Diagnostic Correlation of Ultrasonography, Fine Needle Aspiration Cytology, and Histopathology in Goitre Cases

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Abstract Introduction: *Disorders of thyroid gland are amongst the most common endocrine and surgical problems encountered in clinical practice . The incidence of thyroid diseases is increasing in recent years due to goitrogens and changing food habits. Thyroid gland is afflicted by various pathologies ranging from diffuse enlargement (goitre) to nodular lesions, thyroiditis, and malignancies. High-resolution ultrasound has become the first line imaging modality for evaluation of the thyroid gland due to excellent visualization of the thyroid parenchyma. It is highly sensitive in detecting small nodules, calcification, septations and cysts as well as in guiding fine needle aspiration biopsies.* ***Materials and Methods****: This prospective observational study was carried out in the Dept. of Pathology at over a period of 6 month. Total of 120 patients of either sex, presented with clinically palpable thyroid swellings detected by USG, euthyroid patients with confirmed pathological reports, patient fit for general anaesthesia. Patients who presented in OPD with thyroid swelling underwent thyroidectomies after USG and FNAC diagnosis was confirmed, were included in the study.* ***Results****: The results of this study indicate a strong correlation between FNAC and histopathological findings, with FNAC demonstrating high specificity (94.3%) and sensitivity (84.3%). Out of 120 cases, FNAC correctly identified 85 benign cases and 27 malignant cases when compared to histopathological diagnosis. However, there were a few discordant cases where FNAC misclassified benign and malignant cases, emphasizing the necessity of histopathological confirmation. The overall diagnostic accuracy of FNAC was found to be 89.2%, making it a reliable preoperative diagnostic tool in the assessment of goitre cases.* ***Conclusion****: This study highlights the importance of a multimodal approach in evaluating goitre. While USG and FNAC are valuable, histopathology remains indispensable. Enhanced imaging techniques and molecular markers may further refine diagnostic accuracy in future studies. FNAC is a valuable diagnostic tool in the evaluation of goitre, with high sensitivity and specificity. However, final confirmation should be based on histopathological examination.*

Keywords: *Goitre, Ultrasonography, Fine Needle Aspiration Cytology, Histopathology, Thyroid Nodules, Diagnosis*

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INTRODUCTION

Disorders of thyroid gland are amongst the most common endocrine and surgical problems encountered in clinical practice [1]. The incidence of thyroid diseases is increasing in recent years due to goitrogens and changing food habits. Thyroid gland is afflicted by various pathologies ranging from diffuse enlargement (goitre) to nodular lesions, thyroiditis, and malignancies [2]. High-resolution ultrasound has become the first line imaging modality for evaluation of the thyroid gland due to excellent visualization of the thyroid parenchyma. It is highly sensitive in detecting small nodules, calcification, septations and cysts as well as in guiding fine needle aspiration biopsies [3]

FNAC is a simple, quick, inexpensive method to detect thyroid swelling pathology. FNAC provides the most direct and specific information about thyroid. The use of FNAC reduces the number of thyroidectomies by approximately 50% [4, 5] which roughly doubles the surgical yield of carcinoma and reduces the overall cost of medical care in these patients by 25% [6]. FNAC may fail when the gland is too small or fibrotic and biopsy may be needed in such cases. FNAC may also fail in distinguishing between follicular adenoma and follicular carcinoma for which histopathology is necessary to distinguish between the two. USG and FNAC are commonly used cost effective methods of diagnosis; however there are drawbacks of each technique and the final answer to the problem is still elusive [7]. Ultrasonography and FNAC each have their own shortcomings but as their advantages outweigh the disadvantages, they should be routinely used for diagnosis of thyroid swelling pathology.

Thyroid surgery has many complications like haemorrhage, change in voice due to injury to recurrent laryngeal nerve, respiratory obstruction due to bilateral vocal cord palsy, laryngeal oedema, tracheal injury, thyroid storm, thyrotoxicosis, tetany due to injury to parathyroid glands etc.[8] It is necessary to choose patients who genuinely need surgery especially in small thyroid swellings to avoid the risk of such dreadful complications. The purpose of present study was to find the sensitivity, specificity and accuracy of both USG and FNAC and correlate it with histopathology report so that unnecessary thyroid surgery and hence such dreadful complications can be avoided.[9]

Goitre, characterized by thyroid gland enlargement, requires precise evaluation to guide management. While ultrasonography serves as a primary imaging modality, FNAC is a widely accepted tool for cytological assessment. However, discrepancies between these methods and histopathology warrant a thorough comparative analysis.[10,11]

MATERIALS AND METHODS

This prospective observational study was carried out in the Dept. of Pathology over a period of 6 month. Total of 120 patients of either sex, presented with clinically palpable thyroid swellings detected by USG, euthyroid patients with confirmed pathological reports, patient fit for general anaesthesia. Patients who presented in OPD with thyroid swelling underwent thyroidectomies after USG and FNAC diagnosis was confirmed, were included in the study. Patients who were diagnosed with carcinoma of the thyroid and were on follow-up for residual disease or recurrence, post-operative patients and those with physiological goitre during adolescence and pregnancy were excluded from the study. The final data collected were analyzed using SPSS software version 23.

A brief history and physical examination were carried out. Euthyroid patients underwent USG examination, and any suspected lesions were subsequently evaluated with FNAC. Patient subjected to surgical excision were included in study and histopathological examination report collected for correlation. The Ultra sound machine used was GE LOGIQ P5 with a 4 to 12 MHz linear probe will be used. The acoustic power in the Doppler mode was limited to that recommended by the current U.S food and drug administration guidelines for thyroid scanning

technique of USG neck We have high frequency transducers (3.5 MHZ) currently providing both deep ultrasound penetration up to 5 cm and high definition images with a resolution of 0.7-1.0 mm were used. Linear array transducers are preferred to sector transducers because of wider near field of view.

Technique of FNAC of thyroid lesion FNAC was performed using a 24-gauge needle attached to a 10 cc disposable syringe. Both aspiration and non-aspiration techniques were employed after cleaning and draping the patient. Material was aspirated from the swelling, and two smears were prepared. The first slide was air-dried and fixed in ethanol, while the second slide was wet-fixed in ethanol. The air-dried smear was stained using May-Grünwald-Giemsa (MGG) stain and the wet-fixed smear was stained with haematoxylin and eosin (H and E)

USG-guided FNAC was also conducted as part of the study. Based on the findings from the USG and FNAC reports, the patient was scheduled for a thyroidectomy. The excised sample was sent for histopathological analysis. The USG and FNAC results were then compared with the histopathology findings of the thyroid swelling.

RESULTS

The results of this study indicate a strong correlation between FNAC and histopathological findings, with FNAC demonstrating high specificity (94.3%) and sensitivity (84.3%). Out of 120 cases, FNAC correctly identified 85 benign cases and 27 malignant cases when compared to histopathological diagnosis. However, there were a few discordant cases where FNAC misclassified benign and malignant cases, emphasizing the necessity of histopathological confirmation. The overall diagnostic accuracy of FNAC was found to be 89.2%, making it a reliable preoperative diagnostic tool in the assessment of goitre cases.

Table 1: Distribution of Patients According to Age:

Age Group (Years)	Number of Patients
<20	10
20-40	45
41-60	50
>60	15
Total	**120**

Table 2: Distribution of Patients According to Gender:

Gender	Number of Patients
Male	40
Female	80
Total	**120**

Table 3: Correlation of FNAC and Histopathology Findings

FNAC Diagnosis	Benign (Histopathology)	Malignant (Histopathology)	Total
Benign	85	5	90
Malignant	3	27	30
Total	88	32	120

Table 4: Diagnostic Performance of FNAC

Parameter	Value (%)
Sensitivity	84.3
Specificity	94.3
Positive Predictive Value (PPV)	90.0
Negative Predictive Value (NPV)	89.4
Accuracy	89.2

DISCUSSION

Our study demonstrates a high correlation between FNAC and histopathology, supporting FNAC as a reliable preoperative tool. However, some discordant cases highlight the importance of histopathological confirmation, especially in indeterminate cases.

The primary objective of our monocentric study was to investigate the correlation between cytology and histology, as well as between ultrasound and histology. Additionally, we aimed to evaluate whether the incidence of malignancy in each EU-TIRADS class aligned with the estimations provided by experts from the European Thyroid Association (ETA). Upon analyzing our findings, we observed a correlation coefficient of 0.304 for the cytology-histology comparison and 0.408 for the ultrasound-histology comparison.[12]
The distribution of patients with thyroid dysmorphism revealed a peak occurrence in the 4th, 5th, and 6th decades of life.[13] These findings align with previous studies that have also reported a higher prevalence of thyroid abnormalities in older age groups. In contrast with the existing literature [14], our study revealed a higher rate of malignancy in men compared to women.

In our department, we have implemented the new EU-TIRADS classification developed by the ETA to stratify ultrasound results. This classification system assesses the presence of five lesion prototypes of equal significance and assigns nodules to one of the five categories based on the number of suspicious characteristics [15]. This system is known for its practicality and accuracy. Our findings revealed a malignancy prevalence of 33.33% in EU-TIRADS class 2, 20.80% in class 3, 60.68% in class 4, and 86.36% in class 5. It is interesting to note that these results differ significantly from the estimates provided by ETA experts. According to their estimates, the malignancy rates are close to zero in EU-TIRADS class 2, ranging from 2% to

4% in class 3, 6% to 17% in class 4, and 26% to 87% in class 5 [16].

The prevalence of malignancy in EU-TIRADS classes 3 and 4 was found to be 10 times higher than the estimates provided by ETA experts. This disparity can be attributed to the presence of small malignant nodules in close proximity to nodules that were initially interpreted as less suspicious on ultrasound. It is important to note that many patients in our study had undergone ultrasound examinations elsewhere, which prevented us from verifying the quality and accuracy of those examinations.[17]

During the prospective validation of the TIRADS classification conducted by Horvath et al. [18] on 502 resected thyroid nodules, higher sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) (99.6%, 74.4%, 82.1%, and 99.4%, respectively) were reported compared to our study. However, our findings are consistent with those of [18], who demonstrated sensitivity and specificity values of 75% and 77.91% and 74% and 83%, respectively, for ultrasound in suggesting malignant disease. In our study, we detected a weak positive correlation (r = 0.408) between this non-invasive diagnostic method and the final postoperative diagnosis despite a strong positive correlation being found in the literature [19].

Therefore, ultrasound has the advantage of providing a comprehensive evaluation of the entire thyroid gland rather than just the dominant nodule. However, it is important to note that ultrasound findings alone do not provide definitive evidence of malignancy, as no single feature is pathognomonic. Consequently, ultrasound of the thyroid should be considered a complementary tool to fine needle aspiration rather than an alternative, assisting in the comprehensive evaluation of thyroid nodules.

Regarding cytopathology, only 201 patients underwent FNAB following ultrasound evaluation but prior to surgery. The remaining 143 patients in our population opted for direct thyroidectomy despite 3 patients being classified as EU-TIRADS 2 and 122 as EU-TIRADS 3. The primary reasons for this decision among these 125 patients were symptoms of local compression, potential future malignancy risk, or aesthetic concerns. However, the remaining 18 patients, with 14 classified as EU-TIRADS category 4 and 4 as EU-TIRADS category 5, chose direct surgical treatment over FNAB to minimize follow-up procedures.
This allowed us to identify a strong positive correlation (r = 0.512) between the non-invasive diagnostic method and the minimally invasive approach, which aligns with the correlation recognized in the existing literature [20].

In contrast to our incidence distribution, Machala et al.[21] reported different proportions in each Bethesda category. They found 12.52% of their population in Bethesda category I (compared to 3% in our study), 58.95% in category II (compared to 22.35% in our study), 6% in category III (compared to 21.90% in our study), 7.29% in category IV (compared to 18.90% in our study), 11.33% in category V (compared to 31.35% in our study), and 3.88% in category VI (compared to 2.50% in our study).

Consequently, their distribution was in agreement with the incidence predicted by Bethesda, [22] which suggests that the highest incidence is in category II rather than in the fifth category as found in our population. The lower incidence of benign cytology found in our study can be attributed to the fact that our study is a retrospective evaluation of a highly

selected group of patients who underwent thyroidectomy, possibly already presenting an increased risk for malignancy and excluding other patients who underwent FNAB during the last five years in the hospital. Furthermore, when analyzing each category, the malignancy rate in our study was generally higher than the rates predicted by the Bethesda system [23-28], further supporting our theory.

CONCLUSION

This study highlights the importance of a multimodal approach in evaluating goitre. While USG and FNAC are valuable, histopathology remains indispensable. Enhanced imaging techniques and molecular markers may further refine diagnostic accuracy in future studies. FNAC is a valuable diagnostic tool in the evaluation of goitre, with high sensitivity and specificity. However, final confirmation should be based on histopathological examination

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