cross-sectional type of descriptive study done in the Departments of Pathology, ENT and Surgery of Tezpur Medical College & Hospital (TMCH) for a period of one year (June 2021 to May 2022).

All patients were evaluated by thorough clinical examination followed by routine blood investigations ultrasonography and FNAC and included all patients who

visited the ENT Out Patient Department (OPD) or Surgery OPD of TMCH with chief complaints of a thyroid swelling/nodule and underwent FNAC as well as subsequent surgery with histopathological examination of the specimen. Inclusion criteria included patients with chief complaint of a Thyroid swelling/nodule visiting TMCH and have undergone FNAC and subsequent surgery with histopathological examination of the specimen within the study period. All cases of acute thyroiditis, patients with lesions of parathyroid, lymph node and other surrounding structures, patients with co-morbidities hence unfit for surgery, patients who refused for surgery and patients with inoperable thyroid malignancy, patients who were not willing to undergo FNAC were excluded from the study.

After taking an informed consent from the eligible patients, a detailed medical history as well as clinical examination of the patients was done. Thereafter FNAC was conducted with 23 gauge needle, dried and stained with May Grunwald Giemsa stain followed by histopathological examination of the specimen for those who underwent surgery. Specimens were processed in automated tissue processing units and staining was performed with routine haematoxylin and eosin stain.

**Results**

A total of 63 patients with solitary thyroid nodule were identified: 6 (9.5%) were male and 57 (90.5%) were females. Age of the patients ranged from 11 to 61 years with mean age of 38.09 years. The maximum thyroid disease were characteristically seen at the age group of 21 to 30 years with female more affected than the males.

FNAC results revealed 39 (61.90%) cases as colloid goitre, 05 as Lymphocytic thyroiditis (7.93%), 03 (4.76%) as Atypia of unknown significance, 14 (22.22%) as Follicular neoplasm and 02(3.17%) as papillary carcinoma thyroid. Histopathological examination of excised specimens showed 39 (61.90%) cases as colloid goitre, 11 (17.46%) as follicular adenoma, 5 (7.93%) as Hashimoto thyroiditis, 05 (7.93%) as papillary carcinoma thyroid, 02(3.17%) as Follicular carcinoma and, 01 (1.58%) as medullary carcinoma thyroid.

**Table 1:** Comparison of FNAC with histopathological findings

FNAC diagnosis	No of cases	HPE diagnosis					
		Colloid goitre	Lt/ht	Follicular adenoma	PTC	Follicular carcinoma	Medullary carcinoma
Colloid goitre	39	34	01	04	00	00	00
Lymphocytic thyroiditis	05	01	04	00	00	00	00
AUS	03	01	00	00	00	01	01
Follicular Neoplasm	14	03	00	07	03	01	00
Papillary carcinoma thyroid	02	00	00	00	02	00	00

Out of 63 cases,30.15% were non neoplastic and 69.85% were neoplastic on histopathological examination.

False positive and false negative results shown in Table 2 and 3

**Table 2:** Non-neoplastic lesions diagnosed by FNAC and their comparison with histopathological diagnosis.

FNAC Report	No. of Patients	HPE Report	No of Patients	Remarks
Colloid goitre	39	Colloid goitre	34	True negative
		LT/HT	01	TRUE Negative
HT	05	Follicular adenoma	04	False negative
		Colloid goitre	01	True negative
		HT	04	True negative

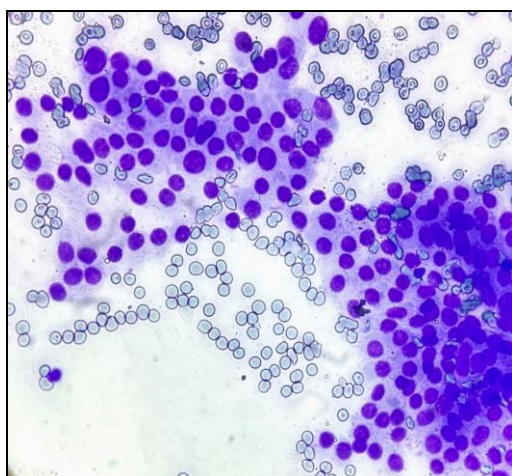
**Table 3:** Suspicious neoplastic lesions diagnosed by FNAC and their comparison with histopathological diagnosis

FNAC Report	No of Patients (n=19)	HPE Report	No of Patients (n=19)	Remarks
AUS	03	Colloid Goitre	01	False positive
		Follicular carcinoma	01	True positive
		MTC	01	True positive
Follicular neoplasm	14	Colloid goitre	03	False positive
		Follicular adenoma	07	True positive
		PTC	03	True positive
		FTC	01	True positive
PTC	02	PTC	02	True positive

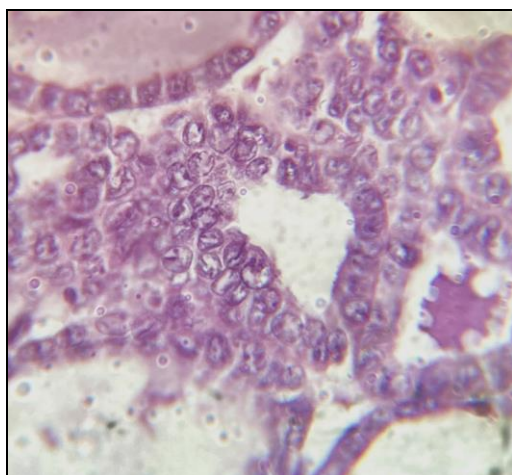
Statistical analysis shows 15 True positive cases, 40 True negative cases, 4 False negative and 4 false positive cases were seen in FNAC with the sensitivity, specificity, and diagnostic accuracy of 78.9%, 90.9% and 87.3% respectively. (Table 4)

**Table 4:** Summary of false positive and false negative results of FNAC

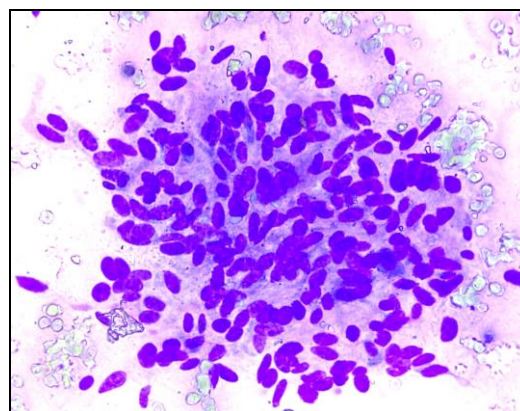
FNAC Diagnosis	HPE Diagnosis		Total
	+	-	
+	15 (True Positive)	4 (False Positive)	19
-	4 (False Negative)	40 (True Negative)	44
Total	55	8	63



**Fig 1:** FNAC smear -Follicular Neoplasm showing crowded follicular cells have round nuclei of similar size and faint cytoplasm (MGG)



**Fig 2:** Microphotograph showing nuclear grooves in Papillary Thyroid Carcinoma (H&E 100X)



**Fig 3:** FNAC smear of Medullary carcinoma thyroid showing spindle cells with tapering end, elongated spindle shaped nuclei with stippled nuclear chromatin and scant cytoplasm

**Discussion**

In the current study the mean age of the participants was 29.9 ± 10.7 years. The majority of participants belonged to the age group of 21-30 years (38.09%) followed by 31-40 years (26.98%), 11-20 years (22.22%), 41-50 years (6.34%), 51-60 years (4.76%) and ≥61 years (1.58%). In the current study the age incidence mean was 29.9 years which was comparable with mean age year of 35 years and 38 years in the studies shown by Das DK *et al* [7] and Gupta M *et al*. [8]

**FNAC Diagnosis:** In the current study, 39 (61.90%) patients had Colloid goitre, 5 (7.93%) patients had Lymphocytic thyroiditis, 3 (4.76%) patients had Atypia of unknown significance, 14 (22.22%) patients had Follicular neoplasm, and 2 (3.17%) patient had Papillary thyroid carcinoma.

In a similar study conducted by Renu Sukumaran *et al* in 2014, 59.68% were cases of Malignancy, 4.03% cases were suspicious of malignancy, 13.3% were cases of Follicular neoplasm/suspicious for a follicular lesion of undetermined significance, Benign cases were 12.5% and 6.04% cases were non diagnostic or unsatisfactory [9].

**HPE Diagnosis:** In the current study 39 (61.90%) patients had Colloid goitre, 5 (7.93%) patients had Hashimoto’s/lymphocytic thyroiditis, 11 (17.46%) patients had Follicular adenoma, 5 (7.93%) patients had Papillary Carcinoma Thyroid, 2 (3.17%) patients had Follicular carcinoma 1 (1.58%) patients had Medullary carcinoma thyroid in histopathological examination.

In a similar study conducted by Khageswar Rout *et al.* in 2011 it was seen that out of total 76 cases 73 cases reflected positive correlation between FNAC and HPE result. There was difference seen in 3 cases wherein diagnosis by FNAC was proved otherwise. In this study 31 cases, out of 32 colloid goitre cases which were diagnosed by FNAC

matched with HPE result while one case did not match with the HPE result which was later diagnosed as Papillary Carcinoma thyroid. The remaining cases of colloid goitre was diagnosed correctly by FNAC<sup>[10]</sup>.

**Diagnostic accuracy of FNAC:** In the current study, the total number of true positive cases was 15 out of 63, true negative was 40 out of 63 cases, false negative was 4 out of 63 cases and false positive was 4 out of 63 cases. Thus, the sensitivity was calculated as 78.9%, specificity was 90.9%, positive predictive value was 78.9%, negative predictive value was 90.9% and the accuracy was calculated to be 87.3% which were comparable to sensitivity and specificity respectively of 70%, 97.5%, 92.8%, 94.2%, 89.47%, 99.2%, 83.3% and 100% in the studies done by Bista M et al, EA Sinna et al, Gupta C et al and Kaur K et al respectively<sup>[16,19]</sup>. The main reason for such a variation in sensitivity and specificity is the way that cytopathologist categorise suspicious cases and how they define False positive and False Negative results. FNAC has its limitations in diagnosing follicular lesions, the predominant reason for this is the overlapping of cytological criteria among hyperplastic adenomatoid nodules in goitres, well-differentiated follicular carcinomas, follicular adenomas and follicular variants of papillary carcinomas. Usually the presence of a microfollicular pattern with syncytial fragments direct the diagnosis towards follicular neoplasm but it is seen that in about 15-25% cases after surgical resection the lesion is usually a hyperplastic nodule.

In our study there was only 4.76% of cases that were diagnosed under category AUS/AFLUS which could be because of the strict adherence to diagnostic criteria and the cytopathologist's efforts in our practice setting to avoid ambiguity and keep the use of AUS/AFLUS to a minimum. Similarly, Shirish S et al. had conducted a study in which they have reported lower percentage of AUS/AFLUS (1%) in their study because they strictly adhered to diagnostic criteria and they also had a large sample size<sup>[20]</sup>. The TBSRTC also recommends that the rate of AUS/FLUS interpretations within a laboratory should be in the 3–6% range of all thyroid FNACs and should not exceed 7%, as higher rates most probably represent overuse of this category when other interpretations would be more appropriate<sup>[21]</sup>.

The more number False-negative cases could be because of inadequate and improper sampling techniques and errors in interpretation. The Cystic lesions of the thyroid and dual pathology in the thyroid lesions (for example a dominant benign nodule may obscure a smaller or more diffusely growing carcinoma) also cause False-negative results. This can be minimized by strict adherence to adequacy criteria (five to six groups of cells showing more than ten cells in each group), proper sampling of tissues from representative areas preferably with ultrasound guidance and preparing high-quality slides.

**Correlation between FNAC and Histopathology:** In the current study, there were a total of 44 cases out of 63 cases diagnosed as non-neoplastic lesion and 19 cases out of 63 cases diagnosed as neoplastic lesion. Out of these cases in FNAC and HPE reports 52 cases i.e. 82.5% cases were correlated (44 in non-neoplastic lesions and 8 in neoplastic lesion).

In the non-neoplastic category, the commonest category was Colloid goitre with 89% cases and the rest was Hashimoto's/

Lymphocytic thyroiditis. While in the neoplastic category, 58% cases were of benign variety and 42% cases were of malignant variety. Out of the malignant variety, 26% were Papillary carcinoma, 11% were Follicular carcinoma and 5% were Medullary carcinoma.

There were problems that arose in the diagnosis of thyroid lesions like nodular goitre, hyperplastic nodules, follicular neoplasm, cystic nodule, and thyroiditis while conducting the study. The reason for this difficulty could be due to the overlapping of cytological picture of nodular goitre with that of follicular neoplasm. Sometimes smears obtained from microfollicular area in the nodular goitre may show a picture which is similar to neoplasm<sup>[11]</sup>.

Thus, in the current study the concordance between FNAC and HPE results was found to be 82.5% which is in accordance with other studies by Schnurer et al.,<sup>[12]</sup> Hag et al.,<sup>[13]</sup> Das et al.,<sup>[7]</sup> Harach et al.<sup>[14]</sup> and Sandeep R Mathew et al.<sup>[15]</sup> concordance value of 93%, 91.4%, 90%, 58.3% and 97.01% respectively.

### Conclusion

Thus, it is evident from the comparisons above that the concordance found between FNAC and HPE in the study is comparable to other similar studies in which the concordance range was found to be as low as 58.3% and in some instance the concordance was found to be as high as 97.01%.

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### Conflict of Interest

Not available

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