



## A COMPARATIVE STUDY OF FINE NEEDLE ASPIRATION CYTOLOGY WITH HISTOPATHOLOGY IN THE DIAGNOSIS OF THYROID LESIONS.

### Pathology

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### ABSTRACT

**Background:** One of the most frequently encountered endocrine complaints in the surgical out patient department is solitary thyroid nodule. It is crucial to differentiate thyroid nodules into benign and malignant to avoid unnecessary surgical interventions. The present study was conducted to assess the correlation between minimally invasive Fine Needle aspiration Cytology (FNAC) and histological diagnosis of thyroid lesions.

#### Aim:

- 1) To find out the array of thyroid lesions in a tertiary care hospital.
- 2) To assess the accuracy of cytological diagnosis in comparison with histopathological diagnosis of thyroid lesions.

**Materials and Methods:** This retrospective study was done in a tertiary care hospital over a period of 2 years which included 120 patients with clinically palpable thyroid swelling. Patients included in the study underwent FNAC as well as histopathological examination. Later cytological diagnosis were compared with histopathological results. **Results:** Out of 120 cases, 74.17% were categorized as Category II, 1.67% as Category III, 6.67% as Category IV, 5% as category V, and 12.5% as Category VI. Sensitivity was 86.96%, specificity was 98.97, positive predictive value(PPV) was 95.24%, negative predictive value(NPV) was 95.24% and the overall diagnostic accuracy of cytological diagnosis was found to be 95.24%. **Conclusion:** FNAC serves as a pivotal diagnostic technique capable of differentiating between benign and malignant lesions with minimally invasive procedures. FNAC stands out as the optimal tool for preoperative diagnosis of thyroid lesions and thereby guiding appropriate clinical management decisions and helping to avoid unnecessary surgeries.

### KEYWORDS

Thyroid, Bethesda, Histopathology, Fine Needle Aspiration Cytology.

### INTRODUCTION

Thyroid gland is the largest endocrine gland and is frequently associated with various clinical complaints due to its significant role in regulating basal metabolic rate.[1] One of the most prevalent initial concerns related to the thyroid gland is the presence of a solitary thyroid nodule. FNAC is widely embraced as a screening and diagnostic tool for thyroid lesions due to its high sensitivity and specificity.[1,2] It is preferred diagnostic aid because of its rapidity, safety, minimally invasive nature, cost effectiveness, risk stratification, and minimal complication.[2]

The Bethesda System for Reporting Thyroid Cytopathology (TBSRTC) is a standardized, tiered reporting system for thyroid fine needle aspiration specimens.[3] TBSRTC was designed to facilitate consistent interpretation and convey the results to referring physicians in a concise, clear and clinically relevant manner so that improving patient care and can avoid unnecessary surgical interventions.[4]

However, histopathology serves as the gold standard for evaluating thyroid lesions. The objective of this study is to identify potential limitations in the diagnosis of thyroid cytology and delineate the spectrum of thyroid lesions encountered. Study also examines the association between FNAC and histopathological diagnosis in thyroid nodules.

### MATERIALS AND METHODS:

#### Source of data:

All patients referred to cytology section of the Department of Pathology, KIMS Hospital, Hubballi for FNAC of thyroid lesion.

#### Inclusion criteria:

- All patients regardless of age or gender with enlarged thyroid gland referred to department of pathology KIMS Hubballi, who give consent for the procedure.

#### Exclusion criteria:

- Patients without preoperative FNACs or who had not undergone an operation (thyroidectomy or lobectomy) after FNACs.
- Non-diagnostic cases

A total of 120 cases were included in the retrospective study conducted

over a two-year period from January 2021 to December 2022. Clinical history and physical findings were documented, followed by the performance of FNAC using the conventional palpation method. The thyroid lesion was localized, and aspiration was performed using a 23-gauge needle under negative pressure.

Smears were prepared using routine staining including Hematoxylin and eosin, Papanicolaou, and Wright's stain. Biopsies obtained from the same patients were fixed in 10% formalin.

The biopsy sections obtained were stained with hematoxylin and eosin(H&E) stains, followed by a comparison of cyto-histopathological diagnosis.

For the thyroid gland, FNAC diagnosis were categorized into six groups based on the TBSRTC. (I) non-diagnostic, (II) Benign, (III) Atypia of Undetermined significance, (IV) Follicular neoplasm, (V) Suspicious of malignancy, (VI) Malignant. Non diagnostic cases were not included in the analysis.

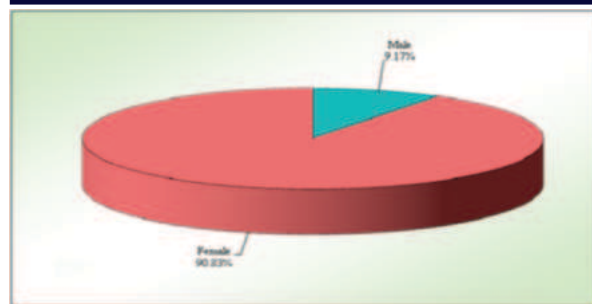
The diagnostic accuracy of FNAC was evaluated by comparing it to histopathology, which served as the gold standard. The suspicious/ malignant FNAC were considered True Positive(TP) in cases where histopathological examination revealed malignancy.

False Positives (FP) when malignant cytology diagnosed cases, histopathological results were negative for malignancy. Benign FNA cytology was considered as True Negatives (TN) when histopathological results were benign, and False Negatives(FN) when benign FNA cytology diagnosed cases had histopathologically proven malignancy.

The sensitivity, specificity, diagnostic accuracy rate, positive predictive value(PPV) and negative predictive value(NPV) of FNAC were calculated.

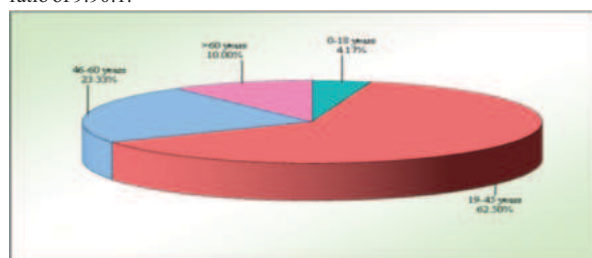
### RESULTS:

A total of 120 cases of thyroid swelling were analyzed of which 109 patients were females and 11 patients were males



**Figure 1: Gender wise distribution**

Figure 1: Females had more number of thyroid swellings with F:M ratio of 9.90:1.



**Figure 2: Age wise distribution of patients**

Most of the cases were between 19-45 years of age group (62.5%) followed by 46-60 years (23.33%), >60 years ( 10%) and 0-18 years (4.17%). Figure. 2

**Table 1: FNAC diagnosis wise distribution of patients**

| FNAC Diagnosis                                               | No of patients | % of patients |
|--------------------------------------------------------------|----------------|---------------|
| Colloid cyst/ cystic colloid nodule                          | 11             | 9.17          |
| Nodular goitre                                               | 65             | 54.17         |
| Hyperplastic nodule/ adenomatoid nodule/ hurthle cell nodule | 1              | 0.83          |
| Thyroglossal cyst                                            | 1              | 0.83          |
| Hashimoto's thyroiditis                                      | 10             | 8.33          |
| Graves disease                                               | 2              | 1.67          |
| Follicular neoplasm                                          | 8              | 6.67          |
| Suspicious for papillary thyroid carcinoma                   | 5              | 4.17          |
| Papillary thyroid carcinoma                                  | 9              | 7.50          |
| Suspicious for medullary carcinoma                           | 1              | 0.83          |
| Medullary carcinoma                                          | 3              | 2.50          |
| Anaplastic thyroid carcinoma                                 | 1              | 0.83          |
| Poorly differentiated thyroid carcinoma                      | 1              | 0.83          |
| Nonhodgkin lymphoma                                          | 1              | 0.83          |
| Atypia of undetermined significance                          | 1              | 0.83          |
| Total                                                        | 120            | 100.00        |

Table 1 : Shows FNAC diagnosis-wise distribution. According to this table, most common lesion was NODULAR GOITER (54.17%) followed by Cystic colloid nodule (9.17%) and hashimoto's thyroiditis. Thyroid malignancy was rare with most common malignancy being papillary thyroid carcinoma (9 cases) followed by medullary thyroid carcinoma. Non Hodgkin lymphoma, Anaplastic carcinoma, Poorly differentiated thyroid carcinoma and Atypia of undetermined significance each accounted for 0.83% of the cases.

**Table 2: Bethesda system wise distribution of cases**

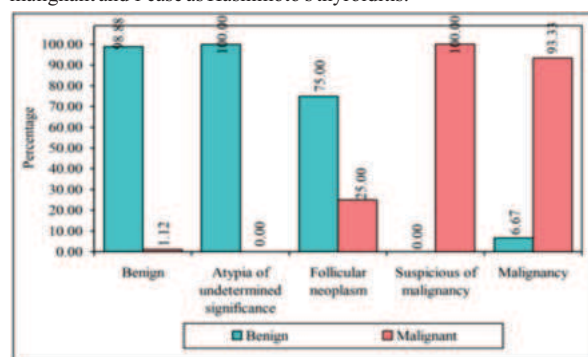
| BETHESDA system                     | No of patients | % of patients |
|-------------------------------------|----------------|---------------|
| Non diagnostic                      | 0              | 0.00          |
| Benign                              | 89             | 74.17         |
| Atypia of undetermined significance | 2              | 1.67          |
| Follicular neoplasm                 | 8              | 6.67          |
| Suspicious of malignancy            | 6              | 5.00          |
| Malignancy                          | 15             | 12.50         |
| Total                               | 120            | 100.00        |

Shows BETHESDA system wise distribution of cases. Based on cytological diagnoses according to the Bethesda system, as depicted in table 2, the highest number of cases were benign lesions ( 89 cases accounting for 74.17%). Followed by malignant tumors (15 cases representing 12.50%). The remaining thyroid lesions included 2 cases (1.67%) categorized as atypia of undetermined significance, 8 cases(6.67%) classified as follicular neoplasm and 6 cases categorized as suspicious of malignancy.

**Table 3: BETHESDA system with Histopathological diagnosis.**

| BETHESDA system                     | Benign | %      | Malignant | %      | Total |
|-------------------------------------|--------|--------|-----------|--------|-------|
| Non diagnostic                      | 0      | 0.00   | 0         | 0.00   | 0     |
| Benign                              | 88     | 98.88  | 1         | 1.12   | 89    |
| Atypia of undetermined significance | 2      | 100.00 | 0         | 0.00   | 2     |
| Follicular neoplasm                 | 6      | 75.00  | 2         | 25.00  | 8     |
| Suspicious of malignancy            | 0      | 0.00   | 6         | 100.00 | 6     |
| Malignancy                          | 1      | 6.67   | 14        | 93.33  | 15    |
| Total                               | 97     | 80.83  | 23        | 19.17  | 120   |

Among 89 cases of benign ( category II) 88 cases were confirmed by histopathology as benign and 1 case as Papillary carcinoma thyroid. Out of 2 cases classified as Atypia of undetermined significance (category III) on FNAC, histological analysis revealed 1 case of colloid goiter and 1 case of Hashimoto's thyroiditis. Among 8 cases of Follicular neoplasm (category IV), histology confirmed 6 cases as Follicular adenoma and 2 cases as Follicular carcinoma. Additionally 6 cases initially labelled as Suspicious of malignancy, histologically validated 5 cases as Papillary thyroid carcinoma and 1 case as Medullary thyroid carcinoma. Lastly Out of 15 cases categorized as malignancy on FNAC, 14 cases were confirmed on histopathology as malignant and 1 case as Hashimoto's thyroiditis.



**Figure 3: BETHESDA system with Histo-pathological diagnosis**

**Table 4: The accuracy of diagnostic test of FNAC in thyroid swelling**

| Test (FNAC)   | Malignant in histopathology | Benign in histopathology |
|---------------|-----------------------------|--------------------------|
| Positive test | True positive (TP) 20       | False positive (FP) 01   |
| Negative test | False negative (FN) 03      | True negative (TN) 96    |

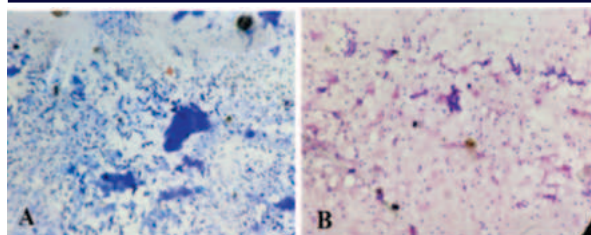
Sensitivity shows the portion of the patients having malignant thyroid disease by histopathology (Gold standard) and positive cytological diagnosis on FNAC, which is found to be 86.96%.

Specificity shows the portion of the patients with non-malignant thyroid disease and positive cytological diagnosis, which is found to be 98.97%.

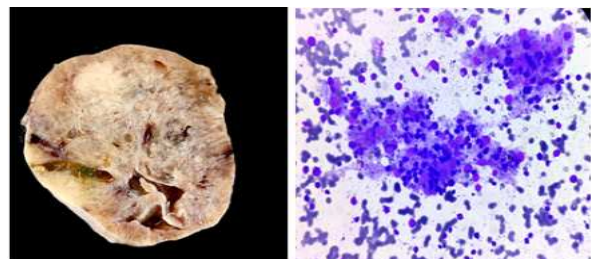
Accuracy: is the portion of the correct results, true positive and true negative in relation to all cases studied is found to be 96.67%

Positive predictive value (PPV) is the probability of having malignant thyroid disease following a positive FNAC finding and is found to be 95.24%.

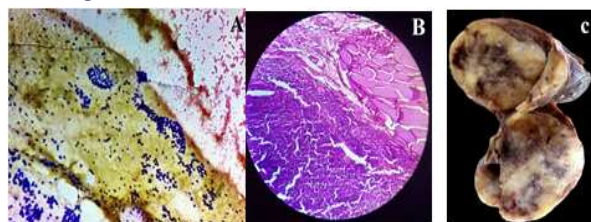
Negative predictive value (NPV): is the probability of not having malignant thyroid disease following a negative FNAC finding and is found to be 96.67%.



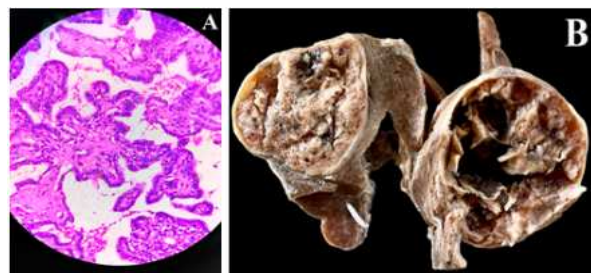
**Figure 5: (A) FNAC (Wright's stain) of colloid goiter (B) FNAC (H & E) Nodular goiter**



**Figure 6: Gross image of nodular goiter Figure 7: FNAC of Hashimoto's thyroiditis (Wright's stain)**



**Figure 8: A) FNAC of Follicular Neoplasm (Wright's stain) (B) HPE of Follicular adenoma (H & E) (C) Gross image of Follicular adenoma**



**Figure 9: A) HPE of papillary carcinoma thyroid (H&E) (B) Gross image of Papillary thyroid carcinoma**

## DISCUSSION

In the current study, an assessment was conducted on 120 patients, focusing on the Fine Needle aspiration Cytology and Histopathology of Thyroid lesions. Here, Histopathological examination is gold standard for the evaluation of thyroid lesions. This study identified the strong correlation between histological findings and the results obtained from Fine Needle Aspiration Cytology of thyroid lesions.

In this study, thyroid lesions predominantly affected females (90.83%), with the highest incidence observed in 19-45 years of age group. These findings align with existing literature, as demonstrated by Gupta et al.[5]

The majority of thyroid lesions were non-neoplastic, accounting for 80.83%, while neoplastic thyroid lesions comprised only 19.17%, aligning closely with findings from a study S Chandanwale et al.[7]

Nodular goiter (57.5%) predominates among non-neoplastic lesions, followed by Hashimoto's thyroiditis (10%) which is comparable to a study conducted by Bharathi Bhushan Chittawadagiet al.[8]

Among thyroid malignancies, papillary thyroid carcinoma was the most prevalent, representing 60% of cases, followed by Medullary carcinoma and Follicular carcinoma, mirrors findings from a study conducted by Sinna E A et al.[9]

Present study observed a prevalence of category II lesions comparable to the findings of Mondal et al. and Nadedkar et al, indicating a high incidence of benign lesions.[10,11]

Although category II lesions pose a low malignancy risk (0-3%) with recommended clinical follow-up, present study found that patients often opt for surgery primarily for cosmetic reasons and pressure symptoms.[12]

There are less number of cases (1.67%) diagnosed under the category of Atypia of undetermined significance in our study, aligning with the approach of Nandedkar et al. to minimize the use of this category and mitigate ambiguity.[11]

Despite the perceived challenge in distinguishing follicular adenoma from carcinoma present study showed out of 8 cases of Follicular Neoplasm,( category IV) identified in this study, histopathological examination revealed 6 cases of follicular adenoma and 2 cases of follicular carcinoma.

Cases categorized as Suspicious of malignancy (6 cases) and malignancy (15 cases) were confirmed as malignant upon histopathological examination except 1 malignant case which is confirmed as benign lesion on histopathology. Study conducted by Zarif HA et al. showed Out of 96 aspirations diagnosed as malignancy, histopathological examination showed Papillary carcinoma, followed by follicular variant. None were diagnosed as benign.[14]

In the current study, sensitivity was 86.96%, specificity was 98.97, positive predictive value(PPV) was 95.24%, negative predictive value(NPV) was 95.24% and the overall diagnostic accuracy of cytological diagnosis was found to be 95.24% which is comparable with study conducted by Sinna E A et al.7

## CONCLUSION:

FNAC offers reliable diagnostic correlation with final histopathological examination. Our findings align with existing literature. Surgery is recommended for cytologically malignant reports: suspicious lesions necessitate repeat aspiration, while benign cases may not require immediate further diagnostic studies. FNAC proves invaluable in thyroid lesion management, boasting high accuracy, safety, simplicity, cost-effectiveness, and outpatient suitability. It provides a rapid and precise diagnosis compared to other clinical tests.

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