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*Original Article*

# A Comparison of the Diagnostic Efficiency of Ultrasound Guided Fine Needle Aspiration Cytology versus Conventional Fine Needle Aspiration Cytology of the Thyroid

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***Abstract:***

***Background:*** *In case of thyroid lesion conventional FNAC (C-FNAC) is most reliable and convenient investigation. But it has high inadequate sample collection rate. Ultrasound guided FNAC (US-FNAC) one of the alternative to investigate a thyroid swelling more appropriately.*

***Objectives:*** *Aim of this study to evaluate the diagnostic precision of C-FNAC and weigh up with US-FNAC as well as histopathology.*

***Methods:*** *In this study, a total of 200 patients divided into two groups (A & B) presenting with thyroid swelling or nodules underwent C-FNAC for group A and US-FNAC for group B with subsequent surgery from January 2022 to December 2023 at Green Life Hospital. Cytological diagnosis was classified according to the Bethesda classification. Final histo-pathological results were compared to find out the accuracy of C-FNAC and US-FNAC.*

***Results:*** *From group A we found 7% nondiagnostic and in group B 1% due to inadequate sample. In term of sensitivity, C-FNAC counted 66.7% and US-FNAC 85.2% and in specificity it was 92.8% and 98.6% respectively. In C-FNAC false negative rate was 33.3% where it was 14.8% in US-FNAC. Finally the accuracy was 95% in US-FNAC where it was 85% in C-FNAC.*

***Conclusions:*** *C-FANC is very simple and useful tool for diagnosis of thyroid lesion. But for more precise and specific diagnosis US-FNAC is more superior due to additional information gathered from ultrasound examination along with well visualized aspiration from the targeted lesion.*

***Keywords:*** *Thyroid diseases, Ultrasound guided FNAC, Fine needle aspiration cytology.*

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**Introduction:**

Fine needle aspiration cytology (FNAC), is widely regarded as a crucial initial diagnostic assay for thyroid abnormalities. Nevertheless, its effectiveness is constrained by insufficient samples in a substantial majority of patients. Ultrasound guided FNAC (US-FNAC) is considered a more effective sample technique than conventional FNAC (CFNAC). Studies have consistently shown that US-FNAC has a significantly higher rate of sufficiency, as well as greater sensitivity and specificity, in detecting thyroid malignancies[1].

The procedure of fine needle aspiration cytology (FNAC) for the thyroid gland is a straightforward and minimally invasive office procedure due to the gland's superficial nature and easy accessibility. FNAC has the potential to decrease unneeded surgical procedures for benign lesions, hence saving costs.

Various workers have stated that the primary reason for mistake during cytological examination is the failure to aspirate from the correct location. Furthermore, a significant drawback of CFNAC is its high insufficiency rate, which has been shown to range from 0.6% to 43.1% in various investigations[2,3].

Rizatto et al. introduced ultrasound guided FNAC (USG-FNAC) in 1973[4]. Numerous investigations have since established that USG-FNAC effectively mitigates the insufficiency rate associated with traditional FNAC[5]. Additionally, it possesses a significant benefit in terms of real-time monitoring, which aids in the precise localization of the needle tip during the process of aspiration.

This study compares the diagnostic efficacy of US-FNAC with C-FNAC and aims to confirm the diagnostic efficiency of fine needle aspiration cytology of thyroid swellings. We will accomplish this by utilizing both well-known and widely-used statistical tests, along with some innovative tests that assess diagnostic value. By understanding the strengths and limitations of each method, patients and healthcare providers can make more informed decisions. We will break down the pros and cons of these two approaches and determine which one offers the most efficient and reliable thyroid diagnosis.

**Materials and Methods:**

This study was conducted at private set-up using a cross-sectional design. It was spanned from January 2022 to December 2023. The study included an intake of 200 individuals, aged 18 to 70, of any gender, who presented with thyroid enlargement or nodules. Total population then divided in to two group following a random selection method where 100 patients were in group A and 100 patients in group B. We excluded patients with inoperable malignancies in advanced stages or those who had metastases in the lymph nodes. All patients were referred to the pathology department for CFNAC and US-FNAC from a private clinic. Group A selected for C-FNAC and Group B for US-FNAC. The histology specimens of both group were forwarded to the pathology department following the surgical procedure.

The majority of patients reported experiencing neck swelling, which may be categorized as either diffuse, multinodular, or solitary. The otolaryngologist conducted a thorough clinical examination of each patient and accurately documented symptoms associated with underactive or overactive thyroid gland. Additional symptoms such as discomfort, coughing, difficulty swallowing, shortness of breath, and changes in voice were also observed. Following a thorough evaluation of the patient's medical background and physical examination, a thyroid function test and ultrasound of the thyroid gland were conducted. The patient was referred to the

Department of Pathology for C-FNAC or US-FNAC according to the selected group. If there are several nodules or disorders affecting both lobes of the thyroid gland, even if only one nodule or one lobe is cancerous and the other is not, the case is classified as malignant in cytology. Cytological diagnosis of the thyroid reported following "The Bethesda System for Reporting Thyroid Cytopathology[6]"

- I – Non diagnostic or Unsatisfactory
- II – Benign
- III – Atypia of undetermined significance (AUS) or follicular lesion of undetermined significance (FLUS)
- IV – Follicular neoplasm or suspicious for a follicular neoplasm
- V – Suspicious for malignancy
- VI - Malignant

A comprehensive analysis of the historical data, clinical symptoms, thyroid profile, ultrasound results, and cytopathology report was conducted, leading to an accurate diagnosis. All cases requiring surgery were scheduled for surgical intervention, and an excised sample of the thyroid gland was subsequently delivered to the same pathology department for histological analysis.

A comprehensive analysis was conducted on a total of 200 cases, taking into account both cytology and histology data. The statistical analysis was conducted for the false negative rate, false positive rate, sensitivity, specificity, and accuracy.

**Results:**

In group A, 100 patients with thyroid nodule or swelling, 71 (71%) were women and 29 (29%) were men between 20 to 72 years of age (Average 46 years old) with female to male ratio 2.5:1. All patients from this group went for CFNAC before surgery.

From group B, 100 patients with thyroid nodule or swelling, 77 (77%) were women and 23 (23%) were men between 23 to 67 years of age (Average 45 years old) with female to male ratio 3.3:1. And as per procedure patients from this group went for USFNAC before surgery.

From both groups cases according to the Bethesda Classification all cytopathological reports were organized as I – Non diagnostic or Unsatisfactory, II – Benign, III – Atypia of undetermined significance (AUS) or follicular lesion of undetermined significance (FLUS), IV – Follicular neoplasm or suspicious for a follicular neoplasm, V – Suspicious for malignancy and VI – Malignant.

All the patients of this study went for CFNAC and USFNAC. After cytopathological examination, from group A we found 7 (7%) Nondiagnostic or Unsatisfactory, 51 (51%) Benign, 8 (8%) Atypia of undetermined significance (AUS) or follicular lesion of undetermined significance (FLUS), 9 (9%) Follicular neoplasm or suspicious for a follicular neoplasm, 11 (11%) Suspicious for malignancy and 14 (14%) – Malignant.

In group B, 1 (1%) Nondiagnostic or Unsatisfactory, 56 (56%) Benign, 7 (7%) Atypia of undetermined significance (AUS) or follicular lesion of undetermined significance (FLUS), 12 (12%) Follicular neoplasm or suspicious for a follicular neoplasm, 7 (7%) Suspicious for malignancy and 19 (19%) – Malignant.

All 200 patients underwent for thyroid surgery after proper evaluation and diagnosis. After surgery, specimen was sent for histo-pathology in the same lab where CFNAC and USFNAC were performed. According to the histopathology reports the malignancy rates from group A in all the categories were as follows – for Bethesda group I - 1 cases (14.3%), group II –7 cases (13.7%), group III – 1 cases (12.5%), group IV – 1 case (11.1%), group V – 8 cases (72.8%) and group VI – 12

cases (85.7%). Finally, the total number of benign lesions was 70 (70%) and malignant lesions 30 (30%). So, the benign-to-malignant lesion ratio is 2.3:1.

From group B after histopathology in all the categories were as follows – for Bethesda group I - 0 cases (0%), group II –2 cases (3.6%), group III – 1 cases (14.3%), group IV – 1 case (8.3%), group V – 6 cases (85.7%) and group VI – 17 cases (100.0%). Finally, the total number of benign lesions was 73 (73%) and malignant lesions 27 (27%). So, the benign-to-malignant lesion ratio is 2.7:1.

The final correlation between CFNAC and USFNAC with the histopathology diagnosis among 200 spacemen is shown in Tables I and II.

**Table-I:**

*Comparison of CFNAC and Histopathology of thyroid lesions*

| CFNAC results according to Bethesda classification | | Histopathology | | |
|---|---|---|---|---|
| | | Benign | Malignant | Discordant case |
| I | 7 | 6 | 1 | 1 |
| II | 51 | 44 | 7 | 7 |
| III | 8 | 7 | 1 | 1 |
| IV | 9 | 8 | 1 | 1 |
| V | 11 | 3 | 8 | 3 |
| VI | 14 | 2 | 12 | 2 |
| Total | 100 | 70 | 30 | 15 |

**Table-II:**

*Comparison of USFNAC and Histopathology of thyroid lesions*

| USFNAC results according to Bethesda classification | | Histopathology | | |
|---|---|---|---|---|
| | | Benign | Malignant | Discordant case |
| I | 1 | 1 | 0 | 0 |
| II | 56 | 54 | 2 | 2 |
| III | 7 | 6 | 1 | 1 |
| IV | 12 | 11 | 1 | 1 |
| V | 7 | 1 | 6 | 1 |
| VI | 17 | 0 | 17 | 0 |
| Total | 100 | 73 | 27 | 5 |

Now to observe the value of CFNAC and USFNAC to detect malignancy in thyroid diseases few statistical analysis was done (Table III)

- Sensitivity = True positive/ (True positive + False negative)
- Specificity = True negative/ (True negative + False positive)
- False positive rate = False positive/ (False positive + True negative )
- False negative rate = False negative/ (False negative + True positive)
- Accuracy = True positive + True negative/ Total number of cases

**Table-III:**
*Details analysis of CFNAC and USFNAC according to final Histopathology report*

| | CFNAC | USFANC |
|---|---|---|
| Sensitivity | 66.7% | 85.2% |
| Specificity | 92.8% | 98.6% |
| False Positive | 7.1% | 1.4% |
| False Negative | 33.3% | 14.8% |
| Accuracy | 85.0% | 95.0% |

• *In group A and group B, N-100*

**Discussion:**

For the identification of thyroid abnormalities find needle aspiration cytology (FNAC) is widely recognized preoperative Diagnostic tool. It is one of the crucial Diagnostic tool and different investigations have demonstrate that it has a satisfactory level of sensitivity and specificity[7,8]. But, now a days the effectiveness of standard FNAC is restricted due to relatively large number of inadequate sample leading to a plight when making surgical decision. As ultrasound developed a lot, now ultrasound guided FNAC (US-FNAC) is becoming a substitute for C-FNAC. It has been found to have a reduce rate of inadequacy as well as a higher sensitivity and specificity and that kind of accuracy help to detecting a greater number of malignant lesions[9]. More studies on US-FNAC definitely have concluded that it is a reliable method for diagnosing thyroid lessons[10].

However there have been some conflicting opinions aslo. The significance of the cytopathologist's proficiency has been accentuated in ensuring the reliability of FNAC results. This prowess may also account for the conflicting conclusions on the effectiveness of US-FNAC in identifying thyroid lesions.

In our study, from both group A and group B, majority of the patients were females. In group A71% were female and in group B 77% were female. Studies performed by other researchers also reported high percentage of female patients in their studies and age group of presentation similar to our study[13,14].

The results of our investigation confirmed that US-FNACs have a significantly lower percentage of inadequate aspirates (1% for US-FNAC compared to 7% for C-FNAC). Furthermore, the US-FNAC method shown a greater rate of identifying malignant patients, which aligns with the results of other research[2,5,11]. Furthermore, the proportion of instances that could not be determined was smaller in comparison to C-FNAC. The reason behind this scenario is most likely the ability to directly observe the thyroid lesion and obtain the accurate sample from it in the case of US-FNAC, as opposed to C-FNAC. Ultrasound examination has been demonstrated to be a valuable imaging tool for the thyroid gland. The possibility of a higher favorable proportion of uncertain diagnoses in the case of US-FNAC is also expected to be influenced by the increased information about the lesion.

High resolution ultrasound has allowed clear identification of suspicious feature like solid or cystic tumor & which includes micro-calcification, margin of the tumor and vascularity in the nodule[12].Ultrasonography, when used in conjunction with FNAC, has been illustrated in a prior study to yield a high level of accuracy in cytological diagnosis. In this study we found only 5% discordant cases from US-FNAC where 15% discordant cases revealed by C-FNAC. This is because of the accuracy of the aspiration with the guidance of the imaging.

In C-FNAC, 7.1% cases are false positive and 33.3% false negative out of 100 cases. In group B where US-FNAC performed in 100 cases, we found 1.4% false positive and 14.8% false negative cases. The false positive

and false negative rates of C-FNAC and US-FNAC in our study were comparable to other similar studies[1,5,13,15].

In our study histopathological diagnosis were available in all the cases among both groups. In group A where we performed C-FNAC, we found the accuracy 85%. In group B where we did US-FNAC, we got the accuracy 95%. So, accuracy was much lower in conventional FNAC if we compare it with US-FNAC. We observed similar results published on other studies[5,15].

The limitation of our study is that it was conducted in a single center. So, we couldn't observe the performance of C-FNAC or US-FNAC from a different center where more expert pathologists or sinologists may be available. For a definitive conclusion, a sample and report from a different institute would have been required.

**Conclusion:**

Here we would like to conclude that both the investigations are useful in diagnosis of thyroid diseases. However, we found US-FNAC is more reliable over to C-FNAC as it has low inadequacy rate with high accuracy. In addition there is also an advantage of a multi-modality approach to diagnosis of thyroid diseases in compare to C-FNAC. So, doing US-FNAC for thyroid lesion would be very helpful for ENT surgeon to decide further management accordingly.

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