

# A Comparative Study of Fine Needle Aspiration Cytology and USG of thyroid gland lesions

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## Abstract —

**Introduction:** Thyroid nodular lesions are a common clinical problem. Solitary thyroid nodule is clinically defined as localized thyroid enlargement with apparently normal surrounding tissue. 4-7% of the adult populations have a clinically palpable thyroid nodule accessible to fine needle aspiration<sup>2</sup>. Majority of the thyroid nodules are benign.

**Aims and Objectives:** To study cytological profile of thyroid lesions and compare the results with Ultrasonography and clinical findings.

**Materials and Methods:** This retrospective study is carried out in the department of pathology on 200 patients with thyroid swelling over a period of 2 years. FNAC cases were reported according to the 2017 Bethesda System for reporting thyroid cytopathology. The results were correlated with Ultrasonography and clinical findings.

**Results:** Out of 200 cases, 166(83%) cases were diagnosed as benign lesions, 23(11.5%) cases were indeterminate lesions and 11 (5.5%) cases were diagnosed as malignant on FNAC. On USG, 173(86.5%) cases were benign, 18(9%) cases were indeterminate lesions and 9(4.5%) cases were malignant lesions.

**Conclusion:** FNAC is a simple, minimally invasive and inexpensive OPD procedure with a higher validity in diagnosing thyroid malignancy than USG. FNAC and USG must be used together in the diagnostic work up to select patients for thyroidectomy in cases harboring a thyroid malignancy.

**Keywords:** Thyroid gland, nodule, neoplasm, FNAC, USG

## I. INTRODUCTION

The thyroid gland is the largest endocrine gland in the body which is superficially palpable when enlarged and easily accessible to fine needle biopsy. The word “thyroid” was first coined by Thomas Wharton due to close proximity of the gland with thyroid cartilage in 120–200 A.D. It is derived from the Greek word “thyros” meaning “shield” as earlier it was thought to guard the larynx.<sup>10</sup> Thyroid nodular lesions are a common clinical problem, although chances of these lesions being malignant are rare. Solitary thyroid nodule is clinically defined as the localized thyroid enlargement with apparently normal surrounding gland tissue. Majority of the thyroid nodules are benign, only 5%-30% are malignant and require thyroidectomy.<sup>1</sup> 4-7% of the adult populations have a clinically palpable thyroid nodule.<sup>2</sup> Thyroid nodules are about four times more commonly found in females as compared to males.<sup>3</sup>

Fine needle aspiration cytology has numerous advantages while making a preoperative diagnosis. It is a minimally invasive and low cost procedure associated with minimal complications. It can be easily done as an OPD procedure within a short duration. FNAC has a sensitivity of 94% and specificity of 98% for diagnosis of malignant lesions excluding follicular lesion.

Risks associated with the thyroid FNAC procedure include possibility of infection, bleeding at the biopsy site and damage to the structures near the thyroid.

Ultrasonography is a highly sensitive and easily accessible diagnostic modality. The spatial resolution achieved on ultrasonography is of the order of 0.7 to 1 mm, not achieved by any other imaging method.<sup>4</sup> USG is the most commonly used method for thyroid gland imaging in radiology as recognized in the guidelines for diagnosis of thyroid lesions as published by the American Thyroid Association.<sup>5</sup> It is an easily available and non-invasive method to assess the thyroid gland with a reasonable cost. It is highly sensitive in terms of differentiating cystic lesion and solid lesions of thyroid.

A variety of diagnostic tests like biochemical, ultrasonography, thyroid nuclear scan, and Fine Needle Aspiration Cytology (FNAC) are accessible for evaluation of thyroid gland lesions. FNAC is considered as the gold standard diagnostic test in the evaluation of a thyroid nodule, and other tests like ultrasound and nuclear scan should be used in conjunction with FNAC. It is essential to evaluate thyroid nodules to identify thyroid nodules which could have with malignant potential.

## II. MATERIALS AND METHODS

A retrospective study was conducted on 200 patients with thyroid lesions in a Tertiary care Hospital attending Out-patient department over a period of 2 years. This study is aimed to evaluate cytological profile of thyroid lesions and compare the results with Ultrasonography and clinical findings.

**Inclusion Criteria:**

- (1) Patients in the age group of 10 to 75 years with thyroid swellings.
- (2) Cooperative patients who were willing for Fine needle aspiration cytology and Ultrasonography.

**Exclusion Criteria:**

- (1) Uncooperative patients who were not willing for Fine needle aspiration cytology and Ultrasonography.
- (2) Patients who are already undergoing treatment after proper diagnosis.

The clinical details of the patient and symptoms were noted from the patients FNAC requisition form. Serum T3, T4 and TSH levels performed by Radioimmuno- assay (RIA) were noted. Patients with thyroid swelling who underwent USG of thyroid gland were explained the procedure of Fine needle aspiration cytology in their vernacular language and FNAC was performed with written informed consent.

5 -10 mL disposable plastic syringe and 22 – 25 gauge, 30 – 50 mm long disposable needle was used to take two to three needle passes. Smears were prepared on labeled slides. Few of the slides were immediately fixed in ethyl alcohol (ethanol) for 30 min and were stained with Papanicolaou stain. The air-dried slides were fixed in methanol for 30 minutes and stained with May Grunwald Giemsa stain.

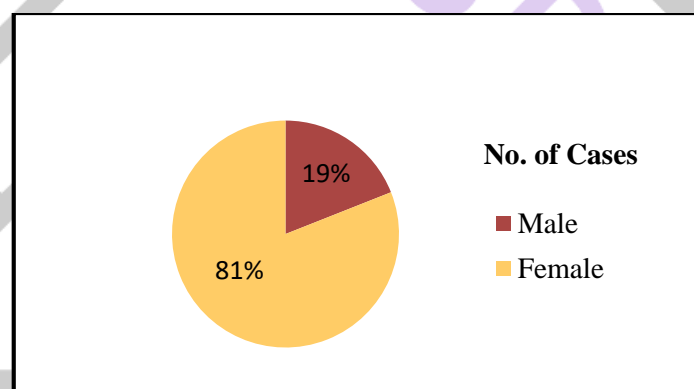
Smears were reported according to the 2017 Bethesda System for thyroid cytopathology. Comparative analysis of the results of Fine needle aspiration cytology with ultrasonography diagnosis was done.

**III. RESULTS**

On FNAC, out of the 200 cases, 166 cases (83%) were benign thyroid lesions, 23 cases (11.5%) were indeterminate lesions and 11 cases (5.5%) were diagnosed as malignant lesions.

On USG, 173 cases (86.5%) were benign, 18(9%) cases were indeterminate and 9(4.5%) cases were malignant. Thyroid nodules were found more commonly in females (81%) than males (19%). (Figure 1) Only 38 males presented with a thyroid swelling compared to 162 females.

**Figure 1: Gender - wise distribution with relation to Thyroid swellings**



**Table 1: Age - wise distribution with relation to Thyroid swellings**

| Age( Years) | Number of Cases | Percentage (%) |
|-------------|-----------------|----------------|
| 13-25       | 20              | 10             |
| 26-35       | 43              | 21.5           |
| 36-45       | 57              | 28.5           |
| 46-55       | 40              | 20             |
| 56-65       | 31              | 15.5           |
| 66-75       | 9               | 4.5            |

Highest percentage of thyroid nodules were seen in the age group of 36 - 45 years (28.5%) , followed by 26 – 35 years (21.5%) and the least number of cases were seen in the age group of 66 - 75 years (4.5%). (Table 1)

**Table 2: Distribution of Cases based on Clinical Signs and symptoms**

| Clinical signs & symptoms | Number of Cases | Percentage (%) |
|---------------------------|-----------------|----------------|
| Swelling in the neck      | 200             | 100            |
| Pain                      | 25              | 12.5           |
| Dyspnea                   | 6               | 3              |
| Dysphagia                 | 12              | 6              |
| Hoarseness of voice       | 4               | 2              |

The commonest presenting symptom was swelling in the neck in all 200 patients (100 %) followed by pain in 25 cases (12.5%). 4 cases out of 200, complained of hoarseness of voice (2%), 6 cases (3%) of dyspnea and 12 cases (6%) presented with dysphagia also. (Table 2)

**Table 3: Distribution of cases depending on FNAC diagnosis (n = 200)**

| FNAC Diagnosis - Thyroid lesions | Number | Percentage (%) |
|----------------------------------|--------|----------------|
| Benign                           | 166    | 83             |
| Malignant                        | 11     | 5.5            |
| Suspicious for malignancy        | 2      | 1              |
| Papillary Carcinoma              | 11     | 5.5            |
| Follicular neoplasm              | 21     | 10.5           |
| Colloid Goitre                   | 109    | 54.5           |
| Multinodular Goitre              | 28     | 14             |
| Hyperplastic thyroid nodule      | 14     | 7              |
| Inflammatory thyroiditis         | 14     | 7              |
| Thyroglossal Cyst                | 1      | 0.5            |

On Fine needle aspiration cytology, 11 cases were diagnosed as malignant (5.5%) and 166 cases (83%) as benign. Maximum cases, 109 out of 200 cases (54.4%) were reported as Colloid Goitre. 1 case of thyroglossal cyst was found, 11 cases (5.5%) of Papillary carcinoma, 14 cases of hyperplastic nodule (7%) and 21 cases of follicular neoplasm (10.5%) were reported. (Table 3)

**Table 4: Distribution of cases depending on USG diagnosis (n = 200)**

| USG Diagnosis               | Number | Percentage |
|-----------------------------|--------|------------|
| Benign                      | 173    | 86.5       |
| Malignant                   | 9      | 4.5        |
| Papillary Carcinoma         | 5      | 2.5        |
| Colloid Goiter              | 105    | 52.5       |
| Multinodular Goiter         | 31     | 15.5       |
| Hyperplastic thyroid nodule | 4      | 2          |

|                          |    |     |
|--------------------------|----|-----|
| Follicular adenoma       | 18 | 9   |
| Indeterminate etiology   | 18 | 9   |
| Inflammatory thyroiditis | 14 | 7   |
| Thyroglossal Cyst        | 1  | 0.5 |

On USG 173 cases (86.5 %) were diagnosed as benign and about 9 cases (4.5 %) were malignant. Majority of the cases were reported as Colloid goiter, i.e. 105 cases (52.5%). 14 cases out of 200 (7%) were inflammatory thyroiditis, 18 cases (9%) were follicular adenoma, 5 cases (2.5%) were papillary carcinoma and 1 case (0.5%) was reported as thyroglossal cyst. Most common diagnosis made was Colloid Goiter both on FNAC (54.5%) and USG (52.5%)

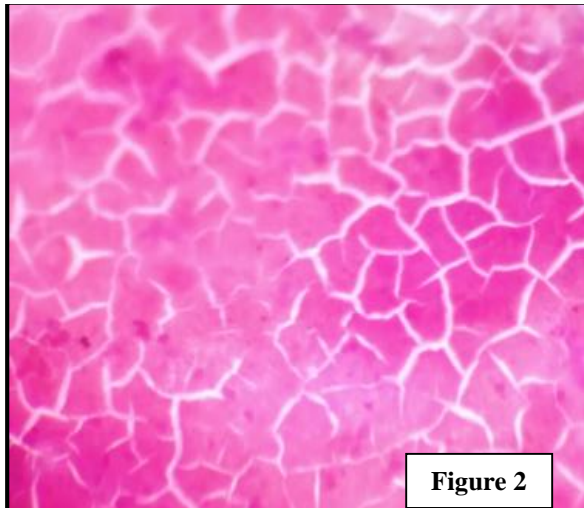


Figure 2

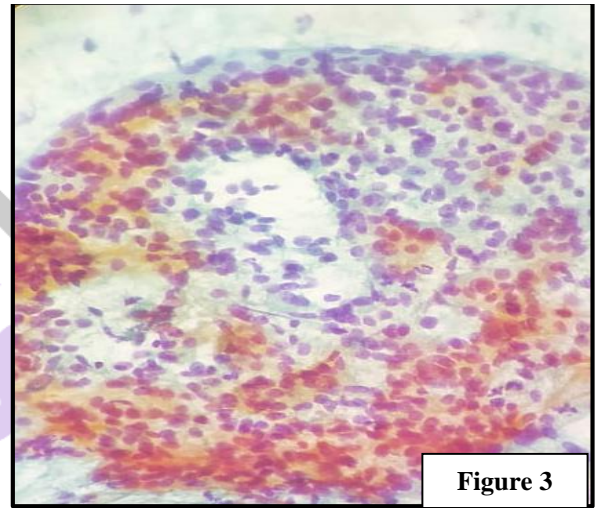


Figure 3

**Figure 2 (40x magnification):** Thin colloid forming varnish like coat of homogenous material with characteristic crazy pavement and cracking artifacts.

**Figure 3 (40x magnification):** Smear shows Granulomatous thyroiditis.

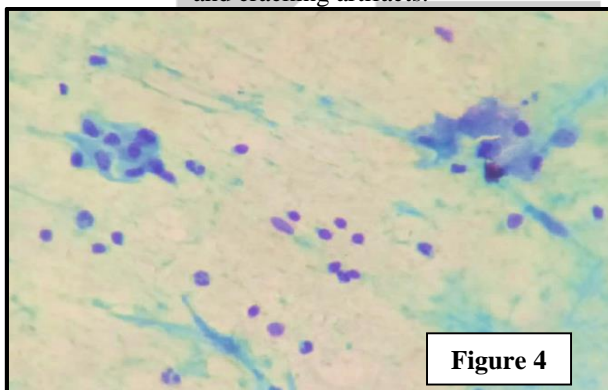


Figure 4

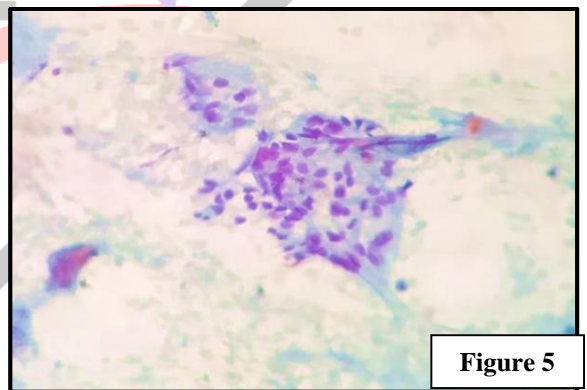


Figure 5

**Figure 4 and 5 (40x magnification):** PAP-stained smears studied show well-formed granulomas with aggregates of epithelioid cells and multinucleated giant cells along with degenerating follicular cells.



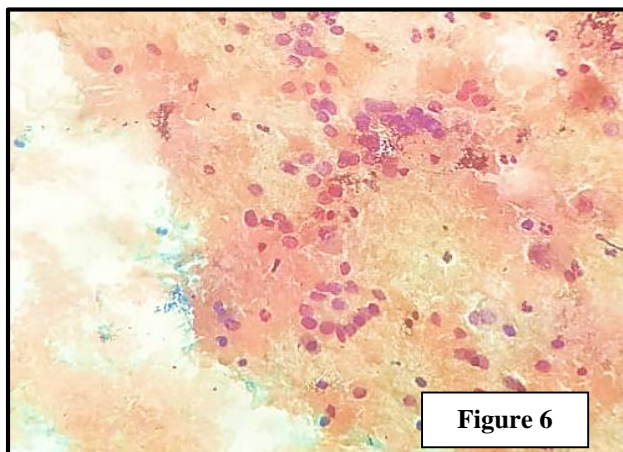


Figure 6

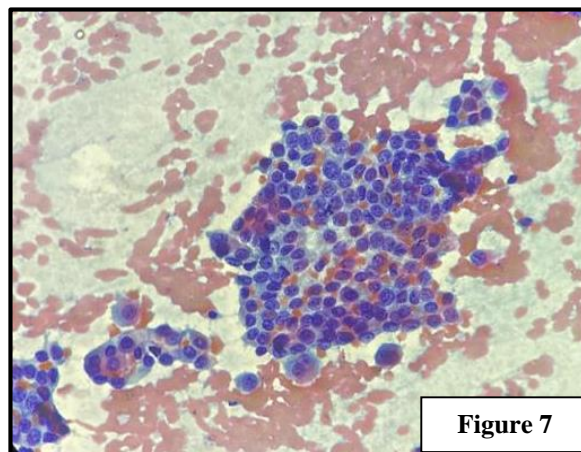


Figure 7

**Figure 6 and 7 (40 x magnification):** PAP and MGG stained smears studied show microfollicular and macrofollicular arrangement in Follicular neoplasm. (Microfollicles or rosettes in a repetitive manner)

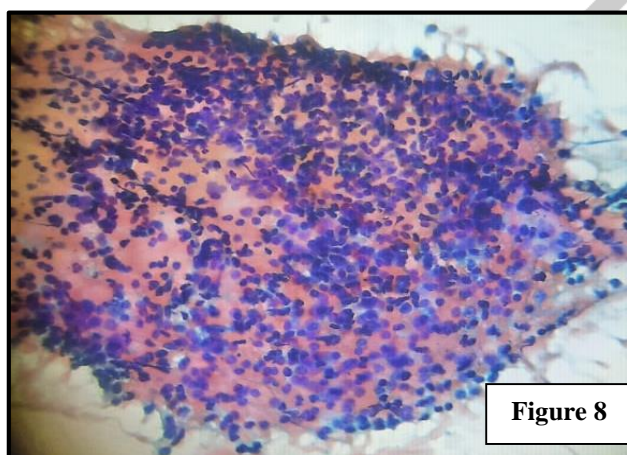


Figure 8

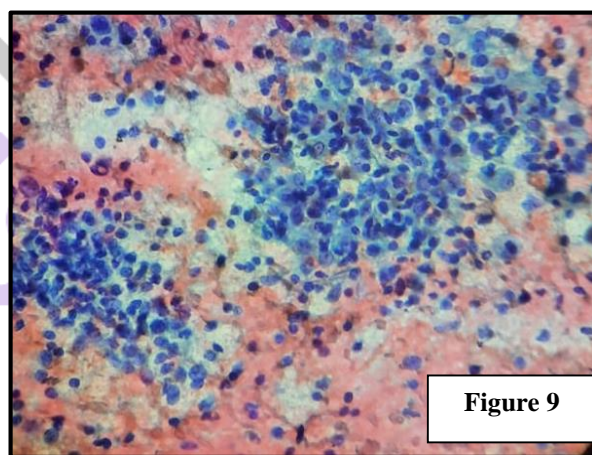


Figure 9

**Figure 8 and 9 (40 x magnification):** PAP-stained smears studied show lymphoid cells impinging on follicular cells along with syncytial pattern of oxyphil cells.

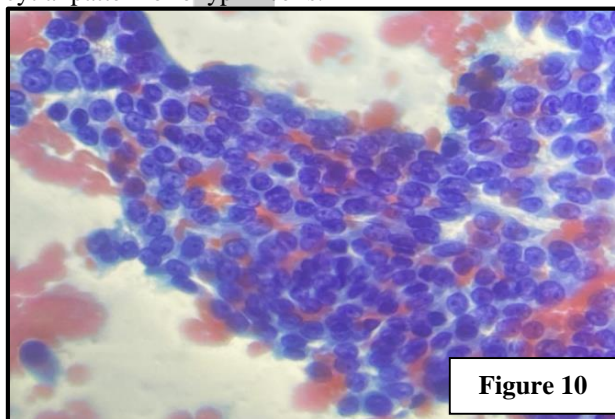


Figure 10

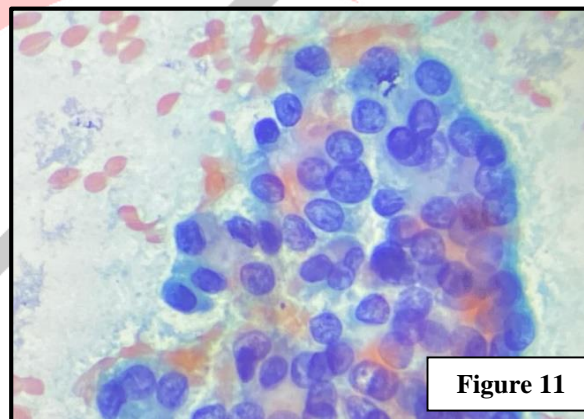


Figure 11

**Figure 10 and 11 (Papillary carcinoma of thyroid):** PAP and MGG stained smears show finger like papillae with anatomical edges. True papillary fragments with a fibrovascular core. Sheets of cells with large crowded nuclei, powdery chromatin, longitudinal grooves and intranuclear cytoplasmic inclusions.

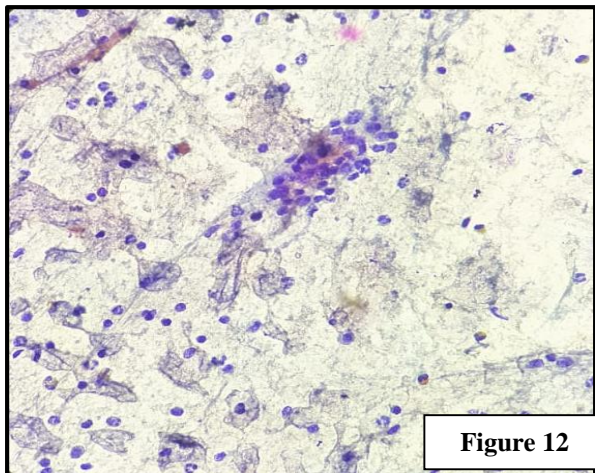


Figure 12

**Figure 12 – 40x magnification- (Thyroglossal cyst):** PAP-stained smears studied cystic macrophages with anucleated squames and few clusters of follicular cells.

#### IV. DISCUSSION

USG and FNAC are being used together in assessing the thyroid gland to detect those patients who may have a high possibility of harboring a malignancy in the nodule and require surgical removal.<sup>14, 15, 16</sup> Nowadays, the primary imaging modality of choice to evaluate the morphology of the thyroid tissue is high-resolution ultrasound along with color Doppler.<sup>11, 13</sup> In the present study, on ultrasonography, out of 200 cases, 173 cases (86.5%) were benign, 18 cases (9%) were indeterminate and 9 cases (4.5%) were malignant lesions. The benign lesions included multinodular goiter (31%), colloid goiter (52.5 %), follicular adenoma (9%) and 1 case of thyroglossal cyst. Cases of inflammatory thyroiditis (7%) were also detected. The diagnosis of malignant lesions on USG was of neoplastic etiology (2%) and papillary carcinoma (2.5%) respectively.

On FNAC, about 166 cases (83%) were reported benign, 23 cases (11.5%) were indeterminate and 11 cases (5.5%) were detected to be malignant lesions. The benign lesions included multinodular goiter (14%), colloid goiter (54.5%), hyperplastic thyroid nodule (7%) and 1 case of thyroglossal cyst. 7 % cases of inflammatory thyroiditis were also noted. 10.5 % cases were diagnosed as follicular neoplasm, 1% as suspicious for malignancy and 5.5 % as papillary carcinoma respectively.

**Table 5: Non-correlating cases on USG and FNAC**

| S.No. | USG Diagnosis           | FNAC Diagnosis              |
|-------|-------------------------|-----------------------------|
| 1.    | Colloid Goitre          | Papillary Carcinoma Thyroid |
| 2.    | Colloid Goitre          | Papillary Carcinoma Thyroid |
| 3.    | Colloid Goitre          | Papillary Carcinoma Thyroid |
| 4.    | Colloid Goitre          | Papillary Carcinoma Thyroid |
| 5.    | Neoplastic etiology     | Hashimoto's thyroiditis     |
| 6.    | Neoplastic etiology     | Hashimoto's thyroiditis     |
| 7.    | Colloid Goitre          | Hashimoto's thyroiditis     |
| 8.    | Colloid Goitre          | Hashimoto's thyroiditis     |
| 9.    | Hashimoto's thyroiditis | Colloid Goitre              |
| 10.   | Hashimoto's thyroiditis | Follicular Neoplasm         |
| 11.   | Hashimoto's thyroiditis | Granulomatous thyroiditis   |

Non correlation was seen in 11 out of total 200 cases (5.5%) and correlation was seen in 94.5%. Four malignant cases diagnosed as Papillary carcinoma thyroid on FNAC were reported as benign Colloid goitre on ultrasound. Two cases found to be of neoplastic etiology on ultrasonography were diagnosed as Hashimoto's thyroiditis on fine needle aspiration.



4 out of the total 11 malignant lesions (36.36%) on FNAC were thought to be of benign etiology till proved on FNAC.

**Table 6: Percentage of thyroid lesions diagnosed on FNAC and USG in Comparison with other authors**

| Thyroid lesions     | FNAC (%)         | USG (%) | FNAC (%)              | USG (%) | FNAC (%)         | USG (%) | FNAC (%)        | USG (%) | FNAC (%)      | USG (%) |
|---------------------|------------------|---------|-----------------------|---------|------------------|---------|-----------------|---------|---------------|---------|
|                     | Kothari S et al. |         | Sundara Rao BS et al. |         | Chavan US et al. |         | Gupta KP et al. |         | Present study |         |
| Benign              | 66               | 84      | 90.8                  | 68      | 60               | 79      | 71              | 90      | 83            | 86.5    |
| Malignant           | 4                | 6       | 3.2                   | 2.8     | 1.4              | 7.8     | 4               | 9       | 5.5           | 4.5     |
| Multinodular Goitre | 4                | 30      | 47.2                  | 52.4    | 2.2              | 32      | 10              | 12      | 14            | 15.5    |
| Colloid Goitre      | 18               | 16      | 6                     | 5.6     | 62               | 27      | 37              | 40      | 54.5          | 52.5    |
| Thyroiditis         | 8                | 10      | 34                    | 29.2    | 14               | 10.4    | 32              | 32      | 7             | 7       |
| Thyroglossal Cyst   | 4                | 4       | 2.8                   | 2.8     | 3.6              | 4.3     | 0               | 0       | 0.5           | 0.5     |

FNAC and USG findings of the present study were comparable to the studies done by Kothari et al., Chavan US et al. and Gupta KP et al. However, the study conducted by Sundara Rao BS et al. showed disparity in the results when compared to our findings as seen in Table 6. Maximum number of thyroid lesions reported on FNAC and USG, 83% and 86.5% respectively were found to be benign in our study. The same was observed in other studies also.

Majority of the cases were diagnosed as Colloid goitre in studies by Kothari et al., Chavan et al. and Gupta et al. which is in accordance with our study whereas Sundara Rao et al. reported maximum cases as Multinodular Goitre. All the authors found papillary carcinoma thyroid as the most common malignancy similar to the findings in the present study. Ultrasound and cytology findings in cases of thyroiditis were in accordance with those of other studies. (Table 6) Least number of cases reported were of thyroglossal cyst by most of the authors which was comparable to our study.

In a study conducted by Kothari S et al., 50 patients were evaluated, 33 patients (66%) were diagnosed as benign on FNAC and 4 % cases were diagnosed as malignant on FNAC. All the cases reported as malignant on FNAC were given as neoplastic on USG. Majority of the cases were seen between 31 to 50 years of age. More females presented with thyroid swelling than males and the most common presenting symptom was neck swelling.<sup>6</sup> Female preponderance was also seen in our study.

In a large study by Sundara Rao BS et al., on FNAC, out of 250 cases, 227 cases (90.8%) were benign and 8 cases [3.2%] were malignant. About 220 cases (88%) were females and 30 (12%) were males (male to female ratio 1:73). On USG 68% cases were diagnosed as benign and 2.8% cases were malignant. Out of which on cytology, 90.8% were benign & 3.2% cases were malignant.<sup>7</sup>

In another study by Chavan US et al., maximum cases were recorded in the age group of 28-47 yrs. The male to female ratio was 1: 626. On ultrasonography, 79 % cases were reported as benign and 7.8% as malignant whereas 61 % cases were diagnosed as benign and 1.4 % as malignant on cytology.<sup>8</sup>

In a study by Gupta KP et al., a total of 100 cases were studied, of which 74 were female (74%) and 2 were male (26%), the female: male ratio is 3:1. Most of the patients were more than 20 years of age and <60 years of age, maximum in the age group of 41– 60 years (35%). On USG 9 cases were found to be suggestive of malignancy, whereas on FNAC four cases were reported as malignant.<sup>9</sup>

## V. CONCLUSION

FNAC is a simple, minimally invasive and inexpensive OPD procedure with a higher validity in diagnosing thyroid neoplasms than USG. Both USG and FNAC must be used together as first line assessment in the diagnostic work up of thyroid nodules to select patients who could be possibly harboring a thyroid malignancy. An accurate diagnosis of benign thyroid swelling will prevent subjecting the patient to undergo unnecessary thyroidectomy. Other neck masses can also be diagnosed on FNAC, whether they are arising from thyroid or extra-thyroid tissue. Fine needle aspiration cytology has certain limitations - scanty sample, suspicious diagnosis and inability to differentiate between benign and malignant follicular neoplasm. This limitation is minimized by histopathological examination for definitive diagnosis.

## VI. DISCLOSURE OF CONFLICT OF INTEREST:

The authors have no potential conflicts of interest to disclose.

## VII. SOURCE OF FUNDING:

No funding was needed.

## VIII. ETHICAL APPROVAL:

The study was approved by the Institutional Ethics Committee.

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