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Evaluation of Thyroid Lesions by Fine Needle Aspiration Cytology according to Bethesda System in a Tertiary Care Centre

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ABSTRACT
Thyroid lesions pose a significant diagnostic challenge, and fine needle aspiration cytology (FNAC) has emerged as a valuable tool for their evaluation. The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) provides a standardized framework for categorizing FNAC results, aiding in clinical decision-making. To comprehensively evaluate thyroid lesions using the Bethesda System in a tertiary care centre, enhancing the understanding of the diagnostic accuracy of FNAC in this context. An analysis was conducted on 150 patients with suspected thyroid lesions who underwent FNAC at a tertiary care centre. The study spanned from January 2019 to June 2019 and FNAC results were classified according to TBSRTC, and relevant demographic and clinical data were collected. Statistical analyses were employed to assess the distribution of Bethesda System categories. The study included 150 cases of thyroid lesions, with a diverse spectrum of Bethesda System categories. The distribution of Bethesda System categories revealed 2 cases (1.3%) in category I, 132 (88%) in category II, 4 (2.7%) in category III, 4 (2.7%) in category IV, 2 (1.3%) in category V, and 6 (4%) in category VI. The male/female ratio (M/F ratio) was 1:9.7, with the highest prevalence observed in the 21-30 years age group. FNAC for thyroid nodules is a safe, quick, and cost-effective outpatient procedure when executed by experts. The Bethesda system provides a unified and comprehensive approach to interpreting results, preventing unnecessary surgeries and promoting more judicious patient care.

INTRODUCTION

Thyroid swellings are a prevalent clinical concern, demanding accurate diagnostic approaches for effective patient management. The prevalence of clinically apparent thyroid swellings in the general population is estimated to be between 4-5%[1]. Fine Needle Aspiration Cytopathology (FNAC) has gained prominence for its safety, efficiency and cost-effectiveness, emerging as a well-established, first-line diagnostic test for thyroid nodules to confirm benign lesions and reduce unnecessary surgeries[2-4].

As the incidence of thyroid nodules continues to rise, the relevance of FNAC in enabling timely and precise diagnoses becomes increasingly apparent[5]. To address the need for standardized reporting and effective communication between pathologists and clinicians, The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) has become a cornerstone in thyroid nodule assessment. Serving as the standard diagnostic reporting system for FNAC, TBSRTC facilitates accurate communication, interpretation and sharing of cytopathologic results among experts in thyroid nodule assessment[6,7]. By categorizing findings into distinct groups, the Bethesda System aims to standardize reporting and guide clinicians in making informed decisions about patients[5].

The six diagnostic categories of the Bethesda System for thyroid FNAC are unsatisfactory/nondiagnostic (ND), benign, atypical follicular lesions of undetermined significance (AFLUS), suspicious of follicular neoplasm (SFN), suspicious for malignancy (SM) and malignant. It provides a comprehensive framework for characterizing thyroid lesions[8,9]. The widespread implementation of the Bethesda System has not only standardized diagnostic terminology in thyroid cytopathology but also provided a universally acceptable system for reporting thyroid lesions[5]. This standardization is crucial for fostering consistency in reporting and enhancing communication between healthcare professionals. The evolving landscape of thyroid nodule management underscores the importance of standardized systems for accurate reporting and effective communication within the medical community. Therefore this study aims to contribute to the understanding of thyroid nodules by comprehensively evaluating FNAC results using the Bethesda System.

Objectives:

- To assess the cytological characteristics of thyroid lesions using The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) in our centre
- To establish correlations between cytological features, as classified by TBSRTC and corresponding histopathological findings

MATERIALS AND METHODS

Study Design: A cross-sectional study was conducted over a 6-month period, from January 2019 to June 2019, in the Department of Pathology.

Study Population: Patients presenting with thyroid swelling, either diffuse or nodular, attending the tertiary care centre within the study period were included in the study. Exclusion criteria encompassed patients unwilling to undergo Fine Needle Aspiration Cytopathology (FNAC) for thyroid lesions, even after detailed explanations of the procedure's purpose, utility and consequences. Lesions involving parathyroid, lymph nodes and surrounding structures were also excluded.

FNAC Procedure: FNAC was performed in the Department of Pathology using a 22-gauge needle with a non-aspiration technique. Direct smears were meticulously prepared, fixed with 95% alcohol and stained with H&E stain. The FNAC procedure was performed by trained personnel following established protocols.

Cytological Evaluation: Expert cytopathologists, blinded to the histopathological outcomes, meticulously reviewed FNAC slides. A detailed assessment encompassed the evaluation of cell morphology, architectural features and any atypical characteristics present. The objective was to establish a nuanced understanding of the cytological landscape inherent in thyroid lesions.

Categorization of FNAC Results: FNAC results were categorized according to The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC), incorporating six distinct categories (Table 1). This categorization aimed to standardize reporting for consistent interpretation.

Bethesda System Evaluation: Stained smears underwent meticulous evaluation based on the Bethesda system of reporting thyroid lesions. Adequacy for evaluation was defined by the presence of at least six well-preserved and well-stained follicular groups, each containing a minimum of ten cells. Smears containing atypical cells were never considered inadequate, irrespective of cellularity.

Histopathological Correlation: Histopathological slides, corresponding to the selected cases, underwent rigorous evaluation by Authors. The correlation process involved a meticulous alignment of cytological findings with their histopathological counterparts. Final histopathological diagnoses were recorded, enabling a robust comparative analysis with FNAC results.

Table 1: Reporting Thyroid Cytopathology according to The Bethesda System

Bethesda Group	TBSRTC Diagnostic category	Risk of Malignancy	Usual Clinical Management
I	Non-diagnostic or unsatisfactory(ND/UNS) e.g Fluid only (cyst), acellular specimen.	Not assessable	Repeat FNA under ultrasound guidance
II	Benign e.g. Adenomatoid nodule, Colloid nodule, Lymphocytic thyroiditis, Granulomatous (subacute) thyroiditis etc	0-3%	Follow up clinically
III	Follicular lesion of undetermined significance or atypia of undetermined significance (AUS/FLUS)	5-15%	Repeat FNAC
IV	follicular neoplasm or Suspicious of follicular neoplasm or (FN/SFN)	15-30%	Surgical lobectomy
V	Suspicious for malignancy (SFM)	60-75%	Surgical lobectomy or near total thyroidectomy
VI	Malignant lesion including Papillary carcinoma, Medullary carcinoma, Poorly differentiated carcinoma etc	97-99%	Near total thyroidectomy

Table 2: Distribution of Thyroid Lesions across age groups and gender

Age groups (in years)	No. of Cases	Male (%)	Female (%)
0-10 years	3	1 (33.3)	2 (66.7)
11-20 years	21	2 (9.5)	19 (90.5)
21-30 years	47	3 (6.4)	44 (93.6)
31-40 years	24	0 (0.0)	24 (100.0)
41-50 years	28	2 (7.1)	26 (92.9)
51-60 years	14	2 (14.3)	12 (85.7)
61-70 years	11	3 (27.3)	8 (72.7)
71-80 years	1	0 (0.0)	1 (100.0)
81-90 years	1	1 (100.0)	0 (0.0)
Total	150	14	136

Table 3: Distribution of Thyroid Lesions based on Cytological Diagnosis according to Bethesda System Categories

Bethesda Group	Category	Frequency	Percentage
I	Unsatisfactory/Nondiagnostic	02	1.3
II	Benign follicular lesion	132	88.0
III	Atypia of Follicular Lesion of undetermined significance (AFLUS)	04	2.7
IV	Follicular Neoplasm/Suspicious for follicular neoplasm	04	2.7
V	Suspicious for Malignancy	02	1.3
VI	Malignant	06	4.0

Table 4: Comparative Analysis of FNAC Diagnoses and Surgical Biopsy Outcomes in Thyroid Lesions

Bethesda Category	FNAC Diagnoses (n)	Surgical Biopsy (n)	Correct Diagnoses (n)	False Negative (n)	False Positive (n)
Benign	132	20	19	-	1
Malignant	06	04	03	1	-
Suspicious for Malignancy	02	01	01	-	-
AFLUS	04	-	-	-	-
Suspicious for Follicular Neoplasm	04	02	02	-	-
Unsatisfactory	02	-	-	-	-

Table 5: Distribution of study participants according to the type of Benign Thyroid Lesion (n = 132)

Category of Benign cases	Frequency (n = 132 Cases)	Percentage
Colloid nodule	22	16.7
Colloid goitre	48	36.4
Lymphocytic thyroiditis	46	34.8
Acute thyroiditis	03	2.3
Thyroid cyst	06	4.5
Adenomatoid nodule	07	5.3

Table 6: Distribution of study participants according to the type of Malignant Thyroid Lesion (n = 6)

Category of Malignant cases	Frequency (n = 6 Cases)	Percentage
Papillary carcinoma	03	50.0
Medullary carcinoma	02	33.3
Anaplastic carcinoma	01	16.7

Data Collection: Written informed consent was obtained from each patient before the collection of data. The study involved a comprehensive review of medical records, capturing demographic details, clinical history and relevant imaging reports. FNAC reports, aligned with TBSRTC categories, were collected alongside corresponding histopathological reports for each case.

Statistical Analysis: Descriptive statistics were employed to summarize demographic and clinical characteristics. Statistical tests were applied to explore the correlation between FNAC and histopathological findings, ensuring a robust analysis of concordance rates within each TBSRTC category.

Ethical Considerations: The study strictly adhered to ethical principles outlined in the Declaration of Helsinki. Ethical clearance was obtained from the institutions ethical committee. Patient confidentiality and privacy were rigorously maintained throughout the research process.

RESULTS AND DISCUSSIONS

The study included a total of 150 cases, with 9.4% (14) being male and 90.6% (135) female. The age distribution across different categories is presented in Table 2. Age-specific analysis revealed a diverse distribution of thyroid lesions across various age groups. Notably, the majority of cases were observed in the 21-30 and 41-50 age groups, with a male predominance in the 61-70 age group. The study encompassed 150 cases, offering a comprehensive insight into the categorization of lesions. The majority

of cases, 88.00% (132 cases), fell under the Benign category (Bethesda II). Other categories included Unsatisfactory/Nondiagnostic (Bethesda I) with 1.33% (2 cases), Atypia of Follicular Lesion (Bethesda III) and Follicular Neoplasm (Bethesda IV) each at 2.67% (4 cases), Suspicious for Malignancy (Bethesda V) at 1.33% (2 cases) and Malignant (Bethesda VI) at 4.00% (6 cases). This breakdown provides a nuanced understanding of the distribution of thyroid lesions as classified by the Bethesda System, facilitating a more informed interpretation of the study findings (Table 3).

We compared the diagnosis on FNAC based on Bethesda system, with the corresponding histopathological diagnosis. Out of 150 cases of FNAC, in 27 cases, histopathological correlation was available. Cytohistological concordance was found in 25 cases whereas two cases were discordant. Out of these discordant cases, one false positive case was of follicular neoplasm, which on histopathological examination was found to be adenomatoid nodule, whereas one false negative case reported as benign on cytology turned out to be papillary carcinoma on histopathological examination (Table 4).

In the present study, the sensitivity, specificity and diagnostic accuracy of FNAC in diagnosing thyroid lesions using TBSRTC system was found to be 92.6, 98.3 and 96.5%, respectively. (Table 5,6) presents the distribution of cases according to the Bethesda system, including benign and malignant categories. Noteworthy benign categories included colloid nodule, colloid goitre, lymphocytic thyroiditis, acute thyroiditis, thyroid cyst and adenomatoid nodule (Table 5). Malignant cases predominantly comprised papillary carcinoma, medullary carcinoma and anaplastic carcinoma (Table 6).

The present study aimed to assess the effectiveness of the Bethesda System, a proposed six-tier diagnostic classification system, in reporting thyroid Fine Needle Aspiration Cytology (FNAC) results. The observed male/female ratio (1:9.7) with predominance of thyroid lesions in females and the highest prevalence in the 40-50 years age group in the current study are consistent with studies conducted by Cibas *et al*.[5] and Safirullah *et al*.[10]. The diverse distribution across various age groups in this study is in concordance with a study conducted by Davies[16] and emphasizes the importance of considering age in thyroid lesion assessment. The study's cytohistological concordance rate of 92.6% supports the reliability of FNAC in diagnosing thyroid lesions[12,13]. The importance of considering both cytological and histopathological findings for comprehensive patient management has also been highlighted in previous studies[14,15].

The distribution of cases across Bethesda System categories in this study aligns with findings from other researches. studies conducted by Cibas *et al*.[5] and Yang *et al*.[16], which also utilized the six-tier classification system, reporting most of the lesions as benign. In terms of unsatisfactory cases, our study (1.3%) closely mirrored the findings of a study conducted by Canstantine *et al*.[17] and AFLUS (2.6%) and SFM (1.3%) categories showed similarities with their reported rates of 3.0% and 1.3%, respectively. The consistent categorization across studies enhances the robustness of the Bethesda System in standardizing reporting. The distribution of benign cases according to the Bethesda system in the present study aligns with the results of study conducted by Ha EJ *et al*.[15]. Malignant cases in this study predominantly comprised papillary carcinoma, medullary carcinoma and anaplastic carcinoma, reflecting the diverse spectrum of thyroid lesions[18,19].

CONCLUSION

In conclusion, The Bethesda system provides a unified and comprehensive approach to interpreting results, preventing unnecessary surgeries and promoting more judicious patient care. Through an analysis of cases from the selected Tertiary Care Centre, the study seeks to delineate the distribution of thyroid lesions across Bethesda categories. This exploration is essential for enhancing diagnostic accuracy, ensuring consistent management approaches and contributing to the growing body of evidence supporting the use of FNAC and the Bethesda System in thyroid nodule assessment. This exploration will shed light on the diagnostic accuracy and clinical implications of FNAC, ultimately enhancing our ability to optimize the assessment and management of thyroid disorders in clinical settings.

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