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USG guided FNAC of thyroid improving diagnostic accuracy

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Abstract
Introduction: USG guided FNAC of thyroid particularly facilitates accurate FNAC of non-palpable small lesions. It has the major advantage of real time monitoring which help in accurate localisation of needle tip during aspiration. It is very useful in the non diagnostic or unsatisfactory cases (according to Bethesda System Bethesda category I). It has been suggested to reduce the rate of non-diagnostic material and subsequently reduce the false-negative interpretation.
Aims: 1) To evaluate the Diagnostic accuracy of USG-guided FNAC of Thyroid. 2) To evaluate cellular yield of aspirated material in USG-guided FNAC.
Materials and Methods: The present study included 100 patients with thyroid swelling undergoing USG guided FNAC who previously were diagnosed by FNAC as Non diagnostic or Unsatisfactory (According to Bethesda System Bethesda category I). USG guided FNAC was done & Smears were made. Then microscopy was done following the Bethesda system (TBS).
Result: Total 100 patients with thyroid swelling undergoing USG guided FNAC who previously were diagnosed by FNAC as Bethesda category I. In present study, Out of 100 patients, maximum no. of patients were in 41 to 50 years age groups (54 cases) and majority were Female (84 Cases). The revised diagnosis in these cases according to TBS were as follow, Nodular goiter (29%), Colloid goiter (26%), lymphocytic thyroiditis (14%), Hashimoto thyroiditis (9%), Graves' disease (2%) & granulomatous thyroiditis (1%). Suspicious for malignancy (4%) and papillary carcinoma (4%) and Follicular neoplasm (3%). There was increased cellular yield of aspirated material in 92% of cases with USG guidance. In present study false negative & True Positive rates were–92% & 8% for Conventional FNAC technique, as concluded after repeat FNAC under USG guidance.

Keywords: Thyroid, USG guided FNAC, accuracy

Introduction
Martin and Ellis first time reported the usefulness of thyroid FNAC in 1930 in New York [1]. Ultrasound guided FNAC (USG-FNAC) was first introduced by Rizatto *et al*. in 1973. Since then, several studies have reported that USG-FNAC reduces the inadequacy rate of conventional FNAC [2].
USG-guided FNAC has the major advantage of real time monitoring which help in accurate localisation of needle tip during aspiration [2]. It is useful, especially in cystic and multinodular lesions harbouring malignancy [3]. Also, Differentiating benign from malignant thyroid disease is of great importance for deciding on medical versus surgical management [2].
USG localization of thyroid lesions followed by USG-guided FNAC of palpable thyroid nodules has been suggested to reduce the rate of non-diagnostic material and subsequently reduce the false-negative interpretation.
USG-guided FNAC is not mandatory, but the pathologist should be encouraged to do USG guided FNAC of thyroid lesions as far as possible. NCI sponsored Bethesda system recommended USG guided FNAC in case of nonpalpable nodule or nodule that has more than 25% cystic component. It also gives proper guidance to target the palpable thyroid nodule. In fact, USG guidance significantly helps in diagnosis. Other important indication of USG guided FNAC is failure to get adequate material in prior aspiration [1].
Different workers reported that failure to aspirate from proper site was the major cause of misdiagnosis during cytological evaluation. Also, high inadequacy rate, (ranging from 6.4 to 32.4%) as found in various studies; is another major limitation of conventional FNAC [2].

Indications and Advantages of USG-guided FNAC of thyroid are as follows [1].

Indications

- Nonpalpable thyroid nodule
- Nodule with more than 25% cystic component(The National Cancer Institute (NCI)- sponsored Bethesda recommended)
- Failure to get adequate material

Advantages

- Less chances of nondiagnostic material
- Reduction of false- negative cases
- Nodule of interest is aspirated
- Puncture of the critical structure like major neck vessels can be avoided

AIMS

1. To evaluate the Diagnostic accuracy of USG-guided FNAC of Thyroid
2. To evaluate cellular yield of aspirated material in USG-guided FNAC

Materials & Methods

The present study included total 100 patients with thyroid swelling undergoing USG guided FNAC who were previously diagnosed by Conventional FNAC as to TBS - Bethesda category I (unsatisfactory/non-diagnostic).

Sampling technique: The patient was placed in supine position with small support under his/her neck to make the thyroid region prominent. All patients were examined using the USG machine with Probe frequency of 5-8 MHz. The front of neck is cleansed with antiseptic. The needle used is a thin, fine-gauge (23G or 25G). The radiologist evaluate the thyroid nodule for the location, size, shape, aspect ratio, boundary, echo level, calcification, blood supply, posterior echo and relationship with surrounding tissues and all features are recorded. Then using ultrasound guidance radiologist confirm the puncture site and puncture path. Then needle is inserted into the nodule and aspiration is done by moving needle back & forth for several times for adequate sampling. Smears are made from aspirated material. Immediately wet smears are fixed in 95% alcohol for PAP stain/ H & E stain. For MGG stain, smears are air dried.

Staining: Wet fixed smears were stained by H&E and PAP stain. Air dried smears were stained by MGG (May Grunwald Giemsa) stain. Then microscopy was done to study cytological features of thyroid lesions**.**

Reporting [4]**:** The Bethesda System 2017 for reporting thyroid cytopathology (TBSRTC): recommended diagnostic categories were followed while reporting as given in Table 1.

Table 1: The Bethesda system for reporting thyroid cytopathology

Bethesda category	Cytomorphological features
I. Nondiagnostic or unsatisfactory	• Cyst fluid only, virtually acellular smear, smear Obscured by blood, clotting artifact etc. **Adequacy criteria** [1] • Six clusters of thyroid follicular cells and at least ten cells in each cluster
II. Benign	• Consistent with a benign follicular nodule (includes adenomatoid nodule, colloid nodule, etc.) • Consistent with lymphocytic (Hashimoto) thyroiditis in the proper clinical context • Consistent with granulomatous (subacute) thyroiditis • Other
III. Atypia of Undetermined Significance (AUS) or Follicular lesion of Undetermined Significance (FLUS)	
IV. Follicular neoplasm or suspicious for follicular neoplasm:	• Specify if Hürthle cell (oncocytic) type
V. Suspicious for malignancy:	• Suspicious for papillary carcinoma • Suspicious for medullary carcinoma • Suspicious for metastatic carcinoma • Suspicious for lymphoma • Other
VI. Malignant:	• Papillary thyroid carcinoma • Poorly differentiated carcinoma • Medullary thyroid carcinoma • Undifferentiated (anaplastic) carcinoma • Squamous cell carcinoma • Carcinoma with mixed features (specify) • Metastatic carcinoma • Non-Hodgkin lymphoma • Other

Results

Total 100 cases of thyroid lesions were evaluated.

The patient's age range was 11-80 years.

Most common affected age group was 31-70 with 64% cases, maximum no. of patient was in 41 to 50 years age groups with 27% cases.

In this study, total females were 84(84%) and males were 16(16%).

Female to male ratio was 5.25:1.

In the present study Age and sex wise distribution was as given in Chart-1.

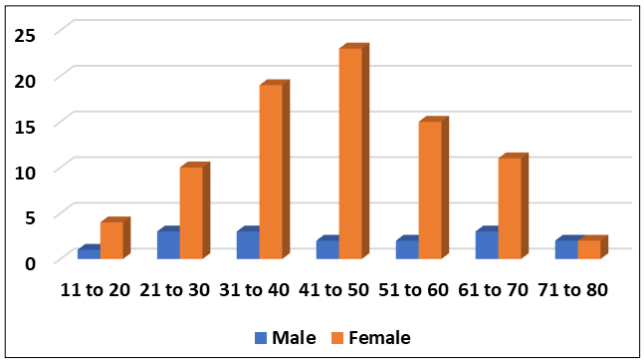

Fig 1: Age-Sex disttribution of the study population

Diagnostic accuracy of Repeat FNAC with USG guidance is 92% over conventional FNAC technique as shown in table 2.

Table 2: Destitution of tbs category thyroid FNAC findings without & repeat with USG guidance

TBS Category	Without USG guided (No. cases)	Repeat With USG guided (No. cases)
I	100	8
II	0	81
III	0	0
IV	0	3
V	0	4
VI	0	4

In our study, result shows that cellular yield of aspirated material in USG-guided FNAC was increased as compare to conventional FNAC technique. Out of 100 only 8 number of cases had inadequate cellularity.
The microscopic features as described in TBSRTC were observed and results were noted according Bethesda categories as shown in Table 3.

Table 3: Incidence of non-neoplastic and neoplastic lesions with Bethedsa categories

Thyroid lesions	Bethesda Category	No. of cases (%)
Colloid goiter	II	26 (26%)
Nodular goiter	II	29 (29%)
Lymphocytic thyroiditis	II	14(14%)
Granulomatous thyroiditis	II	1 (1%)
Hashimoto thyroiditis	II	9 (9%)
Graves' disease	II	2 (2%)
AUS or FLUS	III	0
Nonneoplastic lesion: Total		81 (81%)
Folicular neoplasm	IV	3 (3%)
Suspicious for malignancy	V	4 (4%)
Papillary carcinoma	VI	4 (4%)
Neoplastic lesion: Total		11 (11%)

In this study, nonneoplastic lesions (81%) were more common as compared to neoplastic lesions (11%).
Nodular goiter (29%) was predominant in nonneoplastic group followed by Colloid goiter (26%), Lymphocytic thyroiditis (14%), Hashimoto thyroiditis (9%), Graves'disease (2%) & Granulomatous thyroiditis (1%).
Suspicious for malignancy (4%) and Papillary carcinoma of thyroid (4%) were seen more frequently than Follicular neoplasm (including Hurthle cell neoplasm) (3%) among neoplastic group.

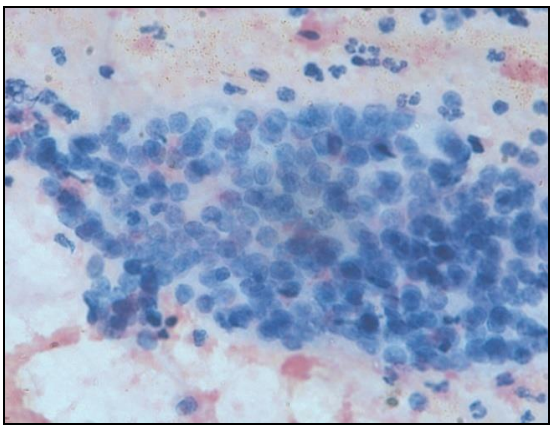

Fig 1: Follicular Neoplasm (H&E, 40X)

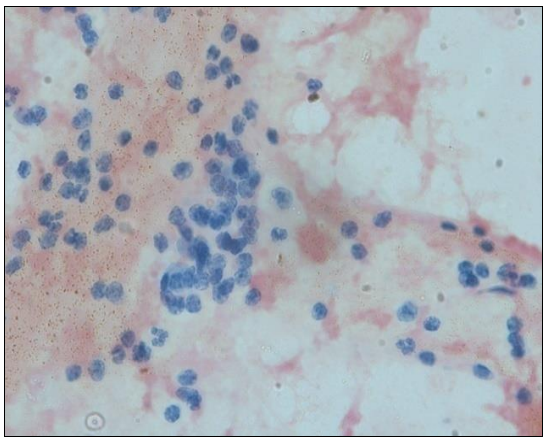

Fig 2: Lymphocytic Thyroditis (PAP, 40X)

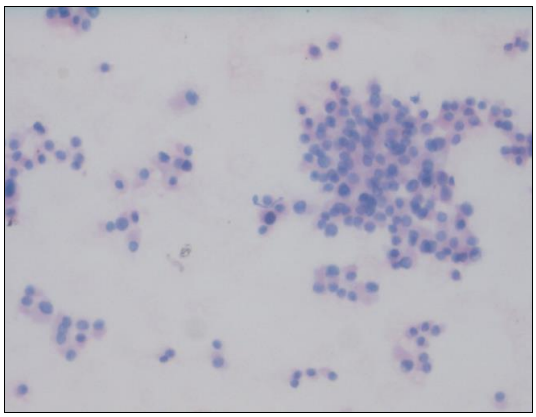

Fig 3: Hurthle Cell Neoplasm (H&E, 10X)

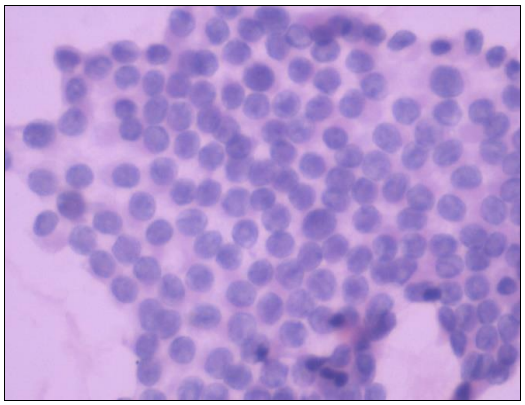

Fig 4: Papillary Carcinoma (H&E, 40X)

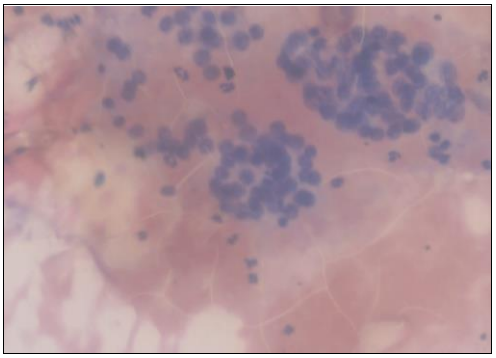

Fig 5: Nodular Goiter (PAP, 20X)

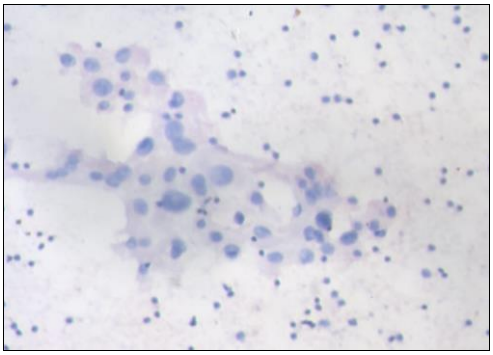

Fig 6: Hashimoto Thyroiditis (H&E, 40X)

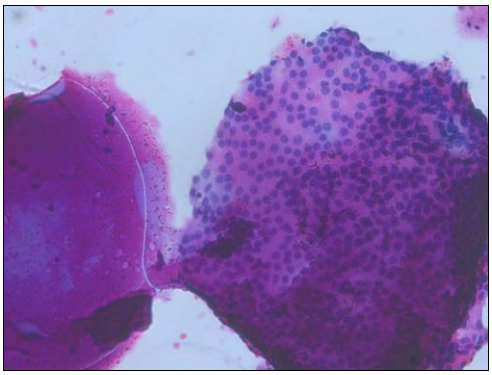

Fig 7: Colloid Goiter (MGG, 20X)

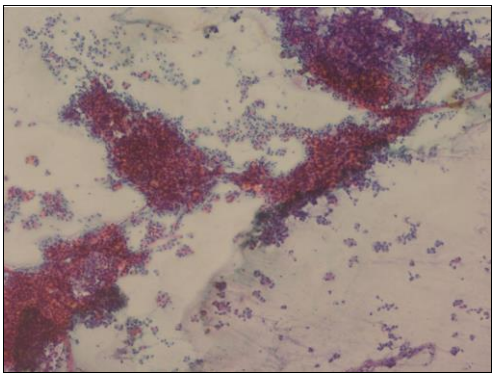

Fig 8: Follicular Neoplasm (PAP, 4X)

Discussion

Thyroid FNAC is important for the preoperative evaluation of thyroid nodules, helping in risk stratification and surgical planning. Thyroid is an organ where multiple revision surgeries are not possible or it is difficult to obtain patient's consent for the same. So, clinicians have to depend largely on the preoperative cytological diagnosis for deciding the medical versus surgical line of treatment [2]. Ultrasonography guidance allows targeting of nonpalpable nodules and the most suspicious sites in larger nodules. This has been shown to increase cellular yield for adequate cytological analysis. The presence of a cytologist on site to screen for adequacy of samples also reduces the likelihood of inadequate sampling [5].

Adequacy criteria includes, that is greater than 6 groups of well-visualised follicular cells, with at least 10 cells per group (preferably on a single slide) [1].

In our study, Out of 100 cases, maximum number of cases were between 41 to 50 years of age group, the youngest being 11 years old and the oldest 80 years old. Comparison of median age with other studies were as given in table 4.

Table 4: Comparison of median age with other studies

Studies	Ujwala S *et al.* [6]	Sinna E *et al.* [7]	Obaid S *et al.* [8]	Ankush *et al.* [9]	Present study
Median age (years)	40	44	40	39	45

In our study, Out of 100 cases, 84 patients were females and 16 were male. The female to male ratio was 5.25:1. So, females were more commonly affected than males. Comparison of Female to Male ratio with other studies were as given in Table 5.

Table 5: Comparison of female to male ratio with other studies

Studies	Uma Handa *et al.* [10]	Ujwala S *et al.* [6]	Sarunya Kantasueb *et al.* [11]	Present study
Female to Male ratio	6.35:1	6.2:1	5.12:1	5.25:1

In our study, Out of 100 cases, 81 cases were diagnosed as nonneoplastic. Comparison of % of non-neoplastic lesions with other study was as given in Table 6.

Table 6: Comparison of % of nonneoplastic cases with other study

Cytological Diagnosis (TBS)	Likhar *et al.* [12]	Present study
Colloid goiter	27.6%	26 (26%)
Nodular goiter	10.41%	29 (29%)
Lymphocytic thyroiditis	4.53%	14 (14%)
Granulomatous thyroiditis	0	1 (1%)
Hashimoto thyroiditis	0	9 (9%)
Graves' disease	0	2
AUS or FLUS	0	0
Other (Thyroglossal cyst, follicular adenoma etc.)	18.86%	0
Nonneoplastic lesion: Total	94.4%	81 (81%)

In our study, out of 100 cases, 81 cases were diagnosed as nonneoplastic and 11 cases were diagnosed as neoplastic. Comparison of % of Nonneoplastic and Neoplastic cases with other study was as given in Table 7.

Table 7: Comparison of % of nonneoplastic and neoplastic cases with other study

Studies	Non neoplastic cases (%)	Neoplastic cases (%)
ankush *et al*. [9]	88	12
jalam S, Sengupta S *et al*. [2]	82	11
Present study	81	11

We experienced relatively low inadequacy rate similar to the experience of B.R.Ashwinietal [13]. who claimed that this low rate was possibly due to less technical errors as FNAC when done by experienced cytopathologist, under guidance of well-trained ultrasonologist. This is shown in Table 8.

Table 8: Comparison of diagnostic accuracy of Usg- guided FNAC

Studies	Jalam S, Sengupta S *et al*. [2]	B.R Ashwini *et al*. [13]	Present study
Diagnostic Accuracy	95.45%	92.9%	92%

Improvement of cellular yield and number of cases falling into TBSRTC Cateory I was also compared with other studies as shown in table 9.

Table 9: Comparison of of cellularity (TBSRTC category i) aspirated material in USG-Guided FNAC with other studies

Studies	Jalam S, Sengupta S *et al*. [2]	B.R Ashwini *et al*. [13]	Present study
No. of Pauci cellular smear cases	1	1	8

Conclusion

Diagnostic accuracy of Repeat with USG guidance FNAC is 92% over conventional FNAC technique. The cellular yield of ultrasonography-guided FNAC at our institution was increased (92%) over conventional FNAC technique.

The present study signifies that USG guided FNAC aids in providing a more accurate diagnosis of thyroid lesions and has an added advantage of multi-modality approach to diagnosis of thyroid lesions in comparision to conventional FNAC; thus reducing False negative cases. It significantly reduces the turnaround time in accurate management of patients and thereby reduces the cost significantly. So, performing USG guided FNAC in all possible cases of thyroid lesions would be of immense help in patient management.

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