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Fine Needle Aspiration Cytology in Thyroid Lesions and Its Cytoclinical Correlation

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Abstract

Context: Fine needle aspiration cytology (FNAC) is one of the important components of cytology. The main purpose of FNAC is confirmation of benign thyroid lesions and thereby reducing unnecessary surgeries for the same. *Aims:* The main aim of the study is to study the correlation ship between cytological findings of thyroid lesions with clinical history and histopathological examination (Wherever available). *Settings and Design:* It is a prospective study of 150 patients having thyroid enlargement carried out in a tertiary care centre over a period of 3 years. *Methods and Material:* A total 150 patients having thyroid enlargement were thoroughly studied and subjected for FNAC. Histopathological examination, ultrasonography (USG) findings and thyroid function tests (TFT) were studied wherever available. Correlation of FNAC finding with clinical diagnosis and histopathological examination was done. *Statistical analysis:* Specificity, Sensitivity, Diagnostic accuracy, Positive predictive value and Negative predictive value of FNAC of thyroid lesions were calculated. Results: Predominant age group in the study was 21-40yrs and Male: Female ratio was 1:9. Most common cytological diagnosis was colloid goiter followed by thyroiditis. Correlation between clinical diagnosis and FNAC was high in thyroiditis. Sensitivity of test for diagnosis of malignancy=90%. Specificity of the test for diagnosis of malignancy=100%. Positive predictive value=100%. Negative predictive value=96.8%. Diagnostic accuracy=87.5%. *Conclusions:* FNAC found to be simple, minimally traumatic, accurate, cost effective office technique for diagnosis of thyroid lesions. The positive influence of FNAC on the management of thyroid lesions is perhaps best highlighted in the low rate of surgical intervention, 26.66% in this study.

Keywords: FNAC; Histopathology; TFT; Thyroid Lesions; USG.

Introduction

Fine needle aspiration cytology (FNAC) is one of the important components of cytology. Cytology is the art which is based on cell morphology whereas histology is based on morphology, intracellular patterns and intercellular matrix [1]. FNAC is the investigation of choice for diagnosis of superficial lumps. Breast, thyroid and lymph nodes are the organs most subjected to FNAC [2]. FNAC is considered as single, most accurate and cost effective procedure for diagnosis of thyroid lesions [3]. It is rapid, minimally traumatic, easily repeated and cost effective office procedure and requires little additional resources to any standard histopathology laboratory. FNAC is used as first line diagnostic test for diagnosis of goiter [4]. It provides accurate diagnosis of the solitary thyroid nodule than any other clinical or laboratory tests [5]. The main purpose of FNAC is to reduce surgeries for benign thyroid lesions by their accurate diagnosis. According to one study the proportion of malignancies in surgically resected nodules may increase to 40% compared with 8-20% before the use of FNAC [6].

Ultrasonography (USG) is not the first line of investigation in thyroid lesions but it is important in follow up of benign nodule [7]. Antibodies are positive in 60-80% cases of thyroiditis in some series [8]. On the other hand 10-15% patients with positive antibody may not have thyroiditis. So Thyroid Function Tests (TFT) and thyroid antibody tests are useful in assessing the thyroid status only when the clinical picture is equivocal.

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Subjects and Methods

Study Design

It is a hospital based prospective study of clinical, cytological, radiological and histopathological (wherever available) correlation of thyroid swellings carried out in a tertiary care centre.

Inclusion Criteria

Patients with thyroid enlargement coming to cytology department, also FNAC thyroid smears coming to the cytology department for evaluation were included in the study.

Aim of Study

1. To study correlation ship between cytological findings of thyroid lesions with clinical history and histopathological examination (Wherever available).
2. Confirmation of clinically obvious thyroid malignancy.
3. To distinguish those patients who require operative intervention from others who need medical treatment, so as to save unnecessary surgeries in our hospital

Period of Study: Three years.

Study Subject

A total 150 patients with midline neck swelling were included in the study. A detailed clinical history and through clinical examination was done before subjecting the patients for FNAC.

Ethical Consideration

Informed consent was taken before enrolling the patients in the study.

Procedure of FNAC

The patient was put into supine position with neck extended by giving shoulder pad. Disposable 5cc syringe and 23 gauze needle was used. The patient was asked not to swallow during the procedure. The neck was cleaned using spirit. The swelling was fixed using left hand of the operator and using all aseptic precautions the needle with syringe was introduced in the swelling creating negative pressure in the syringe. The needle was moved back and forth in different directions in the nodule. The smears were made from aspirated material.

Staining: The smears were stained with Leishman's and Papanicolaou stain.

Histopathological Examination

We received thyroidectomy specimen in 10% formalin. Staining of the slides was done by haematoxylin and eosin stain. Whenever required, Congo red staining for amyloid was done.

Reporting FNAC of Thyroid Nodules

A standard reporting format as suggested by the Papanicolaou Society of Cytology is recommended in order to communicate results clearly to the clinician and to facilitate the calculations and comparison of diagnostic accuracy between laboratories [9].

Observations

Predominant site of involvement in our study was right lobe (61%). Thyroid function tests (TFT) were done in 60 cases. Out of them 78% patients were euthyroid. Ultrasonography (USG) was done in 54 cases. Positive correlation of USG with FNAC was seen in 73.8% cases.

Table1 Shows the incidence of age and sex in thyroid swellings. It is seen that M: F ratio in this study was 1:9 and commonest age group affected was 21-40 yrs.

Table 2 Shows clinical diagnosis in present study. It was made after thorough clinical examination including general, systemic and mainly local examination. Before making the clinical diagnosis reports of TFTs and USG were taken into consideration wherever available. The most common clinical diagnosis was colloid goiter followed by multinodular goiter.

Table 3 Shows FNAC (Cytology) diagnosis. Most common FNAC diagnosis was colloid goiter, followed by thyroiditis. FNAC diagnosis was offered after thorough evaluation of all the smears prepared. In case of cystic swelling the fluid aspirated was centrifuged and smears were prepared from deposits.

Table 4 Shows the correlation between clinical diagnosis and FNAC diagnosis. It is high in the diagnosis of thyroiditis (80%) and goiter (78.6%). The correlation is least in the diagnosis of malignancy (33%).

Table 5 Shows correlation between cytology and histology. The absolute correlation (diagnostic accuracy) was seen in 35 cases (87.5%).

Sensitivity of test for diagnosis of malignancy=90%

Specificity of the test for diagnosis of malignancy=100%

Positive predictive value=100%

Negative predictive value=96.8%

Diagnostic accuracy=87.5%

While calculating the results the cases having cytology diagnosis of follicular neoplasm and histology turned out as follicular carcinoma were taken as true positive. Two cases which were unsatisfactory on cytology and not available for histopathology examination were not considered for the calculation of the results.

Experience with the technique: About 75% aspirations were done by pathologist in the cytology section of the institute. Our observations were, Aspirations of colloid goiter were adequately

Table 1: Incidence of age and sex in thyroid swellings

Age (yrs)	Male (%)	Female (%)	Total (%)
1-10	1%	1%	2%
11-20	0%	8%	8%
21-30	3%	24%	27%
31-40	1%	21%	22%
41-50	3%	16%	19%
51-60	1%	13%	14%
61-70	1%	7%	8%
Total	10%	90%	100%

Table 2: Clinical Diagnosis

Clinical Diagnosis	No of Cases	%
Colloid Goiter	56	37.3
Multinodular goiter (MNG)	30	20
Thyroiditis	20	13.3
Solitary nodule	29	19.3
Grave's Disease	3	2
Malignancy	12	8
Total	150	100

Table 3: FNAC (Cytology) Diagnosis:

Cytological Diagnosis	No. of Cases	%
Colloid goiter(C.G.)	91	60.6%
Adenomatoid goiter	4	2.6%
Hyperplastic goiter	3	2%
Thyroid cyst	9	6%
Grave's disease	2	1.3%
Thyroiditis	18	12%
Granulomatous lesion	1	0.6%
Follicular and Hurthle cell neoplasm(FCN &HCN)	13	8.6%
Malignancy	6	4%
Unsatisfactory	3	2%
Total	150	100%

Table 4: Correlation between clinical and cytology diagnosis

Clinical Diagnosis	Cytology(FNAC) diagnosis								
	C.G.	Adenomatoid Goiter	Hyper Plastic goiter	Thyro iditis	FCN & HCN	Cyst	Grave's disease	Malign ancy	Unsatis factory
C.G.(56)	44	3	-	2	1	5	-	1	-
MNG(30)	26	-	2	-	-	1	-	1	-
Thyroi ditis(20)	-	1	1	16	2	-	-	-	-
Solitary Nodule(29)	17	-	-	-	10	1	-	-	1
Grave's(3)	-	-	-	-	-	-	2	1	-
Malignancy	4	-	-	1	-	2	-	3	2
Total(150)	91	4	3	19	13	9	2	6	3

Table 5: Correlation between cytology and Histology diagnosis

Cytology diagnosis	Histology Diagnosis					
	Goiter	Thyroiditis	FCN	HCN (HCA)	Papillary carcinoma	Medullary carcinoma
Colloid G.(22)	21	-	1(FN of UMP)	-	-	-
Hyperplastic G.(1)	-	1	-	-	-	-
Cystic lesion(2)	-	-	1(FA)	-	1	-
Thyroiditis(2)	-	2	-	-	-	-
FCN(5)	-	-	5(3ca, 2FA)	-	-	-
HCN(1)	-	-	-	1	-	-
Papillary ca(4)	-	-	-	-	4	-
Medullary ca(2)	-	-	-	-	-	2
Inadequate(1)	1	-	-	-	-	-
Total(40)	22	3	7	1	5	2

FNUMP: Follicular neoplasm of uncertain malignant potential, FA- Follicular adenoma, Ca- Carcinoma.

Table 5: Comparison of our findings with other studies

Findings	Our study	Handa etal [14]	Guhamallick etal [15]
Sample size	150	434	288
M:F ratio	1:9	1:6.35	1:2.3
Common age group	21-40	23-53	41-60
Sample adequacy	98%	95%	86%
TFT done	40%	28%	-
Euthyroid	78%	67%	-
Hyperthyroid	12%	20%	-
Hypothyroid	10%	13%	-
Presenting symptoms			
Swelling	100%	100%	-
Swelling for ≥1 year	49%	62%	-
Swelling for 3 months- 1 year	41%	30%	-
Swelling for ≤3months	10%	8%	-
Pain	10%	2%	-
Dysphagia	29%	1%	-
Hoarseness	27%	2%	-
FNAC diagnosis			
Non neoplastic	85.3%	93%	79%
Indeterminate	8.6%	3%	11%
Malignant	4%	4%	10%
Unsatisfactory	2%	5%	14%
Histopathology done	27%	26%	15%

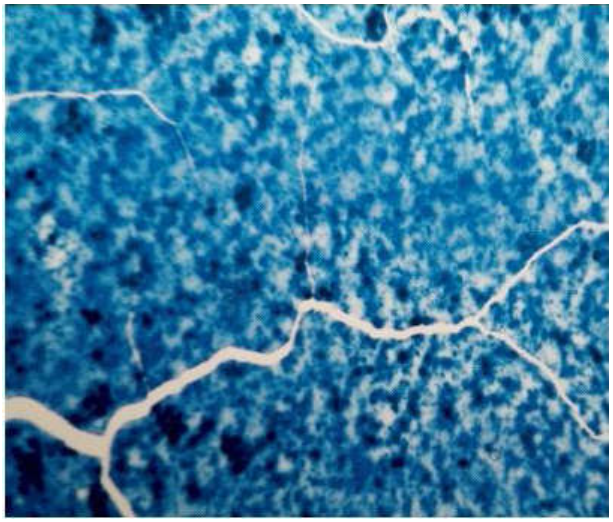

Fig. 1: FNA photomicrograph showing thick colloid showing crackling effect in colloid goiter (LeishmanX40)

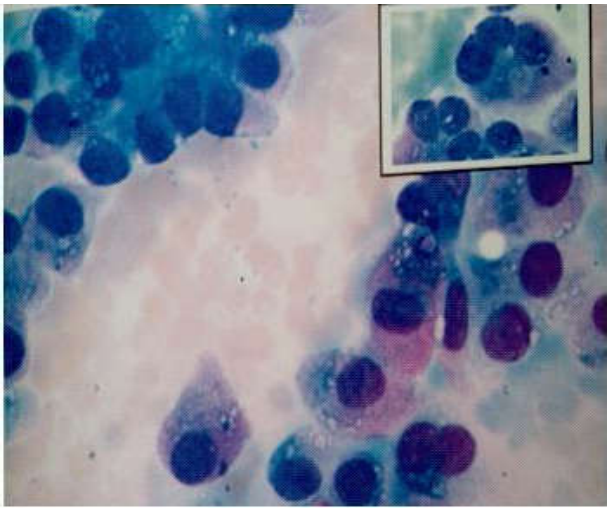

Fig. 2: FNA photomicrograph of medullary carcinoma (LeishmanX400)

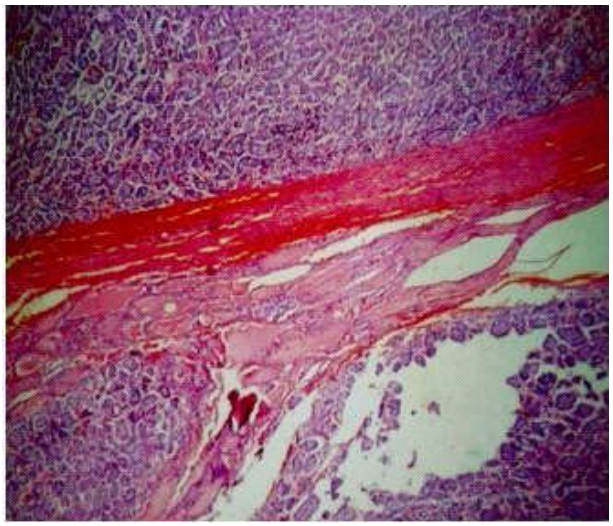

Fig. 3: HPE photomicrograph of follicular carcinoma showing capsular invasion (H&E X100)

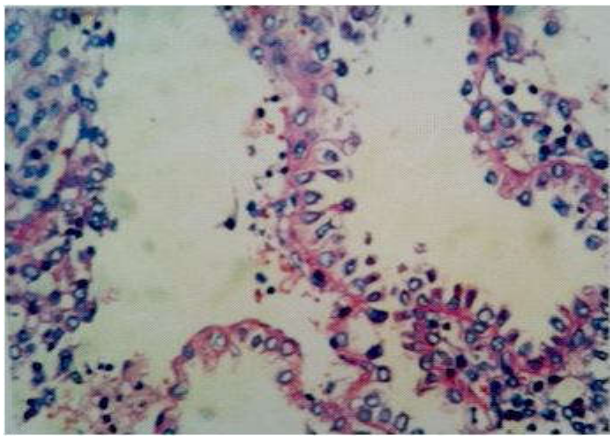

Fig. 4: HPE photomicrograph of papillary carcinoma (H&E X 100)

diagnostic and yielded abundant material; even on gross examination the colloid nature of the aspirate could be identified. Aspirations from thyroiditis were always hemorrhagic. Aspirations from tumours yielded scanty material and often required multiple passes. Cell yield and patient acceptance is more if the procedure is performed by an experienced person.

Discussion

In our study right lobe was involved one and half times that of left lobe and the male to female ratio was 1:9. Similar findings were reported by Psarras [10]. and Messarris [11] et al. Out of 10 malignant cases 4 were males. So the incidence of malignancy in females is 4.5 while that for males is 26.6. The most common age group in our study was 21-40 yrs (49%); similar findings were seen by Bamanikar et al 12] and Gupta et al [13].

Our findings for sample adequacy, major presenting symptom, FNAC diagnoses are correlating with other studies [14,15]. Our findings of M/F ratio, commonest age group affected, duration of swelling, TFT, percentage of surgical samples received are correlating with the study done by Handa etal [14].

Cytohistopathology Concordance: Histopathology was done in 40 cases.

Colloid Goiter: It was the most common histopathology diagnosis. FNAC diagnosed 22 cases as colloid goiter. Out of them 21 cases proved on histology as colloid goiter. One case was discordant. So cytohistology concordance rate in colloid goiter was 95.45%. The concordance rate by Handa etal was 90% [14]. Various studies have shown the concordance between cytology and histology to vary between 80-100% [16,17]. Out of 22 cases, 10 cases had swelling $\geq$ 7cm, 10 cases had size 5-7cm and rest 2 cases had size 4cm in longest diameter respectively. So here surgical resection was done predominantly in swellings which were large in size.

Thyroiditis: 19 cases were diagnosed as thyroiditis on FNAC. Only two cases were subjected for histology and both turned out as thyroiditis on histology. FNAC diagnosis of thyroiditis in these cases led the patient to take medical line of treatment and unnecessary surgeries and hospitalisation was avoided.

Follicular Neoplasm: In our study 12 cases were diagnosed as follicular neoplasm and one case as hurthle cell neoplasm on FNAC. Histopathology was available in 6 cases. It confirmed cytology showing 100% concordance. 2 cases were diagnosed as follicular adenoma, 3 cases as follicular carcinoma and 1 case as Hurthle cell adenoma.

Malignancy: FNAC diagnosed four cases as papillary carcinoma and two cases as medullary carcinoma. Histopathology showed similar diagnosis giving 100% concordance.

Cystic Lesion: 2 cases were diagnosed as cystic lesion on FNAC. On Histopathological examination one was labelled as Follicular adenoma and one as Papillary carcinoma.

One case was diagnosed as hyperplastic goiter on FNAC and was labelled as thyroiditis on histolpathological examination. One case was labelled as inadequate on FNAC and was diagnosed as goiter on histopathogical examination.

Evaluation of Discordant Cases: 5 cases showed cytohistopathological discordance in our study.

1. One case was diagnosed as colloid goiter on FNAC

and was diagnosed as follicular neoplasm of uncertain malignant potential on histopathology as despite of sampling multiple sections definite capsular or vascular invasion was not seen. It was noted that up to half of the capsule showed invasion and there was no vascular invasion outside the capsule. FNAC smears showed moderate cellularity with small clumps of thyroid follicular cells arranged in poorly cohesive groups with colloid material suggesting nodular goiter. Aspiration was probably done over colloid rich macrofollicular area of the neoplasm in this case. Cytological differentiation between follicular neoplasm and nodular goiter is often merging and difficult [18].

2. One case was diagnosed as hyperplastic goiter on FNAC and histopathology diagnosis was autoimmune thyroiditis. FNAC smears showed groups of follicular epithelial cells on the hemorrhagic background and scanty to moderate colloid and occasional macrophage. As the background was hemorrhagic, less attention was given to the presence of lymphocytes (which were probably considered as bare nuclei) and occasional Hurthle cell.
3. One case was diagnosed as cystic lesion on FNAC and on histopathology was turned out as follicular adenoma. Here cytology showed scanty to moderately cellular smears with degenerative changes, macrophages and scanty colloid. This can be explained on the basis of the sampling of areas with cystic change rather than cellular areas. The possible remedy is multiple aspirations from different parts of the swelling that could demonstrate hypercellular areas which would be diagnostic of the lesion.
4. One case was diagnosed as cystic lesion on FNAC and histopathology diagnosis was papillary carcinoma. The cytology showed follicular epithelial cells in clusters on the background of scanty colloid and abundant hemosiderin laden macrophages. . Very large number of macrophages, particularly if they have a tendency to form cohesive clusters, should raise a suspicion of papillary carcinoma. Cystic change is common and sometimes a major part of tumor may be cystic [19]. Possible remedy is reaspiration of swelling after complete aspiration of cyst fluid. We would have not missed the diagnosis probably if we had reaspirated the swelling after aspiration of cyst fluid.
5. One case was given as inadequate on FNAC. On Histopathology it turned out to be colloid goiter. Here the FNAC smears came from ENT department and we requested for repeat FNAC. But we received surgical specimen as the swelling was causing pressure symptoms in the patient. Aspirations from experienced person may reduce the chances of inadequate samples.

In our study FNAC represented an improvement in the clinical diagnosis of malignancy and solitary thyroid nodule, and little improvement in the clinical diagnosis of goiter and thyroiditis, where it supported the clinical diagnosis so unnecessary surgeries were avoided. According to literature the sensitivity of FNAC ranges from 80-98% and specificity from 58-100% [20].

In our study the sensitivity was 90% and specificity was 100%. These results are comparable with Hathila et al [21].

The inadequacy rate was 2%. Previous studies have shown the percentage of inadequate material to vary between 0-25% [22]. In our study positive predictive value was 100%, negative predictive value was 96.8% and diagnostic accuracy was 87.5%. For optimal accuracy of diagnosis on FNAC, strong clinical suspicion should be considered. Accuracy also depends upon the experience of the cytopathologist and improves with experience.

Conclusion

FNAC Thyroid provides the most accurate, rapid and cost effective preoperative diagnosis than any other diagnostic modalities. It showed good cytohistopathogical concordance in our study. Sensitivity and specificity for diagnosis of malignancy being 90% and 100% respectively and diagnostic accuracy being 87.5%. Cytological findings can support long term medical management in clinically nonsuspicious benign lesions as colloid goiter and thyroiditis. The positive influence of FNAC on the management of thyroid lesions is perhaps best highlighted in the low rate of surgical intervention, 26.66% in this study thus reducing the burden on surgical department.

Key Messages

FNAC of thyroid lesions found to be very important diagnostic modality in diagnosis of colloid goiter and thyroiditis as it showed little improvement in diagnosis after histopathological examination. Cystic lesions should be reported cautiously and respirations from residual mass should be done as FNAC found to be less helpful in the diagnosis of cystic thyroid lesions.

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