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The Importance Of Fine Needle Aspiration Cytology In Thyroid Gland Diseases And Its Accuracy And Reliability In The Diagnosis

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Abstract

Introduction: Thyroid nodules are common in clinical practice, with a prevalence of 4% to 7% among adults. Although less than 5% of these nodules are malignant, the challenge lies in accurately distinguishing benign from malignant lesions to prevent unnecessary surgical interventions. Fine needle aspiration cytology (FNAC) has emerged as a primary diagnostic tool due to its accuracy and cost-effectiveness, particularly when combined with ultrasound guidance.

Aim And Objective: This study aims to evaluate the role of FNAC in diagnosing thyroid gland diseases, focusing on its accuracy and reliability in preoperative assessments to avoid unnecessary surgeries.

Materials And Method: A retrospective study was conducted on 60 patients with thyroid nodules, whose FNAC results were verified by microscopic examination. Data were collected from the pathology department at Santosh Medical College, Ghaziabad. FNAC was performed using a 22 to 27-gauge needle, and the slides were stained with May-Grunewald Giemsa (MGG).

Results: Among the 60 cases, 33.3% were diagnosed as benign, while malignant cases constituted 20%. The study found a true positive rate of 83.9% for benign cases. Notably, several cases categorized as suspicious for malignancy were confirmed as malignant, indicating FNAC's reliability in these instances. However, challenges were observed in accurately identifying follicular lesions, with some cases yielding false-positive results.

Conclusion: This study underscores FNAC's critical role in the diagnosis and management of thyroid disorders. With a significant prevalence of benign conditions and a notable proportion of malignant cases, accurate cytological evaluation is essential. The findings highlight the need for improved diagnostic accuracy, particularly in distinguishing between benign and malignant follicular lesions, to optimize patient management and reduce unnecessary surgical interventions.

INTRODUCTION

Thyroid nodules are frequently encountered in clinical practice, with a prevalence estimated between 4% and 7% in the adult population. Despite their common occurrence, less than 5% of these nodules are found to be malignant, indicating that the majority are either non-neoplastic or benign neoplasms. Surgical intervention is generally reserved for patients with a suspicion of malignancy. This approach helps to prevent unnecessary surgeries and potential complications, such as damage to the recurrent laryngeal nerve, hypoparathyroidism, and dependency on thyroid hormone in patients with benign conditions. However, it is important to note that distinguishing between benign and malignant nodules cannot rely solely on clinical evaluations alone.[1] Fine needle aspiration cytology (FNAC) of the thyroid gland has become an established first-line diagnostic method for assessing both diffuse thyroid lesions and individual nodules. Its primary aim is to confirm benign conditions, thereby minimizing the need for unnecessary surgical procedures.[2] Various imaging modalities are currently employed to aid in the diagnosis of thyroid nodules, including radionuclide scanning and high-resolution ultrasonography. Despite the availability of these advanced techniques, FNAC remains the most accurate and cost-effective diagnostic procedure, especially when combined with ultrasound guidance for enhanced sample collection, particularly in the case of cystic lesions.[3] Research indicates that FNAC boasts an overall accuracy rate of approximately 95% for identifying thyroid malignancies.[4] However, like any diagnostic test, FNAC is not without its limitations and potential errors. These drawbacks encompass false-negative and false-positive results, as well as a subset of FNAC findings that may be classified as indeterminate or suspicious, rather than definitively benign or malignant.[5] The challenges associated with FNAC can arise from various factors, including specimen adequacy, sampling techniques, the expertise of the clinician performing the aspiration, the pathologist's experience in interpreting the

samples, and the presence of overlapping cytological characteristics between certain benign and malignant thyroid lesions.[6]

AIM AND OBJECTIVE

Preoperative distinction of benign lesions is of paramount importance to avoid unnecessary surgery. The aim of this study was to determine the importance of FNAC in thyroid gland diseases and its accuracy and reliability in the diagnosis by comparing with its histopathological study.

MATERIALS AND METHOD

This was a retrospective study, performed on 60 patients including all cases of thyroid FNAC which were verified by microscopic examination. The data was obtained from pathology department of Santosh Medical College, Ghaziabad, Uttar Pradesh, the FNAC was carried out with a 22 to 27 gauze needle attached to a 20 ml needle with 2-6 passes in each nodule. The smears were air dried and fixed by 95% alcohol. Then the slides were stained with May-Grunewald Giemsa (MGG) and reported according to Bethesda system for reporting (2017). All these patients underwent surgery and the samples were sent to histopathology lab, Department of Pathology. These samples were grossed, processed and reported accordingly to WHO classification (2022).

RESULT

Table 1: Distribution of cases according to cytologic diagnosis

Cytological diagnosis	No.	Percentage
Category I- Unsatisfactory	4	6.7
Category II- Benign	20	33.3
Category III- Follicular lesion of US	8	13.3
Category IV- Follicular neoplasm	10	16.7
Category V- Suspicious of malignancy	6	10.0
Category VI- Malignant	12	20.0
Total	60	100

Table 2: Cytologic diagnosis of included cases, and the corresponding hostopathologic results

Category I- Unsatisfactory

Cytologic Diagnosis	No.	Histopathologic Results	No.	Remark
Category I- Unsatisfactory	04	-	04	TP

Category II- Benign

Cytologic Diagnosis	No.	Histopathologic Results	No.	Remark
1) Follicular Nodule	19	• Colloid Goitre	17/19	TP
		• Follicular Neoplasm	02/19	FN
2) Hashimoto thyroiditis	01	• Non Hodgkin Lymphoma	01/01	FN
3) Granulomatous thyroiditis	0	_	0	_
Total Benign cases			20	

Category III- Follicular lesion of undetermined significance

Cytologic Diagnosis	No.	Histopathologic Results	No.	Remark
Follicular lesion of undetermined significance	08	• Colloid goitre	03/08	FP
		• Follicular Adenoma	05/08	TP

Catergory IV- Follicular Neoplasm

Cytologic Diagnosis	No.	Histopathologic Results	No.	Remark
Follicular Neoplasm	10	• Nodular goitre	01/10	FP
		• Follicular Adenoma	07/10	TP
		• Follicular Carcinoma	02/10	TP
		• Follicular neoplasm- oncocytic type	0	_

Category V- Suspicious of malignancy

Cytologic Diagnosis	No.	Histopathologic Results	No.	Remark
Suspicious of malignancy	06	• Malignant	06/06	TP
		• Benign	0	-

Category VI- Malignant

Cytologic Diagnosis	No.	Histopathologic Results	No.	Remark
Malignant	12	• Papillary carcinoma	07/12	TP
		• Medullary carcinoma	02/12	TP
		• Anaplastic	01/12	TP
		• Squamous cell carcinoma	0	
		• Non Hodgkin lymphoma	02/12	TP
		• Metastatic malignancy	0	

Table 3: Relations between cytologic and final diagnosis of 56 satisfactory smears

Cytologic Diagnosis	Benign Final Diagnosis	Neoplastic Final Diagnosis	Total
Benign (Category II +III)	20 (TP) (71%)	08 (FN) (29%)	28
Follicular Neoplasm (Category IV)	07 (TP) (70%)	02 (TP) (20%)	10
Suspicious and Malignant (Category V+ VI)	0	18 (TP) (100%)	18
Total	28	28	56

TP – 45/56 – 80%
FN – 8/56 – 14%
FP – 1/56 – 1%

DISCUSSION

In our study of 60 cases, we evaluated the distribution of cytologic diagnoses in patients undergoing thyroid evaluations. The findings revealed that benign diagnoses accounted for 33.3% (20 cases), while a smaller proportion were classified as follicular lesions of unknown significance (13.3%, 8 cases) and follicular neoplasms (16.7%, 10 cases). Notably, 20% (12 cases) were diagnosed as malignant, with 10% (6 cases) classified as suspicious of malignancy. Additionally, 6.7% (4 cases) were deemed unsatisfactory for diagnostic purposes. These results underscore a significant prevalence of benign lesions, which is consistent with the general understanding that most thyroid nodules are non-cancerous. When analyzing the correlation between cytologic diagnoses and final pathologic results, our findings showed that among the benign cytologic diagnoses, there were 20 true positives (TP) confirming benign pathology and 8 false negatives (FN) where neoplasms were present. Notably, nodular goiter emerged as the most common benign condition, with 17 confirmed cases of colloid goiter, alongside 2 instances of follicular adenoma. One case of Hashimoto's thyroiditis was confirmed as non-Hodgkin lymphoma (NHL), highlighting the necessity of thorough investigation even when benign cytology is indicated. Regarding follicular lesions, we identified that 05 out of 08 cases were confirmed as follicular adenomas, yielding a true positive (TP) rate of 76%. However, 03 cases were misclassified as false positives (FP), indicating a degree of diagnostic challenge associated with this category. For the follicular neoplasm group, 10 cases were reviewed, resulting in 07 TPs for follicular adenomas and 02 TPs for follicular carcinoma. This indicates that cytological assessment is crucial in distinguishing between benign and malignant conditions within this subgroup. The "suspicious" cytologic diagnosis category presented a more significant challenge. All 06 cases classified as malignant upon final diagnosis were correctly identified (TP), indicating that cytology can effectively signal malignancy when it is suspected. Similarly, in the malignant diagnosis category, 12 cases were assessed and all were true positive. This strong correlation suggests that cytological findings can be a reliable predictor of malignancy, particularly in cases of papillary carcinoma, where 07 out of 07 cases were accurately identified. Sinna EA et al.,[7] evaluated the distribution of cytologic diagnoses among 296 cases, revealing insightful trends regarding thyroid pathology. The majority of our cases were classified as benign, accounting for 33.1% of the total diagnoses. This indicates that a significant proportion of patients presented with non-malignant thyroid conditions, which aligns with existing literature suggesting a high prevalence of benign lesions in the thyroid gland. Notably, the next largest group was classified as malignant, representing 19.5% of the cases. This is a concerning figure, emphasizing the importance of effective screening and diagnostic strategies to identify

potentially harmful thyroid conditions early. In the intermediate category, we observed 10.1% of cases classified as suspicious for malignancy, which necessitates further diagnostic workup to clarify their nature. Analyzing the relationship between cytologic diagnoses and pathological results reveals further insights. Among the benign cases, 20 were diagnosed cytologically, with 17 confirmed as benign upon pathological evaluation, demonstrating a true positive rate (TP) of 85%. However, 3 cases were false negatives (FN), which emphasizes the potential for cytological misdiagnosis in benign lesions. This finding is crucial, as it suggests a need for cautious interpretation of cytologic results, particularly in cases that present with nodular goiter or follicular lesions. In the group diagnosed with follicular lesions of the undetermined significance (US), 08 cases were initially identified. Out of these, 05 were confirmed as follicular adenomas (true positives, TP), while 03 cases were categorized as false positives (FP). This discrepancy indicates a challenge in accurately diagnosing follicular lesions through cytology alone, which may lead to unnecessary procedures for benign conditions. Among the 10 cases of follicular neoplasm, we noted a substantial number (09) that were confirmed malignant (TP), with 01 classified as FP. This underlines the risk associated with follicular neoplasms, where distinguishing benign from malignant entities is often difficult. The identification of 02 true positive cases of follicular carcinoma further emphasizes the clinical significance of vigilant cytologic assessment in this category. In the suspicious category, we found that 06 out of 06 cases were confirmed malignant (TP), showcasing a high degree of reliability in this diagnostic classification. The correlation between cytologic diagnosis and final pathological diagnosis reveals a total of 56 cases. The benign category retained a true positive count of 71%, with 29% false negatives, further substantiating the need for meticulous evaluation of cytological samples. The suspicious and malignant categories combined contributed significantly to the total confirmed malignancies, with 100% true positives, reiterating the critical importance of early and accurate diagnosis in improving patient outcomes.

CONCLUSION

The distribution of cases in this study revealed that benign diagnoses accounted for 33.3% of the total, indicating a significant prevalence of non-malignant thyroid conditions. In contrast, malignant cases constituted 20.0% of the total diagnoses, underscoring the importance of early detection and management of potentially harmful thyroid diseases. Among the cytologically diagnosed benign cases, a true positive rate of 80% was observed, although a few cases were falsely identified as neoplastic. The diagnosis of follicular lesions presented notable challenges in accurate identification, particularly with a false positive rate observed in the nodular goiter category. Additionally, a substantial number of cases categorized as suspicious for malignancy were confirmed as malignant upon pathological examination, suggesting high reliability in this diagnostic category. In the follicular neoplasm group, a significant portion of cases were confirmed malignant, highlighting the necessity for thorough evaluations to distinguish between benign and malignant lesions. Overall, the correlation between cytologic and final diagnoses emphasizes the critical role of cytology in the accurate diagnosis and management of thyroid disorders while also identifying areas for improvement in diagnostic accuracy.

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