



DIAGNOSTIC ACCURACY OF ULTRA SOUND GUIDED FINE NEEDLE ASPIRATION AND ULTRA SOUND GUIDED FINE NEEDLE NON ASPIRATION CYTOLOGY IN GOITRE

General Surgery

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ABSTRACT

BACKGROUND: Early diagnosis and appropriate treatment has become a necessity in management of thyroid lesion. USG guided fine needle aspiration cytology (FNAC) and USG guided Fine needle non aspiration cytology (FNNAC) are useful cost effective techniques for pre-operative evaluation of the lesion. Both techniques have their own advantages and disadvantages and superiority of one over the other is hard to establish.

AIM OF THE STUDY: To assess the diagnostic accuracy of ultrasound guided FNAC and ultrasound guided FNNAC in Goitre.

OBJECTIVE OF THE STUDY: To compare FNAC and FNNAC with histopathological examination (HPE) in the diagnosis of thyroid lesions in terms of type of nodule/lesion and to designate diagnostic accuracy for benign and malignant lesions.

MATERIALS AND METHODS: Around 40 patients with thyroid lesion, enrolled in sequential manner were included in this cross sectional study conducted, between January 2018 and July 2019. Both ultra sound guided FNAC and FNNAC were done for the patients. Patient was subjected to proposed surgery based on FNAC report. Reporting of FNAC, FNNAC and HPE was done by individual pathologists who were blinded about other reports. The reports of FNAC and FNNAC were compared with final HPE report and data were analyzed.

RESULTS: We have concluded that the maximum incidence of thyroid lesions occurred in the third decade of life. Thyroid lesions show a female preponderance with the current study showing 98% of the study population being female. Colloid goitre was the most common benign lesion and papillary carcinoma was the most common malignancy accounting for 52.5% and 12.5 % of the study population, respectively. USG guided FNNAC had a sensitivity, specificity, positive predictive value and Negative predictive value of 83.3%, 94.5%, 71% and 97% respectively. The diagnostic accuracy of ultra sound guided FNNAC (95.5%) was found to be higher than that of ultra sound guided FNAC (92.5%).

CONCLUSION: In spite of conflicting evidences in literature, our study has shown ultrasound guided FNNAC had better diagnostic accuracy than ultrasound guided FNAC in thyroid lesion.

KEYWORDS

Fine needle aspiration cytology, Fine needle non aspiration cytology, Thyroid, Ultrasound guided

INTRODUCTION

Diseases of the thyroid gland are commonly encountered surgical problems in the clinical practice. According to literature, 42 million people have thyroid disorder in India¹ and it is of increasing trend due to various advancements in diagnostic techniques and accessibility to health care. Early diagnosis and appropriate treatment form the foundation in treatment of the disease. The basic ideology remains to identify the benign and malignant lesion. Any thyroid nodule >1cm with a high-risk category on ultrasound (USG) requires cytological evaluation according to the American Association of Clinical Endocrinologists Guidelines update released in 2016². The endocrine society of India also issued a statement which was coherent to these guidelines.³

Since early 1950s Fine needle aspiration cytology (FNAC) has been used in preoperative evaluation of the lesion. Accuracy of fine needle aspiration cytology increased when done under USG guidance. It is believed that this aspiration technique frequently leads to microscopic haemorrhages, which are an obstacle to proper cytological interpretation.⁴

In an attempt to overcome this problem, Fine needle non-aspiration cytology (FNNAC) or fine needle capillary sampling (FNCS) were developed recently. This technique depends solely on capillary action of the fine needle, therefore is less painful, less traumatic and thus much more patient-friendly.⁵

We intended to conduct observational cross-sectional for one-year study at this moment to weigh the benefit of FNNAC over FNAC and its stand in routine practice for cytological diagnosis of euthyroid thyroid nodules.

AIMS AND OBJECTIVES

AIM:

To assess the diagnostic accuracy of ultrasound guided FNAC and ultrasound guided FNNAC in Goitre.

OBJECTIVES:

To compare fine needle aspiration cytology and fine needle non aspiration cytology with histopathological examination in the diagnosis of thyroid lesions in terms of type of nodule/lesion

SUBJECTS AND METHODS

STUDY SUBJECTS

This cross-sectional study was conducted in Mahatma Gandhi Medical College and Research Institute, Puducherry, between January 2018 and July 2019 after obtaining Institute Ethics Committee clearance. Around 40 patients presenting with thyroid nodule/lesion and planned for definitive treatment were enrolled by sequential sampling. Those patients who were included in the study were with normal thyroid function tests (euthyroid state), hypothyroidism, those who are aged between 18 years and above. Those patients who were less than 18 years, patients who presented with hyperthyroidism, patients with bleeding diathesis, patients who are unwilling for surgery were excluded from the study.

METHODOLOGY

After obtaining written consent from all participating patients, elaborate history was elicited. Once proper clinical examination was done patient was subjected to image guided cytological examination. Nodule was localised using Ultrasound with the help of radiologist.



Figure 1: Positioning of patient with neck extended over support

Under strict aseptic precaution, a fine- gauge needle (usually a 25 gauge 1.5-inch needle) was inserted into the nodule. The needle was rocked gently few times to obtain as much tissue as possible. The procedure was repeated two or three times to ensure adequate tissue were collected.

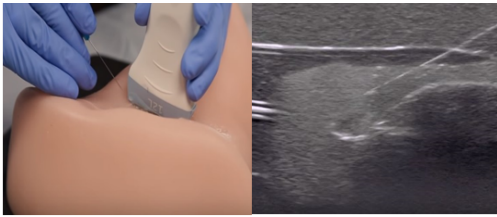


Figure2: USG guided FNNAC

Again a small, fine gauge needle connected to a piston was inserted into the nodule under USG guidance. The piston was withdrawn producing suction to draw enough sample tissue. This procedure was repeated two to three times to ensure adequate tissue were collected.



Figure 3: USG guided FNNAC

The material obtained from FNNAC was expelled into glass slides were labelled as A. Those material obtained from FNAC was expelled into glass slides were labelled as B. Around 6 slides were made by gently pressing clean slides over submitted thyroid tissue. The slides were submerged in 95% ethanol in a kopljin jar. The slides were stained with rapid H & E staining methods. The pathologist who was blinded from the procedure was asked to report the slides A and B separately on the next day.

Based on the FNAC report the patient was planned for the proposed thyroid surgery. After the thyroid surgery, the excised thyroid tissue was sent for histopathological examination.

The histopathological report, labelled as C, was given by different pathologist who was blinded from previous FNAC and FNNAC reports. Finally histopathological report (C) was compared with FNNAC (A) and FNAC (B) reports. Statistical analysis was then calculated for individual parameters using Kruskal Wallis test and chi-square test comparing two groups.

RESULTS

GENDER DISTRIBUTION

The study showed that of the 39 females, around 74% had benign lesion, which formed the major cluster in the population. The single male subject in the study group was also diagnosed to have benign lesion.

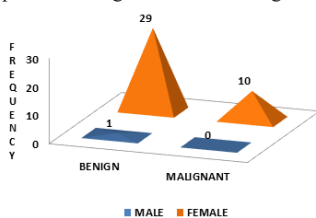


Figure 4: Association of gender with final diagnosis based on HPE

AGE DISTRIBUTION

The study showed that the majority of the patients belong to age group 31-49 year. Around 47.5% of the subjects were within thins group. The two youngest subjects were 18 years of age and the oldest patient in the study population was 72 years of age.

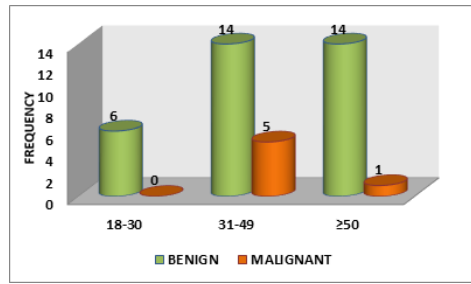


Figure 5: Association of age with final histopathological diagnosis

In the current study the percentage of the patients diagnosed to have malignancy based on the final HPE report was maximum in the age group between 31-49 years of age. Of the 19 thyroid lesions studied in the age group between 31-49 years of age, which formed the major cluster of the population, 14 were benign lesion. In younger age group 18-30 years of age, all of them were benign lesions. In older age groups, > 50 years of age, 93.3 % of the lesions were benign. Overall, of the 6 malignant lesions around 83.3% patients were within 31-49 years of age.

PROCEDURES DONE

Of the 40 patients studied, majority of the patients had undergone total thyroidectomy. It accounted for 57.5% of the total procedures done. It was followed by hemi thyroidectomy in 35% of the study population. Only 3 patients had undergone subtotal thyroidectomy which formed 7.5% of the procedures done.

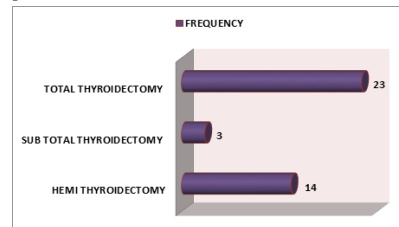


Figure 6: Details of procedures done

HISTOPATHOLOGICAL TYPES OF LESIONS

Colloid goitre accounted for the highest number of lesion in the study population. It formed almost half of the study population. Of the 40 study subjects around 21 were reported as colloid goitre in final histopathological report, which formed 52.5% of the study population. Other benign lesions reported were hashimoto thyroiditis forming 20% of study group and 4 cases of chronic thyroiditis. There was one case of follicular adenoma.

There were totally 6 subjects reported as malignancy, 5 cases of papillary carcinoma and one case of medullary carcinoma. No case of follicular neoplasm was reported during the study period.

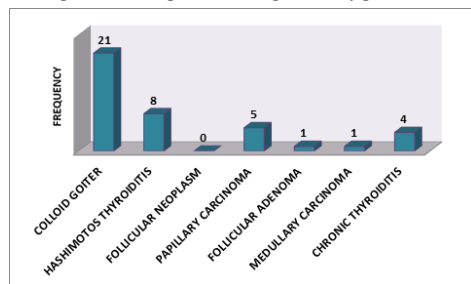


Figure 7: Final diagnosis of thyroid lesions based on HPE examination

Of the 7 malignant lesions diagnosed in final HPE report, 1 case was diagnosed falsely as benign lesion. FNNAC was able to diagnose all 33

benign cases successfully.

Table 1: Comparison between pre-operative Fine Needle Aspiration Cytology (FNNAC) report and post-operative histopathology examination (HPE) of study participants.

| Malignant Status | Malignant Post OP HPE n(%) | Benign Post OP HPE n (%) | n(%) |
|---------------------------|----------------------------|--------------------------|-----------|
| Malignant- Pre OP (FNNAC) | 5 (83.3%) | 1 (2.9%) | 6 (15%) |
| Benign- Pre OP (FNNAC) | 1 (16.7%) | 33 (97.1%) | 34 (85%) |
| Total | 6 (100%) | 34 (100%) | 40 (100%) |

The sensitivity and specificity for FNNAC were found to be 83.3% and 97% respectively, in the study. The positive predictive value was 83% and the negative predictive value was 97.06%. The diagnostic accuracy of the FNNAC was found to be the 95%.

ROLE OF FNAC

Of the 6 malignant lesions diagnosed in final HPE report, 1 case was diagnosed falsely as benign lesion. FNAC was able to diagnose 32 benign cases successfully.

Table 2: Comparison between pre-operative Fine Needle Aspiration Cytology (FNAC) report and post-operative histopathology examination (HPE) of study participants.

| Malignant Status | Malignant Post OP HPE n (%) | Benign Post OP HPE n (%) | n(%) |
|--------------------------|-----------------------------|--------------------------|------------|
| Malignant- Pre OP (FNAC) | 5 (83.3%) | 2 (5.9%) | 7 (17.5) |
| Benign- Pre OP (FNAC) | 1 (16.7%) | 32 (94.1%) | 33 (82.5%) |
| Total | 6 (100%) | 34 (100%) | 40 (100%) |

The sensitivity and specificity for FNAC were found to be 83.3% and 94% respectively, in the study. The positive predictive value was 71% and the negative predictive value was 92.5%. The diagnostic accuracy of the FNAC was found to be the 92.5%.

DISCUSSION

Thyroid lesion is a common case we often come across in our clinical practice. The nodule is palpable in 5% of cases and 60% are detected in those who undergo ultrasound scanning. 6 Most of the nodules are benign in nature. Since its time of implementation, FNAC continues to be the gold standard test for diagnosis of the pathological type of thyroid lesion. They have been immensely credited with marked decrease in unnecessary thyroid surgeries. Though FNAC has significant advantages such as minimally invasive and cost effective and high sensitivity and positive predictive value,⁷ it has its own disadvantages such as unsatisfactory specimen and improper cytological inferences due to bloody background during negative pressure aspiration. In an attempt to overcome this problem FNNAC was developed to in 1982, which relies on the capillary tension to suck the tissue within the lumen of the needle, thus reducing tissue damage and the bloody background.

In the current study of 40 cases females constituted majority of the study population accounting for about 98% of the sample. This is in concurrence with other studies throughout the world, which show female predominance due to roles of hormones. Similar study done by Pradeepkumar et al in 2012, in coastal areas of Puducherry and Cuddalore showed prevalence of 91.2%.⁸

Histopathological examination remains the gold standard for diagnosing the thyroid lesion. The different types of thyroid lesion in the present study have been compared with similar studies of the various authors. The distribution patterns when compared showed higher prevalence rate of colloid goitre similar to the studies conducted by pradeepkumar et al⁸ and Rahman et al⁹. In the current study colloid goitre was the most common benign lesion. Papillary carcinoma was the most common malignant lesion. This result is in concurrence with study of other authors.⁸

Table 3: Comparison of HPE diagnosis with other studies

| S.N | DIAGNOSIS | Current Study | Pradeep kumar et al ⁸ | Rahman et al ⁹ | Patil et al ¹⁰ |
|-----|----------------|---------------|----------------------------------|---------------------------|---------------------------|
| 1 | Colloid Goiter | 52.5 | 34.5 | 75 | 29.42 |

| | | | | | |
|---|------------------------|------|-------|-------|-------|
| 2 | Hashimotos Thyroiditis | 20 | 12.28 | 2.78 | 2.94 |
| 3 | Follicular Neoplasm | 0 | 1.46 | 1.85 | 1.47 |
| 4 | Papillary Carcinoma | 12.5 | 20.47 | 5.55 | 13.24 |
| 5 | Follicular Adenoma | 2.5 | 10.19 | 28.65 | 41.18 |
| 6 | Medullary Carcinoma | 2.5 | - | - | 1.47 |
| 7 | Chronic Thyroiditis | 10 | - | - | - |

The sensitivity of FNAC was found to be 83.3%, which was higher when compared to other studies conducted by Ozdemir et al [41], Ahmadinejad et al [42] and Lngegowda et al [43]. In contrast study conducted by Hajmanoochehri et al in 2015 evaluating diagnostic accuracy of FNAC had higher sensitivity rate of 95.2%. The specificity was found out to be 94% which are almost in concurrence with studies of Ozdemir et al [41], Ahmadinejad et al [42] and Lngegowda et al [43]. Overall diagnostic accuracy was 92.5% in our study.

Table 4: Comparison of diagnostic indices of FNAC with other studies

| S. No | Indices | Current Study | Hajmanooch ehri et al ¹¹ | Ozdem iret al ¹² | Ahmadine jad et al ¹³ | Lngegow daet al ¹⁴ |
|-------|---------------------------|---------------|-------------------------------------|-----------------------------|----------------------------------|-------------------------------|
| 1 | Sensitivity | 83.3 | 95.2 | 78.5 | 62.5 | 66.7 |
| 2 | Specificity | 94 | 68.4 | 97 | 100 | 98.9 |
| 3 | Positive Predictive Value | 71 | 83.3 | 72.6 | 100 | 88.9 |
| 4 | Negative Predictive Value | 97 | 89.6 | 97.8 | 95.3 | 96 |
| 5 | Accuracy | 92.5 | 85.1 | 95.3 | - | 95.4 |

In the current study the sensitivity of FNNAC was found to be 83.3% which was almost similar to studies done by Nisha et al [20] and Mc Elavanna et al [27]. Specificity of FNNAC was found to be 97%. In our study specificity value was higher than the sensitivity for FNNAC. Overall diagnostic accuracy was 95% which was higher than other studies [20][27].

Table 5: Comparison of diagnostic indices of FNAC with other studies

| S. No | Indices | Current study | Nisha et al ¹⁵ | Swaranka ur et al ¹⁶ | Tauro et al ¹⁷ | Mc Elavanna et al ¹⁸ |
|-------|---------------------------|---------------|---------------------------|---------------------------------|---------------------------|---------------------------------|
| 1 | Sensitivity | 83.3 | 85.6 | 95 | 100 | 81 |
| 2 | Specificity | 97 | 88.2 | 94.2 | 100 | 77 |
| 3 | Positive Predictive Value | 83 | - | - | - | - |
| 4 | Negative Predictive Value | 97 | - | 96.2 | - | - |
| 5 | Accuracy | 95 | 64.5 | - | - | 77 |

In the current study ultra sound guided FNNAC had diagnostic accuracy of 95% when compared to 92.5 % in ultra sound guided FNAC in thyroid lesions. It is a well known fact that the smear quality affects the cytological interpretation of the thyroid nodules. The two important criteria in assessing the quality of the smear are background blood clot and amount of cellular material. [44] In theory FNAC may cause more aspiration of blood resulting in bloody background and FNNAC may produce better cellular material than FNNAC.

LIMITATIONS

Larger studies involving a larger sample size are required to further establish the role of FNNAC in thyroid lesions and inability to diagnose follicular neoplasm still remains a problem. Difference in suction pressure and depth of insertion of fine needle may have caused small but possible bias.

CONCLUSION

The present cross sectional study have concluded that the maximum incidence of thyroid lesion occurred in the third decade of life. Maximum number of malignancies was reported in 31-49 year age group with papillary carcinoma being the most common. The diagnostic accuracy of ultra sound guided FNNAC was found to be higher than that of ultra sound guided FNAC.

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