

**Original article:**

**A comparative evaluation of USG-guided FNAC with conventional FNAC in the preoperative assessment of thyroid lesions: A particular reference to cyto-histologically discordant cases.**

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**Abstract:**

**Aims & Objectives:** To assess the relative usefulness of ultrasound (USG) guided fine needle aspiration cytology (FNAC) in diagnosis of thyroid lesions over conventional FNAC (C-FNAC) & to evaluate the possible causes of pitfalls of cytological diagnosis. **Materials & Methods:** The study included 84 patients with thyroid swellings. Among them 48 patients underwent only conventional FNAC & 36 underwent both conventional & USG guided FNAC (USG-FNAC). Histology was available in 40 cases- 18 from C-FNAC patients & 22 from combined conventional & guided FNAC patients. Cyto-histological correlation was done & diagnostic accuracy calculated. **Results:** Inadequacy rate was higher with C-FNAC (10.42%) than that of USG-FNAC(2.78%). Sensitivity, specificity & diagnostic accuracy was 71.43%, 90.91%, 83.33% respectively with C-FNAC & 100%, 92.31% , 95.45% respectively with USG-FNAC. False positive & false negative rates were – 5.56% & 11.11% for C-FNAC and 4.55% & zero percent with USG-FNAC. **Conclusion:** FNAC under USG guidance significantly increases the diagnostic accuracy in thyroid lesions than C-FNAC alone; thus reducing the turnaround time & cost in accurate management.

**Keywords:** Thyroid; Fine Needle Aspiration Cytology; USG guided; Histopathology

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**Introduction:**

Annual incidence rate of thyroid nodules is 4-8%.<sup>1</sup> However, autopsy and ultrasound data have shown that prevalence rate of thyroid nodules in normal individuals is 70 %.<sup>2</sup> Most of these thyroid nodules are benign, with malignancy being detected in only 5% cases.<sup>3,4</sup> In addition to this, a very few of thyroid cancers are lethal. As a result, differentiating benign from malignant thyroid disease is of great importance for deciding on medical versus surgical management. Fine needle aspiration cytology (FNAC) of thyroid is a simple, minimally traumatic office procedure as the gland is a superficial & easily accessible organ. FNAC has potential benefit of reducing unnecessary surgery for benign lesions & thus reduces the cost.<sup>5</sup>

Different workers reported that failure to aspirate from proper site was the major cause of misdiagnosis during cytological evaluation.<sup>5</sup> Also, high inadequacy rate, ranging from 6.4 to 32.4% as found in various studies, is another major limitation of conventional FNAC.<sup>6</sup>

Ultrasound guided FNAC (USG-FNAC) was first introduced by Rizzato et al in 1973. Since then, several studies have reported that USG-FNAC reduces the inadequacy rate of conventional FNAC.<sup>7,8,9,10</sup> It also has the major advantage of real time monitoring which help in accurate localisation of needle tip during aspiration.<sup>5</sup>

There are only two recent guidelines available on the practice of USG-FNAC; both were published in 2006. American Association of Clinical Endocrinologists

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(AACE) recommends ultrasound (USG)-guided fine-needle aspiration (FNA), universally for all thyroid nodules that are  $\geq 10$  mm in diameter in euthyroid subjects.<sup>11</sup> In contrast, American Thyroid Association (ATA) recommends either palpation- or ultrasound-guided FNA biopsy.<sup>12</sup> As established guidelines differ on the utility of ultrasound guidance, we aimed to compare the results of conventional and ultrasound-guided thyroid fine needle aspiration biopsies in our clinical case series conducted in the department of pathology, BSMCH.

**Materials And Methods:**

The study was conducted from 1st October 2011 to 30<sup>th</sup> June 2013, in the department of Pathology of our institution. Informed consent was taken from 84 patients having thyroid lesions. Among them, 36 patients gave consent to undergo both conventional and USG-guided FNAC. All patients with complaints of thyroid swelling coming to our department were included in the study. No age and sex criteria were utilized for selection of cases in the study.

Conventional FNAC (C-FNAC) was done in the Department of Pathology. Subsequently, USG was done with high frequency probe (7 to 10MHz transducer) in the department of Radiology, at our institution. USG findings were noted with special attention to the number of nodules, size, echogenicity, margin and calcification. FNAC was then repeated on the patients under USG-guidance on a representative or suspicious area. In both the methods, FNAC was done under aseptic precautions using 25-gauge needle fitted to 10ml syringe with patient in supine or sitting posture with neck extended. We followed no aspiration technique. The material was collected in the bore by capillary action. In some cases, particularly in cases where primary attempt failed to aspirate adequate material, aspiration technique was used. The aspirate was then expressed on the clean glass slides and fixed with 95% alcohol and by air dry technique. A minimum of four slides were smeared from each aspirate. The smears were then stained with Papanicolaou(Pap) and May-Grunwald-Giemsa(MGG) staining. The slides prepared from conventional FNAC and USG-guided FNAC were reported separately by the same pathologist. Smears with at least six clusters of follicular cells, each having at least ten follicular cells, were considered adequate for reporting following standard recommendations.<sup>13</sup> Among 84 cases, 40 patients underwent surgery and so histopathological correlation was possible in them.

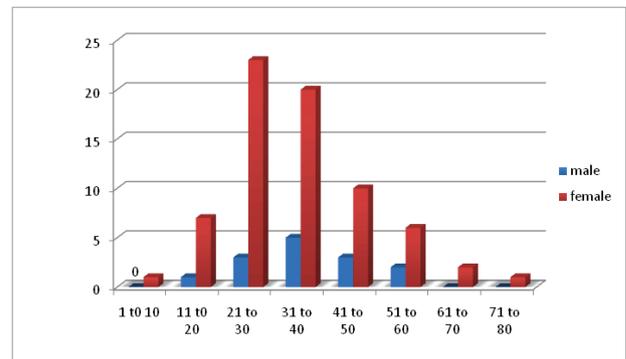
Histopathological results were correlated with results of conventional FNAC and USG-guided FNAC. Finally all clinical data, imaging findings and histopathological report were recorded, cross checked and tabulated for statistical analysis and comparative study by standard statistical methods.

**Ethical approval:** permission was taken from the ethical committee of BSMCH

**Results:**

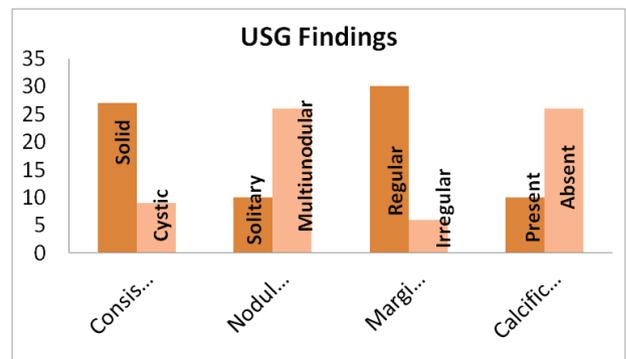
The FNAC of thyroid were done on total 84 patients with an age range of eight to 71 years with majority

**Table No 1. Age-Sex distribution of the study population**



USG findings were available in 36 patients (42.85%). Among them 27 (75%) lesions were predominantly solid and nine were predominantly cystic (25%). 26 (72.22%) lesions were diffuse or multinodular and 10 (27.78%) were solitary nodules. Margin was irregular in 6 (16.67%) lesions. Calcification was present in 10 (27.78%) cases. (Table-2)

**Table No 2. Ultrasonography Findings of patients undergoing guided fine needle aspiration cytology**



of them being in the age group of 21 to 40 years. Most of the patients were females accounting for 70 cases (83.33%). (Table-1)

Table-3 shows the results of C-FNAC and USG-FNAC. 48 patients underwent only C-FNAC and 36

underwent both C-FNAC & USG-FNAC. Number of inadequate smears were five in C-FNAC (10.42%) and one (2.78%) in USG-FNAC. C-FNAC results included 36 non-neoplastic lesions, one follicular neoplasm and six malignant lesions. USG-FNAC results showed 21 non-neoplastic, three follicular neoplasms and 11 malignant lesions.

**Table No 3. Results of fine needle aspiration cytology of all patients**

Total No Cases (%)	Category	No	Category Of Diagnosis			
			Inadequate	Non Neoplastic	Follicular Neoplasm	Malignancy
84 (100%)	Only C-Fnac	48 (57.14%)	5	36	1	6
	C-Fnac + Usg-Fnac	36 (42.86%)	1	21	3	11

[C-FNAC – conventional fine needle aspiration cytology, USG-FNAC – ultrasound guided fine needle aspiration cytology]

Table-4 shows the cytohistological correlation in all possible cases. 40 patients, 18 from C-FNAC group and 22 from USG-FNAC group, underwent surgery and thus histology were available in them. The histological findings of 18 cases that had undergone conventional FNAC, showed 11 non-neoplastic lesions and seven neoplastic lesions

(two follicular adenoma and five malignancies). Histological findings of 22 patients who underwent both conventional and USG-guided FNAC showed 13 non neoplastic lesions and nine neoplastic lesions (Three follicular adenomas, one follicular carcinoma and five other malignancies).

**Table No 4: Cyto-Histological correlation in all possible cases**

Total Cases With Histology	Category Of Cases According To Method Of Cytology	No.	Cytodiagnosis	No.	Histopathological Diagnosis		
					Nn	Fn	M
40	C-Fnac	18	Nn	12	10	1	1
			Fn	2	1	1	-
			M	4	-	-	4
	C-Fnac + Usg-Fnac	22	Nn	12	12	-	-
			Fn	5	1	3	1
			M	5	-	-	5

[ NN- non-neoplastic; FN- follicular neoplasm; M- malignancy]

Among 22 patients of USG-FNAC, accurate diagnosis was possible in 21 cases and there was one false positive and no false negative diagnosis. In C-FNAC, 15 accurate diagnoses were available out of 18 cases and there were one false positive and two false negative cases. (Table-5)

**Table No 5. Comparison of diagnostic accuracy of conventional & guided cytology**

Category of cytology where histology available	No.	No. of cases with accurate diagnosis	%	No. and % of false positive cases	No. and % of false negative cases
Conventional cytology	18	15	83.33	1 (5.56%)	2 (11.11%)
Guided cytology	22	21	95.45	1(4.55%)	0

Discrepancy was found in four cases (three in C-FNAC and one in USG-FNAC) as shown in table-6. A case of adenomatoid goitre was diagnosed as follicular neoplasm in C-FNAC, one case of follicular neoplasm and one case of papillary carcinoma were diagnosed as adenomatoid goitre in C-FNAC. A case of thyroiditis was diagnosed as Hurthle cell neoplasm (follicular neoplasm) in USG-FNAC.

**Table No 6. Cyto-histologically discordant cases**

Sl No.	Age & Sex	Method Of Fnac	Cytodiagnosis	Histological Diagnosis
1	35/F	C-Fnac	Follicular Neoplasm	Adenomatoid Goitre
2	43/F	C-Fnac	Adenomatoid Goitre	Follicular Neoplasm
3	23/F	C-Fnac	Adenomatoid Goitre	Papillary Carcinoma
4	33/F	Usg-Fnac	Follicular Neoplasm	Thyroiditis

The statistical evaluation with various parameters showed 71.43% sensitivity, 90.91% specificity and 83.3% diagnostic accuracy on conventional FNAC and 100% sensitivity, 92.31% specificity and 95.45% diagnostic accuracy on USG-guided FNAC.

### **Discussion:**

FNAC is now firmly established as the first line diagnostic test for the evaluation of thyroid lesions.<sup>(14)</sup>FNAC enables us to classify thyroid lesions into benign and malignant lesions, and in many cases also helps in sub typing them.<sup>15</sup>

However, FNAC of thyroid has its limitations also. Firstly, there is high inadequacy rate of conventional FNAC procedure. The causes of inadequacy may be failure to aspirate from the proper site, cystic papillary carcinoma, technical error, variable criteria adopted for adequacy in different institutions.<sup>(16)</sup> Secondly, categorising thyroid follicular lesions into benign and malignant neoplasm is very difficult by cytology. This is unavoidable as the distinction requires demonstration of capsular and vascular invasion by histology.<sup>13</sup> So, we included both lesions under umbrella term follicular neoplasm, according to standard guidelines.

USG examination of thyroid and neck is a basic diagnostic imaging method providing information on structure of parenchyma of thyroid gland, its relationship to its surroundings and on regional lymph nodes<sup>16</sup>. Modern high resolution and Doppler ultrasound has allowed the definition of suspicious features over & above description as solid or cystic and these include microcalcification, the irregularity of the nodule margin and intralesional vascularity<sup>(13)</sup>. But due to overlapping features of USG, these features alone cannot determine the exact nature of the lesion.<sup>(15)</sup> We have also similar experience.

USG findings in combination with FNAC of the lesion, can increase the accuracy of results almost at par with histology, as proposed by different workers.<sup>(17)</sup> This study was conducted to ascertain the relative usefulness of USG-FNAC in our institution catering tertiary care to people of relatively underdeveloped districts of West Bengal.

In our study, majority of the patients were females- 70 (83.33%) out of 84 cases and majority were of the age group 21-40yrs (60.71%). Studies performed by other workers also reported high percentage of female patients in their studies and age group of presentation similar to our study.<sup>(15,18)</sup>

USG findings were available in 36 out of 84 cases (42.86%). Features suggesting malignancy like- predominantly solid, solitary lesions having irregular margin with evidence of microcalcification were found in one cases (16.67%). All but one was proved to be malignant lesions on subsequent FNAC. This was in concordance with other workers who found these USG features to be reliable predictors of malignancy.<sup>(15,18,19)</sup>

In the present study, the inadequacy rate with conventional (C-FNAC) and ultrasound guided FNAC (USG-FNAC) was 10.42% and 2.78% respectively. The rate of inadequacy of thyroid FNAC varied from 6.4 to 32.4% in studies performed by different workers.<sup>(6)</sup> We experienced relatively low inadequacy rate similar to the experience of B.R.Ashwini et al who claimed that this low rate was possibly due to less technical errors as FNAC was done by experienced cytopathologist, under guidance of well trained ultrasonologist.<sup>(15)</sup>

Histological diagnoses were available in 40 cases (18 cases of C-FNAC and 22 cases of USG-FNAC). Proportions of non neoplastic lesions undergoing histological study in our series were less in comparison to other research works. Possibly due to suspected non neoplastic lesions were not offered surgical management because of patient burden. In cytohistological correlation of both types of FNAC, it was found that malignant lesions were identified more accurately by both techniques. Inaccurate diagnosis rate was higher among nonneoplastic and follicular neoplasm group. Similar results were obtained by Amita K. et al<sup>(19)</sup>

In C-FNAC, there were two (11.11%) false negative cases and one (5.56%) false positive case out of 18 cases. One case of follicular neoplasm and one case of papillary carcinoma were diagnosed as adenomatoid goitre in cytology i.e. false negative diagnosis. Possible explanation of false negative diagnosis of follicular neoplasm is that follicular pattern of follicular neoplasm was disrupted in smear and cells were in sheets or clusters and there was no acinar structure. Possible explanation of false negative diagnosis of papillary carcinoma was inability in recognizing the minimal cytological atypia present

in the smear (Fig-1).

The false negative and false positive rates of C-FN in our study were comparable to that in literature. In literature the same are in the range of 6.6-25.5% and 2-20% respectively.<sup>(20,21)</sup>

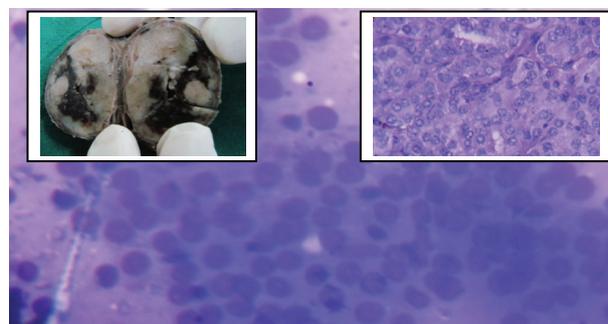


Fig-1: Photomicrograph showing cytological features of adenomatoid goiter (100x Leishman-Giemsa stain). Inset photomicrograph(Rt) shows histopathological features of papillary carcinoma of thyroid (100X, H&E). Inset (Lt) showing the gross features of haemorrhage and solid area.

One case of adenomatoid goitre was diagnosed as follicular neoplasm in cytology i.e. false positive (Fig-2). The possible explanation is selective sampling of microfollicular region of adenomatoid goitre.

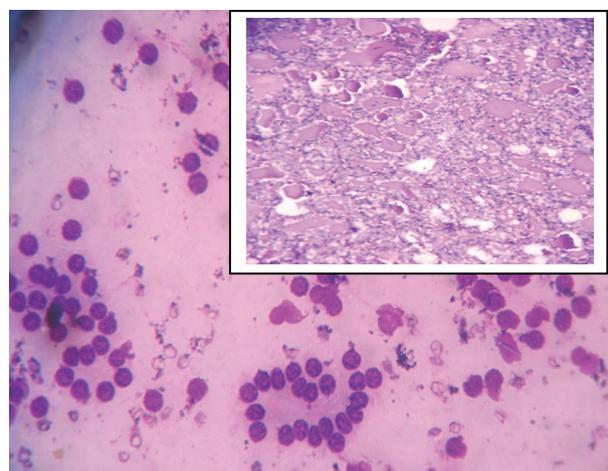


Fig. 2 : Photomicrograph showing cytological aspirates from thyroid showing a follicular neoplasm(100x Leishman-Giemsa stain). In set photomicrograph shows histopathological features of nodular goiter (100X, H&E)

In USG-FNAC, there was one false positive (4.55%) and no false negative diagnosis out of 22 cases in our study. A case of Hashimoto's thyroiditis was diagnosed as Hurthle cell neoplasm in cytology. The possible explanation of the false positive diagnosis is due to selective sampling of Hurthle cells from a case

of Hashimoto's thyroiditis (fig-3).

So, both the false positive and false negative rates were lower in USG-FNAC. The diagnostic accuracy of USG-FNAC was almost comparable to that of histopathology.

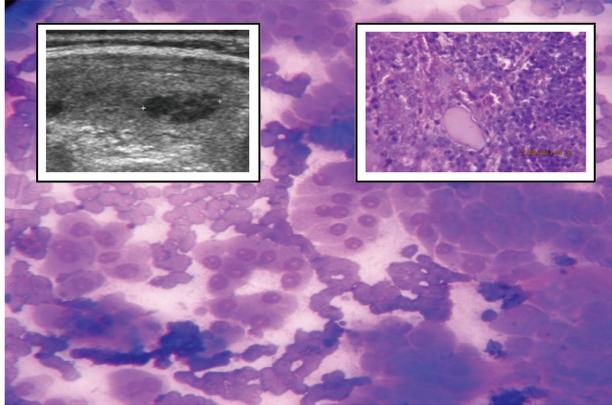


Fig-3: Photomicrograph showing cytological features of Hurthle's cell neoplasm ((100x Leishman-Giemsa stain). Inset photomicrograph (Right) showing histopathological features of Hashimoto's Thyroiditis (100X,H&E). Inset photomicrograph (Left.) shows USG picture of hypoechoic nodule.

The limitation of our study is that the study population is small, so there may be some bias in selection of cases. For definitive conclusion, a larger population would have been required.

**Conclusion:**

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. The present study signifies that USG guided FNAC aids in providing a more accurate diagnosis of thyroid lesions and has an added advantage of a multi-modality approach to diagnosis of thyroid lesions in comparison to C-FNAC. 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.

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