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Original Research Article

Diagnostic Accuracy of Fine Needle Aspiration Cytology (FNAC) of the Thyroid Gland Lesions

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ABSTRACT

Objective: Fine needle aspiration cytology is a diagnostic tool used in the clinical management of different thyroid lesions, to distinguish benign and malignant lesions and plan accordingly into operative and non-operative lesions, as they have higher incidence of malignancy. **Methods:** Prospective study to find the utility of fine needle aspiration cytology (FNAC) in thyroid lesions, conducted at a tertiary level Medical College and Hospital from June 2006 to May 2008. Fine needle aspiration specimens from 94 patients with solitary thyroid nodule were analyzed. In 74 patients histopathological study was made and cyto-histopathological correlation was done. **Results:** Out of 94 cases, female sex was found predominant (72.34 %) and mean age of the patients was 45.67 yrs. Sensitivity, specificity, Positive predictive value, Negative predictive value and accuracy of the study for malignancy were 89%, 86% , 87%, 88%and 87% respectively. **Conclusion:** FNAC may take part in the diagnosis and management planning of thyroid nodules significantly due to its high accuracy, sensitivity and specificity.

Key words: Cyto-histopathological correlation, fine needle aspiration cytology FNAC, Solitary thyroid nodule

INTRODUCTION

Occurrence of thyroid illness is common in India and thyroid disorders are in a conversion phase from an iodine deficient population to now iodine sufficient inhabitants of India .The prevalence of goiter is more than 40 million in India with more than 2 billion globally.[(1)] The estimation of incidence and true prevalence of Thyroid disorders is intricate in India, even some studies estimates the geo-graphical prevalence of Iodine Deficiency Disease about 42 million cases.[(2)] Well-designed studies of the goitrous problem showed overall prevalence of 5.4% hypothyroidism, 1.9% hyperthyroidism. 7.5% prevalence of autoimmune thyroiditis was confirmable by fine needle aspiration biopsy among female goitrous students. In the vision of this nationwide study and other related studies, it can now be anticipated that the total load of noteworthy thyroid disease

in the country in the post salt-iodization period is about 42 million. [2]

A localized thyroid enlargement with rest of the thyroid appears normal is clinically defined as solitary nodule of thyroid. The foremost concern in the management of solitary thyroid nodule (STN) is the correct diagnosis and extent of thyroidectomy. [3,4] Thyroid nodularity being so common, it would be impracticable to operate on every patient with a thyroid mass, in United States more or less 275,000 thyroid nodules are identified per year, among them only about 1400 are detected as thyroid cancers.[5] As occurrence of malignancy is relatively low weigh against on the whole incidence of thyroid nodularity. So, the object of diagnostic hone now is to operate those patients who have high probability of comprising malignancy in the nodule.

Procedures like ultrasound and radio-isotope scan are commonly used, but the limited information is provided to the actual condition of the nodule. The greater part of cold nodules represents approximately 90% of nodules, have a 5% risk of being malignant. [6]

Martin and Ellis described about the Fine needle aspiration cytology (FANC) first in 1930.[7,8] Now, FNAC has become a decisive step in the assessment of neck lesions.[9] Earlier, prescribed open surgical biopsy will give a clear histopathological diagnosis but may directed an complex way, by which best management may be affected [10]and increase risk of spread of malignancy in superficial tissues of neck due to break the barrier. Then comes the role of FNAC, the easiness of which joined with the rapidity of obtaining a pathological diagnosis allows more intelligent therapeutic approach.[11] Hence the role of a cost effective diagnostic modality like FNAC becomes important in such cases Thyroid aspiration is useful:

a) To distinguish patients with thyroid malignancy (sensitivity)
b) To rule out patients without malignancy (specificity)
c) To predict the presence or absence of cancer (positive and negative predictive value) and
d) To correctly classify patients as those who should have their nodules excised and those for whom excision is unnecessary (efficiency).

Their limitations consist of false negative, false positive, indeterminate or suspicious results. [12] The false negative is defined as the patients in which FNAC shows benign pathology but histopathology identifies malignancy, while false positive points out malignancy in FNAC but histopathology demonstrates benign lesion. [13]

This study was carried out to assess the diagnostic reliability of FNAC in thyroid disease in distinguishing benign and malignant pathologies.

MATERIAL AND METHODS

This study was conducted at Pathology Department of a tertiary level Medical College and Hospital during a period of two years. Appropriate permission had been taken from Institutional ethics committee. Patients who gave informed consent and referred to Pathology laboratory with a clinical diagnosis of Solitary Thyroid Nodule were included in this study. Uncooperative patients and patients having diffuse and multi-nodular thyroid enlargement were excluded. All the referred patients, who had undergone routine investigations, were clinically evaluated in detail and a cautious palpation of the thyroid nodule was done to judge in particular the location for aspiration. FNAC was done on the nodule using a 23 gauge needle attached to a 5 ml syringe under aseptic precautions. Then several smears were prepared and

promptly fixed in a fixative containing equal amounts of ether and 95% ethyl alcohol. These were stained by Hematoxylin and Eosin (H&E) stain and Papanicolaou's stain. Air dried smears were also prepared and stained with Giemsa stain. Whenever fluid was found, all the contents were made to empty by gentle pressure in the thyroid gland. The fluid was centrifuged for Microscopic examination and smears were made from the sediment and. If residual mass felt, Re-aspiration was done.

Surgical elimination of the lesion was done at the judgment of the surgeons. At every time the biopsy specimen was come in the pathology department, paraffin sections were made and stained by H&E. Histo-pathological examination was done. A Cyto-histopathological correlation of results of cytological and histo-pathological studies was done to estimate the efficacy of FNAC.

RESULTS

There were 94 patients who presented with Thyroid lesions on whom FNAC was performed. Patients in the fourth decade of life constituted the major group (29.62%) with females out numbering the males in a ratio of 1.8:1 (Female= 61, Male=33). The duration of the lesions varied from 6 months to eight years.

Table- 1 Co-relation between FNAC and histological diagnosis of thyroid gland lesions

Sr.No.	FNAC Diagnosis	No. of Cases (94)	Percentage	No. of cases with surgical biopsy (76)	Consistent (65)	Nonconsistent (9)	Histopathological finding
1. a.	**Non-neoplastic** Colloid goiter/ adenomatous goiter	39	41.48	35	31	4	31 Colloid goiter 4 follicular adenoma
b.	Colloid cyst	2	2.12	--	--	--	--
c.	Thyroditis– Lymphocytic thyroiditis	4	4.25	--	--	--	--
d.	Abscess	5	5.31	--	--	--	--
2.	Follicular neoplasm	33	35.10	30	25	5	Follicular adenoma-23 Follicular carcinoma-2 Follicular variant of Papillary carcinoma 1 Multinoduliar goiter -4
3.	Suspicious of malignancy Papillary carcinoma	2	2.12	2	2	-	Papillary Carcinoma 2
4.	Diagnosis of malignancy Papillary carcinoma	7	7.44	7	7	-	Papillary Carcinoma 7
5.	Unsatisfactory / Non diagnosis	2	2.12	-	-	-	-
	Total	**94**	**100**	**76**	**65**	**9**	

Cytological diagnoses of the thyroid glands were grouped in five groups. Maximum cases were diagnosed as colloid goiter/ adenomatous goiter 39 cases (41.48%) followed by follicular

neoplasm 33 cases (35.10 %), 7 cases were papillary carcinoma, 5 cases were Abscess, 4 cases were Lymphocytic thyroiditis, 2 cases were cytological suspicious for papillary carcinoma and 2 cases were diagnosis of Colloid cyst , 2 case of FNAC were unsatisfactory. Cytological diagnosis and histological diagnosis of thyroid gland lesions were correlated in 76 cases (80.85%). Results are found to be consistent in 65 cases (87.83%) and inconsistent in 9 cases (12.16%).

Figure 1. Soltory Thyroid Nodule (Goiter) and FNAC showing Colloid goiter with thick Colloid

Table- 2. Diagnostic accuracy of FNAC in palpable lesions of thyroid glands

FNAC Diagnosis	Total No. of FNAC cases	No. of cases with surgical biopsy	Correct cytological diagnosis	False Positive	False Negative
Malignant	44	39	34 (True positive)	05	-
Benign	49	35	31 (True negative)	-	04
Inconclusive	02	-	-	-	-
Total	95	74			

There are 5 false positive cases (which were cytologically diagnosed as malignant and on histopathology found to be benign) and 4 false negative cases (which were cytologically diagnosed as benign and on histopathology found to be malignant).

Table 3. Showing the statistical values for thyroid malignant lesions

Statical Parameter	Formula	Value in %
Sensitivity	TP/ (TP+FN). x100	89.47
Specificity	TN / (TN+FP). x100	86.11
Positive predictive value	TP/ (TP+FP). x100	87.18
Negative predictive value	TN/ (TN+FN).x100	88.57
Diagnostic accuracy of FNAC	$\frac{TP+TN}{TP+TN+FP+FN}$ x100	87.83

This table shows that FNAC in palpable lesion of Thyroid glands has a high sensitivity and specificity rate. Above table shows that FNAC in palpable lesions of head and neck region has a high predictive value for both positive and negative results and high diagnostic accuracy.

DISCUSSION

Prior awareness of nature of disease alters the treatment choice significantly. In thyroid, benign nodules require partial thyroidectomy or lobectomy, where as malignant disease required widespread surgery, i.e., total thyroidectomy, neck dissection followed by radio iodine ablation and thyroxine supplement for throughout life. In thyroid disease, this advantage of early acquaintance of lesion is established by FNAC which is a well recognize

technique for pre-operative assessment of thyroid nodules. [14] FNAC is safe, simple, and cost effective procedure that can be performed on out patients with wide patient acceptance. It provides a more rapid and accurate diagnosis of the thyroid nodule than any other combination of clinical or laboratory tests. [4]

In present study total 94 cases were aspirated from thyroid gland cytological diagnosis was classified in five groups, based on standard criteria reported in the literature Mc Nicol et al (2004). [15]

Maximum case 39 cases (41.48%) were cytologically diagnosed as colloid goiter and 35 cases were correlated with histological diagnosis. (Table No. 1). Histological findings was found to be consistent in 31 cases. Four cytologically diagnosed case of adenomatous goiter were turned out to be follicular adenoma in histology. The cytological appearances in colloid goiter form a continuum which merge with those of follicular adenoma, and in this grey area, cytological criteria alone cannot reliably distinguish between the two (Orell et al 2005). [16] If a micro follicular focus in a nodular goiter is selectively sampled, the smear shows a repetitive pattern of micro-follicles or rosettes with no colloid and the distinction from follicular neoplasm may be impossible.

Mehdi et al (2003) [17] studied FNAC of 100 cases of thyroid swelling and surgical biopsy available in 34 cases. They also observed in their study that histological examination results were consistent with cytological findings except in two cases, where one case of colloid cyst and another of colloid goiter turned out to be follicular adenoma

In present study, one cytologically diagnosed case of follicular neoplasm turned out to be follicular carcinoma on histopathology and 23 follicular neoplasm were benign follicular adenoma.

The cytological findings in follicular adenoma and follicular carcinoma are similar. Lowhagen advocated that a cytological report should only state that a follicular neoplasm is present with no implication of its benign or malignant nature (Lowhagen et al 1974). [18] Friedman et al (1979) advised histological examination in such cases. [19]

Bajaj et al (2006) studied 160 cases of thyroid FNAC and in subsequent histo-pathological exami-nation 74.3% results found to be consistent with cytological findings and 20% results were not consistent and 9 cases (5.6%) were inadequate. [20] Results of present study were similar with finding of Bajaj et al. In present study 88% results are found to be consistent in thyroid FNAC and 9.21% were not consistent and 2.12% were inadequate.

One cytologically diagnosed case of follicular neoplasm was turned out to be follicular variant of papillary carcinoma (False Negative) and four cases turned out Multinoduliar goiter in histology. The follicular variant of papillary carcinoma may have well-formed follicles containing colloid, and cystic papillary tumors often contain abundant colloid. This can cause diagnostic difficulties if smears are poor in cells. Gagneten (1987) stressed the importance of doing multiple aspirations in a thyroid swelling in order to obtain representative material from different area. [21]

In this study seven cases of papillary carcinoma were diagnosed cytologically and very well confirmed histologically. Jogai et al (2005) studied 192 cases of FNAC from thyroid swelling. They reported 39 cases (20.3%) as positive for malignancy out of which 38 cases were found to be consistent (24 classic papillary thyroid carcinoma, 12 case follicular variant of papillary carcinoma, 1 case of follicular carcinoma, 1 case of medullary carcinoma).Two cases

were cyto-logically diagnosed as follicular variant of papillary carcinoma which was turned out to be papillary carcinoma on histology. [22]

Kumar et al (1999) analyzed cytological findings in 15 cases of follicular variant of papillary thyroid carcinoma (histologically proven). [23] They considered that Adenomatous colloid goiter and follicular adenoma are differential diagnosis of follicular variant of papillary carcinoma due to presence of microfollicles but the presence of numerous colloid balls with multilayered microfollicles (rosettes) are cytological finding of follicular variant of papillary thyroid carcinoma.

Nggada et al revealed an accuracy of 94.2%, sensitivity of 88.9% and specificity of 96.1% and suggested that FNAC is more specific than sensitive in detecting thyroid malignancy. [13] The present study showed an accuracy of 87%, sensitivity of 89%, specificity of 86%, Positive predictive value of 87% and Negative predictive value of 88%, and in contrast to Naggda study our study suggested that FNAC is more sensitive than specific in detecting thyroid malignancy.

CONCLUSION

In the present study, the specificity of FNAC of thyroid tumors was established to be more appropriate to allow surgical intervention after a cyto-diagnosis of malignancy. FNAC can also be used for monitoring therapy. Ultrasound guided biopsy is recommended in case of small lesions to avoid giving false negatives. Also application of various techniques like advanced imaging techniques, immune-cytochemistry, immunologic analysis, analysis of hormone receptors and electron microscopic study can result in further reduction in misdiagnosis and can considerably expand the diagnostic range and increase the diagnostic accuracy. FNAC has a distinguished role in the diagnosis and management of thyroid lesions due to its high accuracy, sensitivity and specificity. It is cost-effective and free of complication in expert hands.

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