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## RESEARCH ARTICLE

### A CLINICAL STUDY TO SEE THE DISTRIBUTION OF VARIOUS BENIGN THYROID LESIONS BY FREE HAND GUIDED FNAC IN A STUDY POPULATION IN NORTHERN INDIA AND COMPARE THE SAME WITH ULTRASOUND- GUIDED FNAC

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#### ABSTRACT

**Aim:** The present study is undertaken to see the distribution of various benign thyroid lesions by free hand guided FNAC in a study population in northern India and compare the same with ultrasound- guided FNAC.

**Introduction:** Clinical examination, although very accurate in most cases of thyroid lesion, is inadequate in some areas especially, in staging and in detecting the multi-nodularity of the gland.

**Materials and Methods:** The study was conducted in the Postgraduate Department of Pathology of a teaching hospital for a period of 1 year. It was a prospective hospital based Study. In each case, a brief clinical history and physical examination along with evaluation of relevant investigation was carried out. Patient were explained about whole of the procedure & the consent for the procedure was taken in all patients. FNAC of thyroid gland was done, by both Free hand guided and ultrasound guided and the results were correlated using SPSS 11.5 software.

**Observation:** Out of the 139 patients, 87 shows non- neoplastic lesions. In free hand FNAC Colloid goitre was the most common accounting for 49 cases (54.44%), followed by Lymphocytic thyroiditis 12(13.33%), Hashimoto's thyroiditis 7(7.78%), Autoimmune thyroiditis 11 (12.22%) and Thyroglossal cyst 2 (2.2%). On the other hand, ultrasound guided FNAC showed 87 non- neoplastic lesions, Colloid goitre was the most common accounting for 51 cases (67.61%), followed by Lymphocytic thyroiditis 13 (9.35%), Hashimoto thyroiditis 8 (9.86%), Autoimmune thyroiditis 13(9.35%) and Thyroglossal cyst 2 (1.43%). Age of the patients ranged from 18-70yrs with maximum number 16 (31.37%) in the age group of 31-40. Majority of the patients of colloid goitre were female accounting for 12 out of 13 and only one case was male. Cytological diagnosis of Comparison of Non neoplastic lesions results both by USG guided FNAC and Free Hand FNAC shows difference of 3 cases in colloid goitre, 1 case in lymphocytic thyroiditis, 1 case in Hashimoto's Thyroiditis, 2 cases each of Thyroglossal cyst. Number of unsatisfactory smears were 9 and 3 in free and USG guided FNAC respectively. In USG guided FNAC, Sensitivity was 96.96%, Specificity was 93.3%. Positive predictive value was 96.96%, Negative predictive value was 93.33% and Diagnostic accuracy was 95%. In Free Hand FNAC, Sensitivity was 90.0%, Specificity was 80.0%. Positive predictive value was 90.0%, Negative predictive value was 80% and Diagnostic accuracy was 86.66

**Conclusion:** The statistical significance of USG-guided FNAC as: Sensitivity 96.96%, Specificity 93.3%, Positive predictive value 96.96%, negative predictive value 93.33%, diagnostic accuracy 95%. The statistical significance of Free-guided FNAC as: Sensitivity 90%, specificity 80%, positive predictive value 90%, negative predictive value 80%, diagnostic accuracy 86.66%. The statistical significance shows Ultrasound guided-FNAC had a significantly higher rate of diagnostic accuracy compared to palpable FNAC

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#### INTRODUCTION

Thyroid nodules are commonly encountered in clinical practice, with a prevalence of 2% to 5% for palpable thyroid nodules (Rojeski *et al.*, 1985) and 19% to 46% for nodules detected by thyroid ultrasonography (Brander *et al.*, 1992).

Thyroid nodules are more common in women, and the incidence increases with age, history of radiation and diet containing goitrogenic material (Rojeski *et al.*, 1985). Thyroid nodules are the most common endocrine disorders particularly in countries where dietary iodine intake is low (Maheshwari *et al.*, 2004). Clinically thyroid lesions present as goitre or thyroid enlargement which can be nodular (solitary or multiple) or diffuse (Mathur *et al.*, 2005). Fine-needle aspiration cytology (FNAC) is a standard diagnostic test for evaluating palpable thyroid nodules. It is a simple rapid, reliable and minimally

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traumatic procedure that is done as a routine practice (Mathur *et al.*, 2005 and Gagneten *et al.*, 1987). The procedure is regarded as a valuable method of distinguishing between malignant from those with benign nodules that can be followed clinically (Ko *et al.*, 2003). As a diagnostic test, FNAC can be used to diagnose most benign nodular goitres, cysts & thyroiditis with high degree of accuracy based on cytomorphological features (Suen, 2002). FNAC is considered as an ideal first line diagnostic procedure without any disadvantage of open surgical biopsy (Das *et al.* 1999 and Al-Rikabi *et al.*, 1998). The advancements in management of thyroid pathology has been possible, because of developments in the field of imaging radiology. Most importantly application of ultrasound in the preoperative evaluation has enhanced the armamentarium of the head and neck surgeon. Rapid evolution in sonographic technology has made ultrasound an important adjunct to the practice of head and neck surgery. Ultrasound of the neck is extremely sensitive in detecting thyroid pathology and is felt to be the most complete and cost-effective imaging method for the evaluation of the thyroid gland (Lew *et al.* 2010). Rizatto *et al.* in 1973, introduced USG guided-FNAC. Thereafter, several studies have reported that USG guided-FNAC reduces the inadequacy rate, helps to accurately select the patients for surgery, avoids unnecessary diagnostic thyroidectomies.

Ultrasound guided-FNAC had a significantly higher rate of diagnostic accuracy compared to palpable FNAC<sup>12</sup>. The reported incidence of thyroid nodules in children and adolescents is estimated to be between 1% and 2%. However, this incidence may be increasing because diagnostic radiological procedures are detecting incidental thyroid nodules in children (Izquierdo *et al.* 2006). The majority of thyroid fine needle aspiration Cytology (FNAC) are performed by palpation. Not infrequently, patients are sent to radiology for an ultrasound-guided FNAC. Real-time ultrasound FNAC allows for continuous visualization of the needle during insertion and sampling (Seiberling *et al.*, 2008). It is reported that 9 to 47% of palpation-guided and 4 to 21% of ultrasound-guided FNA smears are inadequate (Goudy *et al.*, 2005). Mehrotra and co-workers (2005) reported an unsatisfactory specimen rate of 46.8% for palpation-guided FNAs and 15.6% for USG-guided core-cutting needle aspirations. From a large study with 9683 subjects, Danese and coworkers (1998) reported the sensitivity, specificity and accuracy of palpation-guided thyroid FNAs as 91.8%, 68.8% and 70.9% and of USG-guided FNAs as 97.1%, 70.9% and 75.6%, respectively. FNAC and USG are thus used in association with clinical features. The present study is undertaken to evaluate thyroid nodules by Free guided and USG - guided FNAC to diagnose various palpable and non palpable lesions & to compare the efficacy of two procedures.

**MATERIALS AND METHODS**

The study was conducted in the Postgraduate Department of Pathology in Northern India. It was a prospective hospital based study in which FNAC of new cases of thyroid lesions was done. In each case, a brief clinical history and physical examination along with evaluation of relevant investigation was carried out. Fine Needle Aspiration Cytology of thyroid

gland was done by (a) palpable method and (b) Ultrasound guided. The slide smears were stained by May-Grunwald Giemsa (MGG) and Papanicolaou (PAP) staining method

**Procedure for Palpable FNAC**

Patient were explained about whole of the procedure. The consent for the procedure was taken in all patients & the Palpable FNAC was carried out by positioning patient in supine position on an examination couch. During the procedure, the thyroid nodule was manually fixed in position & fine needle aspiration was performed .At least 2 passes in different quadrants of the thyroid nodule were performed to achieve a detailed cytologic picture keeping in mind that the majority of thyroid lesions are heterogeneous in morphology Smears were air-dried & then stained with May Grunwald Giemsa (MGG) stain. Some of the smears were fixed with 95 % ethanol. Those smears were then stained with Papanicolaou’s stain.

**Procedure for USG Guided FNAC**

USG guided FNAC was performed whereby the lesion were identified and the Fine Needle was introduced under continuous guidance of ultrasound. The procedure was done both in axial or sagittal plane. Correlation of the two methods was done by statistical evaluation using SPSS 11.5 software.

**Observations**

Whereas in free hand FNA among non neoplastic lesions, Colloid goitre was the most common accounting for 49 cases (54.44%), followed by Lymphocytic thyroiditis 12(13.33%), Hashimoto's thyroiditis 7(7.78%), Autoimmune thyroiditis 11 (12.22%) and Thyroglossal cyst 2 (2.2%).

**Table 1. Distribution of benign lesions on Free guided FNAC**

AGE(yrs)	C.G.	L.T.	H.T.	A.L.T.	T.G.C.	Total
<10	0	0	0	0	1	1
11-20	3	0	0	0	1	4
21-30	12	1	1	3	0	17
31-40	14	10	3	4	0	31
41-50	8	0	2	4	0	14
51-60	7	1	1	0	0	9
61-70	4	0	0	0	0	4
>70	1	0	0	0	0	1
Total	49	12	7	11	2	81

C.G= Colloid Goitre, L.T. = Lymphocytic Thyroiditis, A.I.T=Autoimmune Thyroiditis, H.T.= Hashimato’s Thyroiditis, T.G.C.=Thyroglossal Cyst

**Table 2. Distribution of Benign lesions on USG-guided FNAC**

AGE(yrs)	C.G.	L.T.	H.T.	A.L.T.	T.G.C.	Total
<10	0	0	0	0	1	1
11-20	4	0	0	0	1	5
21-30	12	1	2	4	0	19
31-40	16	11	3	5	0	35
41-50	8	0	2	4	0	14
51-60	6	1	1	0	0	8
61-70	4	0	0	0	0	4
>70	1	0	0	0	0	1
Total	51	13	8	13	2	87

C.G= Colloid Goitre, L.T. =Lymphocytic Thyroiditis, A.I.T=Autoimmune Thyroiditis, H.T.=Hashimato’s Thyroiditis, T.G.C.=Thyroglossal Cyst

In the present study, ultrasound guided FNAC showed 87 non-neoplastic lesions, Colloid goitre was the most common accounting for 51 cases (67.61%), followed by Lymphocytic thyroiditis 13 (9.35%), Hashimoto thyroiditis 8 (9.86%), Autoimmune thyroiditis 13(9.35%) and Thyroglossal cyst 2 (1.43%).

**Table 3. Comparison of Benign lesions between USG-guided FNAC and Free-Hand FNAC**

Thyroid lesion	USG-Guided FNAC	Percentage	Free-Hand FNAC	Percentage
Colloid goitre	51	57.30	49	54.44
Lymphocytic Thyroiditis.	13	14.61	12	13.33
Hashimoto's Thyroiditis.	8	8.99	7	7.78
Autoimmune thyroiditis	13	14.61	11	12.22
Thyro-glossal Cyst	2	2.25	2	2.22
Unsatisfactory	3	3.44	9	11.11
TOTAL	90	100	90	100

Cytological diagnosis of Colloid Goitre was present in 51(57.3%) cases in USG- guided FNAC and 49(54.44%) cases free hand FNAC. Age of the patients ranged from 18-70yrs with maximum number 16 (31.37%) in the age group of 31-40. Majority of the patients of colloid goitre were female accounting for 12 out of 13 and only one case was male. Cytological diagnosis of Lymphocytic thyroiditis was present in 13(14.61%) cases in USG- guided FNAC and 12 (13.33%) cases free hand FNAC. Age of the patients ranged from 18-70yrs with maximum number 11(84.6%) in the age group of 30-41. Majority of the patients were female accounting for 12 out of 13 and only one case was male. Cytological diagnosis of Hashimoto's thyroiditis was made in 8 (8.99%) cases in guided FNAC and 7 (7.78%) cases free hand FNAC. Age of the patients ranged from 18-70yrs with maximum number 3(37.5%) in the age group of 31-40. Majority of the patients were female accounting for 4 out of 5 and only one case was male. Cytological diagnosis of Autoimmune Thyroiditis was made in 13(14.61%) cases in USG-guided FNAC and 11(12.22%) cases free hand FNAC. Age of the patients ranged from 18-70yrs with maximum number 5(38.46%) in the age group of 31-40. Majority of the patients were female accounting for 4 out of 5 and only one case was male. Cytological diagnosis of Thyroglossal cyst was made in 2 cases in both guided FNAC and free hand FNAC. Comparison of Non neoplastic lesions results both by USG guided FNAC and Free Hand FNAC in 89 patients shows difference of 3 cases in colloid goitre, 1 case in lymphocytic thyroiditis, 1 case in Hashimoto's Thyroiditis, 2 cases each of Thyroglossal cyst. Number of unsatisfactory smears were 9 and 3 in free and USG guided FNAC respectively.

The overall findings of USG Guided are summarised as; Colloid Goitre 51 (36.69%), Hashimoto's Thyroiditis 8 (5.76%), Lymphocytic Thyroiditis 13 (9.35%), Autoimmune Thyroiditis 13 (9.35%), Thyroglossal Cyst 2 (1.44). The overall findings of Free-Hand FNA are summarised as; Colloid Goitre 49(35.25%), Hashimoto's Thyroiditis 7 (5.04%), Lymphocytic

Thyroiditis 12 (8.63%), Autoimmune Thyroiditis 11 (7.91%), Thyroglossal Cyst 2 (1.44%).

**Table 4. Comparison of USG Guided versus FREE HAND-FNAC**

Lesions	USG - guided FNAC		Free hand FNAC	
	Number	Percentage	Number	Percentage
Colloid goitre	51	36.69	49	35.25
Hashimoto's Thyroiditis	8	5.76	7	5.04
Lymphocytic thyroiditis	13	9.35	12	8.63
Autoimmune thyroiditis	13	9.35	11	7.91
Thyroglossal cyst	2	1.44	2	1.44

**Table 5. Statistical comparison between USG and free hand FNAC**

VALUE	USG	FREE-HAND
Sensitivity	96.96%	90%
Specificity	93.3%	80%
Positive Predictive value	96.96%	90%
Negative Predictive value	93.33%	80%
Accuracy	95%	86.66%

In USG guided FNAC, Sensitivity was 96.96%, Specificity was 93.3%. Positive predictive value was 96.96%, Negative predictive value was 93.33% and Diagnostic accuracy was 95%. In Free Hand FNAC, Sensitivity was 90.0%, Specificity was 80.0%. Positive predictive value was 90.0%, Negative predictive value was 80% and Diagnostic accuracy was 86.66%.

## DISCUSSION

In the present study Ultrasound guided and Free handed Fine needle aspiration was performed in 139 patients with thyroid swelling. The present study aimed at studying the Cytological features of Thyroid lesions by Ultrasound guided Fine needle aspiration and compared with Free-hand Fine needle aspiration. Fine needle aspiration cytology (FNAC) is the fundamental method for evaluation of thyroid nodules. Examination of the material obtained by FNAC enables to differentiate between benign and malignant lesions. However, FNAC of thyroid has its own limitations. Adequate cytologic interpretation depends on correct detection of the location of the suspected lesion and on the aspiration technique. Wrong detection and poor aspiration techniques cause most of the false negative reports (Martinek *et al.* 2004). Ultrasound guidance allows continuous visualization of the needle during insertion and sampling which results in pinpoint accuracy with a high level of safety. Ultrasound guided Fine needle aspiration cytology improves the yield of cancer detected at surgery (Carmeci *et al.* 1998). The incidence of solitary and diffuse nodules was 79.1% and 20.8%, respectively in the present study. The right lobe was more frequently involved than the left lobe as reported by Psarras *et al.* (1972). In our study, the right lobe of the thyroid was involved in 62.5% of the cases and the left lobe in 37.4% of the cases.

## FINDINGS ON FNAC

In the present study, fine needle aspiration of thyroid lesion results are interpreted as per Bethesda system (Table 20). The results obtained by USG-guided FNAC of benign, malignant.

Intermediate and Unsatisfactory subgroups, are incorporated in the following table and compared with results of studies by other authors.

**Table 3. Comparison of results of present study with Other Authors**

Cytological results	A Martinek et al	A S Can et al.	Present Study
Benign	4	147	87
Malignant	36	5	39
Indeterminate	8	9	9
Unsatisfactory	8	23	4

Aspiration was done from at least 2-6 sites. Laurie *et al.*(1996) stresses the importance of doing multiple aspirations as the thyroid can be affected by more than one disease process<sup>21</sup>. Aspirates done by Ultrasound guided FNAC were satisfactory for cytological evaluation in 135 cases and unsatisfactory in 4 cases where as aspirates done by conventional FNAC were satisfactory in 124 cases and unsatisfactory in 15 cases with the percentage of inadequate samples being 2.87 % and 10.79 % respectively. This when compared to study by P Mehrotra *et al.* (2005), the percentage of inadequate samples is lower in both free hand and guided FNAC. For considering the aspirate adequate for interpretation, it requires five to six groups of well preserved cells with each group consisting of 10 or more cells. Many studies have applied the same criteria for satisfactory aspirates. The presence of colloid is helpful for determining that the thyroid was sampled but without cells it is non-diagnostic (Laurie *et al.* 1996).

In the present study, the most common lesion in ultrasound guided FNAC was Colloid goitre accounting for 51 cases followed by Lymphocytic thyroiditis 13, Autoimmune Thyroiditis 13, Hashimoto’s Thyroiditis 8 and 2 were Thyroglossal Cyst. Free hand FNAC showed similar picture with the most common non neoplastic lesion being Colloid Goitre 49, followed by Lymphocytic Thyroiditis 12, Autoimmune Thyroiditis 11, Hashimotos thyroiditis 7 and 2 were Thyroglossal cyst. Distribution of thyroid lesions when compared with studies by A Martinek *et al.* (2004), was similar in colloid goitre and higher in case of Hashimoto’s thyroiditis. In the present study, Goitre was the commonest thyroid lesion accounting for 51(57.3%) by USG-guided FNAC. Similar observation was made by A Martinek *et al.* (2004) who reported 156 (50.4%) out of 309 cases<sup>10</sup>. In the present study, cytological diagnosis of Hashimoto’s thyroiditis was made in 8 cases by USG-guided FNAC constituting 9.19% of total cases.

Study	Sensitivity	Specificity	PPV	NPV	Accuracy
Takashima <i>et al.</i>	96%	91%	96%	91%	94%
Baloch <i>et al.</i>	87.84%	78.5%	33.51%	98.13%	79.53%
Kim <i>et al.</i>	96.9%	93.4%	86.1%	98.6%	94.4%
Cesur <i>et al.</i>	93.5%	26%	43%	86%	54%
Kwak <i>et al.</i>	96.4%	74.5%	92.7%	94.9%	80.9%
Rosen <i>et al.</i>	60.9%	100%	100%	80%	85%
Present Study	96.96%	93.33%	96.96%	93.33%	95%

In this study we have achieved a sensitivity of 96.96% by ultrasound guided FNA which is comparable with that of Kim *et al.* (2003) (96.9%), Takashama *et al.* (1994) (96%), Kwak *et al.* (2008) (96.4%) and Cesur *et al.* (2006) (93.5%) and higher compared to Cai *et al.* (2006) (83.3%) study but lower than AS Can *et al.* (2008) (100%). Specificity of our study was 93.33% which was comparable with Kim *et al.* (2003) (93.4%) and AS Can *et al.* (2008) (94.0%) but higher than Kwak *et al.* (2008) (74.5%), A Martinek *et al.* (2004) (85.0%), Takashama *et al.* (1994) (91.0%) and lower than Cai *et al.* (2006) (98%). The present study had Positive predictive value 96.96%. It is comparable with Takashama *et al.* (1994) (96%), but higher than Cesur *et al.* (2006) (43.0%), AS Can *et al.* (2008) (67%) and Cai *et al.* (2006) (71.0%). The negative predictive value of the study was 93.33%. It was comparable with Takashama *et al.* (1994) (91%) but higher than Cesur *et al.* (2006) (86%) but lower than 1AS Can *et al.* (2008) 100%, Kim *et al.* (2003) (98.6%) and Cai *et al.* (2006) (98.4%). Negative predictive value of nearing 93.33 % is an indication of best screening test. Positive likelihood ratio and negative likelihood ratio was 14.54% and 0.03% respectively. Diagnostic accuracy of the present study is 95.83% which is comparable to Kim *et al.* (2003) (94.4%) and Takashama *et al.* (1994) (94%) but higher than Cesur *et al.* (2006) (54%), Kwak *et al.* (2008) (80.9%) and A Martinek *et al.* (2004) (86%). The agreement between the USG guided FNAC and Free hand FNAC is highly significant shown by kappa k = 94 %.

**Conclusion**

The present study was conducted in the Post-graduate Department of Pathology in a teaching hospital in Northern india. The present work compromised of One year prospective analysis of thyroid lesions by USG-guided and conventional method fine needle aspiration cytology (FNAC).The study compromised of 139 patients of thyroid lesions who were subjected to USG-guided and conventional method fine needle aspiration cytology (FNAC). Following conclusions were inferred from the study:

- The distribution of benign lesions by USG guided FNAC was as: Colloid Goitre 51, Lymphocytic Thyroiditis 13, Hashimato’s Thyroiditis 08, Autoimmune Thyroiditis 13 and Thyroglossal cyst 02.The distribution of benign lesions by Conventional FNAC was as: Colloid Goitre 49, Lymphocytic Thyroiditis 12, Hashimato’s Thyroiditis 07, Autoimmune Thyroiditis 11 and Thyroglossal cyst 02.
- The statistical significance of USG-guided FNAC as: Sensitivity 96.96%, Specificity 93.3%, Positive predictive value 96.96%, negative predictive vale 93.33%, diagnostic accuracy 95%.
- The statistical significance of Free-guided FNAC as: Sensitivity 90%, specificity 80%, positive predictive value 90%, negative predictive vale 80%, diagnostic accuracy 86.66%.

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