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RESEARCH PAPER

Cytomorphological correlation of thyroid lesions with thyroid hormone profile in a tertiary care centre in Assam

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ABSTRACT

Background and aims: Fine Needle Aspiration Cytology (FNAC), combined with Ultrasonography (USG) and a Thyroid Function Test (TFT), is the mainstay of evaluating thyroid swellings. The American Thyroid Association states that Serum Thyroid Stimulating Hormone measurement should be included in the initial evaluation of thyroid swellings. The Bethesda System for Reporting Thyroid Cytopathology comprises six categories. FNAC and TFT help decide the course of treatment for the patient. In this study, the cytomorphological features of the thyroid lesions are studied, categorised according to The Bethesda system for reporting thyroid cytopathology, and correlated with the thyroid hormone status of the patient.

Methods: FNAC was performed on 108 cases of thyroid swellings. Each case was classified according to age and gender, cytological results, and The Bethesda System for reporting Thyroid Cytopathology categories. The cases were also correlated with the results of TFT function tests.

Results: Non-neoplastic lesions outnumbered neoplastic lesions, with colloid goitre being the most prevalent. According to the Bethesda System, the cytological majority fell into Category II. Nondiagnostic lesions are 12.0%, benign 62.2%, Atypia of undetermined Significance 9.2%, follicular neoplasm 3.7%, suspicious for malignancy 5.5% and malignant 7.4%. Most cases were determined to be euthyroid based on an analysis of TFT. In category II, abnormal TFTs were most prevalent. In Category V, every patient was euthyroid, but in Category VI, 5/8 cases were hypothyroid, and 3/8 were euthyroid. However, not a single malignant case was hyperthyroid.

Conclusion: FNAC and TFTs can be used for early and accurate diagnosis. It gives explicit management directions, including treatment plan/surgery and follow-up.

Keywords: The Bethesda system of reporting thyroid cytopathology; thyroid function test; thyroid swelling.

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INTRODUCTION

Thyroid gland swelling is a common manifestation of benign and malignant thyroid disorders. A number of these conditions are linked to thyroid dysfunction. The prevalence of thyroid enlargement ranges from 4% to 7% among adults and 0.2% to 1.8% among children.[1] It is essential to determine whether thyroid lesions are benign or malignant to avoid unnecessary surgery and ensure adequate treatment.

The procedure of fine needle aspiration cytology is an outpatient procedure. It is a straightforward, minimally invasive, easily accessible, reliable, time-saving, and cost-effective technique. Due to these factors, FNAC is universally believed, and it proves to be a crucial diagnostic technique for screening and assessing diffuse and solitary thyroid nodules. FNAC has made thyroid lesions simple and accurate to diagnose, reducing the need for unneeded surgery. In addition to preventing unnecessary thyroid surgery for benign nodules, FNAC has increased the cancer rate in nodules removed from 14% to 50%.[2] Proper communication between the cytopathologist and referring physician regarding the FNA interpretation is vital to managing the patient. In 2007, the National Cancer Institute (NCI) organised The

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Thyroid Fine Needle Aspiration State of Science Conference in Bethesda, Maryland, to address terminology and other concerns about thyroid FNA. NCI subsequently released a monograph named "The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC)", which comprised a definition, diagnostic and morphologic criteria, explanatory notes, and a clear management plan for each category.[3,4]

TBSRTC is a six-category system of thyroid cytopathology reporting. These include nondiagnostic/unsatisfactory, Benign, Atypia of Undetermined Significance or Follicular Lesions of Undetermined Significance, Suspicious for follicular neoplasm, Suspicious for malignancy and Malignant. Each category has an implied cancer risk which ranges from 0% to 3% in the benign category and 100% in the malignant category.[5,6]

The thyroid is an endocrine organ comprising thyroid follicular cells that secrete triiodothyronine (T3) and thyroxin (T4), regulated by thyroid stimulating hormone secreted by the anterior pituitary gland.[7] Based on T3, T4, and TSH levels, thyroid lesions can be categorised as hypothyroid, euthyroid, or hyperthyroid disorders.[1]

This study aims to assess study morphological features of various thyroid lesions and classify them by using the TBSRTC criteria and also correlate them with the thyroid hormone status.

MATERIALS AND METHODS

The study was conducted in the cytology section, Department of Pathology, Assam Medical College and Hospital. The study was conducted from January 2021 to January 2022. A total of 108 cases were studied. A detailed clinical history and thorough clinical examination, including general examination and local examination of the thyroid gland, were done. The findings were noted along with the thyroid hormone profile. The results of the thyroid hormone profile were obtained from the Department of Biochemistry of Assam Medical College. The patients were explained about FNA, and informed consent was taken for the procedure.

Under aseptic precautions, FNA was conducted with a 23-gauge needle attached to a 10cc disposable syringe following standard practice. In cases where an adequate aspirate was not produced, a second FNA was performed under USG guidance. Immediately after aspiration, smears were made from the aspirates. Some smears were allowed to air dry and then stained with MGG, while some were wet-fixed using alcohol and later stained for PAP. These smears were stained with MGG and PAP stains. The cytological characteristics were evaluated and reported according to the TBSRTC standards. The cytomorphological detail, FNAC diagnosis, and TFT details were entered in Microsoft Excel and study variables were statistically analysed.

RESULTS

The study comprised 108 cases of thyroid lesions, irrespective of age and sex, referred for the cytological test from the ENT/surgery/OPD or admitted to the ward. The study showed 11.2% males (12 cases) and 88.8% females (96 cases) with a male-to-female ratio of 1:8. The age range was from 11 to 90 years, and the maximum number of cases in the 21-30 years (30 cases) accounting for 27.8% of the cases (**Table 1**).

Table 1 Age and gender-wise distribution of patients with thyroid lesions

Age group	Number of males	Number of females	Total number
11–20	00	03	03
21–30	01	29	30
31–40	00	16	16
41–50	04	23	27
51–60	04	15	19
61–70	02	08	10
71–80	01	01	02
81–90	00	01	01
Total number	**12**	**96**	**108**

Out of the 108 cases, a maximum number was seen in Category II (62.2%), while the minimum was in Category IV (3.7%). In Category II, the majority of the cases were benign thyroid lesions (Colloid goitre), accounting for 28/68 cases, followed by Nodular Goitre (19/68), and Hashimoto's thyroiditis/Lymphocytic thyroiditis (16/68) and granulomatous thyroiditis (05/68). In cases where only cyst fluid was aspirated without cellularity or colloid, the cases were categorised as unsatisfactory or inadequate under category I (12.0%). 4/108 cases (3.7%) showed highly cellular smears of uniform follicular cells in crowded clusters and micro-follicles and were diagnosed as Follicular Neoplasm (TBSRTC IV). In category VI, 8/108 cases were diagnosed as malignant lesions, where 6 cases were diagnosed as Papillary Carcinoma of the Thyroid, one as Anaplastic Carcinoma of the Thyroid and one as Metastatic deposit (**Table 2**).

Table 2 Distribution of cases according to TBSRTC in the present study

TBSRTC category	Number of cases	Percentage
Category I (Nondiagnostic)	11	12.9%
Category II (Benign)	68	62.9%
Category III (AUS)	10	9.2%
Category IV (Follicular Neoplasm)	4	3.7%
Category V (Suspicious for Malignancy)	5	5.5%
Category VI (Malignant)	8	7.4%

TBSRTC: *The Bethesda System for Reporting Thyroid Cytopathology.*

Evaluation of the thyroid function status was done in all 108 study subjects, out of which 72 cases (66.6%) were euthyroid; 20 cases (18.6%) were hyperthyroid, and 16 cases (14.8%) were hypothyroid. Most of the patients in Category II, with colloid goitre, were found to be euthyroid. In contrast, most patients with lymphocytic thyroiditis were found to have thyroid dysfunction, either hypothyroidism or hyperthyroidism. Among the malignant cases, 5/8 were hypothyroid (**Table 3**).

Table 3 Correlation of Thyroid function test with Bethesda Categories

Categories	Euthyroid	Hyperthyroid	Hypothyroid
Category I	10	02	00
Category II	45	15	08
Category III	07	02	01
Category IV	01	01	02
Category V	06	00	00
Category VI	03	00	05
Total	**72**	**20**	**16**

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The different types of lessons (Histopathological slides) are shown in Figure 1,2,3,4,5.

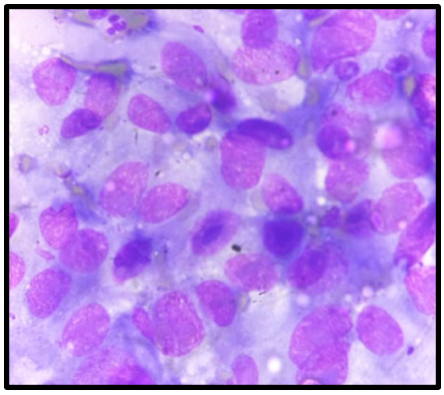

Figure 1 Anaplastic Carcinoma (100X, MGG)

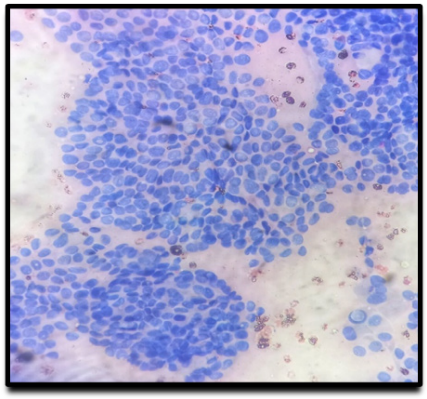

Figure 2 Papillary Carcinoma (40X, PAP)

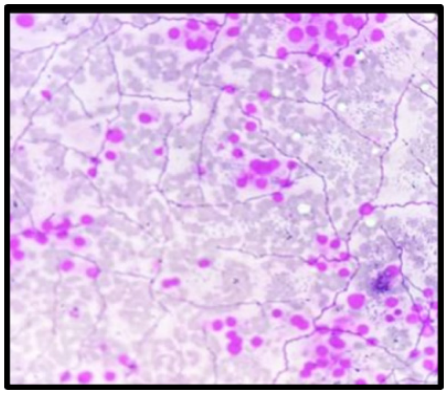

Figure 3 Colloid Nodule (10X, MGG) (Crazy pavement appearance and cracking artefacts)

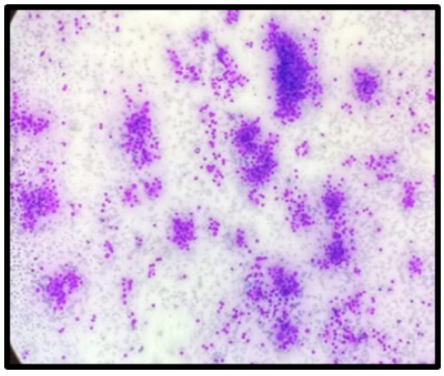

Figure 4 Follicular Neoplasm (4X,MGG) (repetitive pattern)

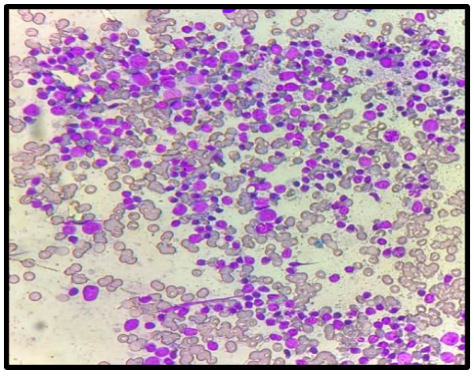

Figure 5 Lymphocytic thyroiditis (40X, MGG)

DISCUSSION

Fine needle aspiration cytology is the gold standard diagnostic technique for thyroid lesions. FNAC, in combination with a solid clinical history, thorough physical examination, ultrasonography, and thyroid function assays, is the mainstay for diagnosing thyroid lesions. The Bethesda System for Reporting Thyroid Cytopathology was developed as a standard terminology to bridge the gap between diagnosticians and clinicians for interpreting thyroid lesions. This aided in the management of the patients and prevented needless surgical procedures.[7]

According to ATA recommendations, the estimation of serum TSH should be included in the initial evaluation of thyroid lesions. A higher serum TSH level is typically related to a higher likelihood of malignancy in a thyroid nodule and a more advanced stage of thyroid cancer.[8]

This study investigated the cytomorphological characteristics of thyroid lesions and their correlation with thyroid hormone status. In our study, the mean age of individuals with thyroid lesions was 42.00 ± 15.45. The male: female ratio is 1:8. The results were compared to previous studies like Vaishali et al.,[9] and Mehrotra et al.,[10] and were found to be similar.

Table 4 Distribution of cases as per the six-tier Bethesda system in the present study and other comparable studies

Diagnostic Category	Singh et al.[11]	Naz et al.[12]	Mehrotra et al.[10]	Vaishali et al.[9]	Present study
Cat I (Nondiagnostic)	13%	4.7%	4.57%	10.9%	12.0%
Cat II (Benign)	41%	76.3%	68.58%	69.1%	62.2%
Cat III (AUS)	37%	12.7%	5.72%	1.81%	9.2%
Cat IV (Follicular Neoplasm)	5.6%	2.1%	17.14%	10.94%	3.7%
Cat V (Suspicious of malignancy)	3.9%	3.4%	1.14%	1.21%	5.5%
Cat VI (Malignant)	4.5%	0.8%	2.85%	6.1%	7.4%

Table 5 Comparison of various studies according to TBSRTC categories distribution about the hormonal status

Hormone status	Studies	Cat1	Cat2	Cat3	Cat4	Cat5	Cat6	Total
Euthyroid status	Mehrotra et al.[10]	03	25	00	06	00	00	34/69
	Present study	10	45	07	01	06	03	72/108
Hyperthyroid status	Mehrotra et al.[10]	00	08	00	03	00	00	11/69
	Present study	02	15	02	01	00	00	20/108
Hypothyroid status	Mehrotra et al.[10]	01	15	03	03	00	02	24/69
	Present study	00	08	01	02	00	05	16/108

The distribution of the cases according to TBSRTC categories obtained in the present study was compared with some other studies, as shown in **Table 4**. In comparison, certain variations were found in Category I. However, these variations could be due to the technique and expertise of the cytopathologist as well as the inherent nature of the lesion (Solid or Cystic).

The maximum number of cases were listed as Benign and listed as category II.

Category III AUS also showed several variations. Typically, a second FNA with USG and follow-up is recommended for this category. Even though FNAC can provide an accurate diagnosis in most instances, there are difficulties with diagnosing uncertain categories such as III, IV, and V, including AUS/FLUS and Suspicious Neoplasms. In some instances, molecular testing for somatic mutations, such as BRAF, RAS, RET/PTC, and PAX8/PPARy, might supplement cytology findings and lead to improved treatment recommendations.[13] This study's incidence of malignant lesions was similar to other studies, with papillary carcinoma being the most typical type.

All 108 individuals underwent TFT, distributed along TBSTRC and compared with Mehrotra et al. The TSH parameter is the most sensitive of the TFT parameters. T3 and T4 levels can be altered in non-thyroid diseases. Based on their TSH levels, this investigation classified cases as euthyroid, hypothyroid, or hyperthyroid. Our study's results were compared to those of other studies (**Table 5**).

Most cases were Euthyroid (72/108), similar to the study compared. 20/108 cases were hyperthyroid, among which 15/20 (majority) were benign in Category II, while 02/20 cases belonged to each Category I and Category III, and 1/20 belonged to Category IV.

16/108 cases were hypothyroid, among which 8/16 were benign, 2/16 were in Category IV, and 5/16 were malignant cases of Category VI.

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Of 8/108 malignant cases, 3/8 presented as euthyroid and 5/8 as hypothyroid. None of the malignant cases was hyperthyroid. This finding was similar to the study compared.

The ability of FNAC of thyroid reporting by TBSRTC to differentiate between benign and malignant lesions, except for follicular neoplasm, which requires demonstration of capsular and/or vascular invasion, which cannot be evaluated on cytology, aids in determining the management algorithm, with biochemical tests aiding in determining the use of combined medical and surgical modalities in individual cases.

CONCLUSION

Thyroid FNAC can therefore be considered a first-line diagnostic procedure. It is simple, reliable, cost-effective, and has high patient acceptance as it is non-invasive and has infrequent complications.

The universal terminology in thyroid cytology in the form of 'The Bethesda System for Reporting Thyroid Cytology' truly caters to the need for better communication between the clinician and the cytopathologist and therefore has been termed the gold standard. When combined with TFTs, FNAC can be utilised for the early and accurate detection of thyroid lesions, enabling effective care. FNAC has been shown to eliminate unnecessary surgical operations and improve follow-up.

However, a proper medical history, physical examination, laboratory tests, and ultrasonography should also be evaluated simultaneously for better patient management decisions.

Data availability: The data used to support the findings of this study are included in the article.

Conflicts of interest: None declared.

Ethical clearance: Taken.

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