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Diagnostic accuracy of fine needle aspiration cytology for thyroid lesions in correlation to histopathology

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ABSTRACT

Background: Thyroid enlargement is a common problem and causes various pressure symptoms. Majority of swellings does not require surgery. Fine needle aspiration cytology (FNAC) is considered the gold standard diagnostic test in the evaluation of thyroid swellings. In the present study we correlated the FNAC findings with histopathology so that rate of unnecessary thyroidectomise in benign pathologies could be avoided.

Materials and Methods: The present study is a retrospective and prospective analysis of 298 cases of thyroid swellings which were done over a period of 12 years from August 2001 to July 2012. These cases were underwent FNAC followed by surgery. Correlation of histopathological findings was performed with FNAC. Sensitivity, specificity, accuracy, positive predictive value, and negative predictive value were calculated for neoplastic and malignant lesions.

Results: Statistical analysis of neoplastic lesions showed sensitivity, specificity, accuracy, false positive rate, false negative rate, positive predictive values, negative predictive value of FNAC 88.6%, 96%, 92.9%, 4%, 11.4%, 94% and 92.3%, respectively whereas statistical analysis of carcinomatous lesions showed sensitivity, specificity, accuracy, false positive rate, false negative rate, positive predictive values, negative predictive value of FNAC 85.4%, 97.3%, 95.7%, 2.7%, 14.6%, 83.3% and 97.8%.

Conclusion: FNAC of thyroid nodules provides the most accurate pre-operative diagnosis than any other diagnostic modality. FNAC is a valuable and minimally invasive procedure and hence considered as a gold standard for pre-operative assessment of patients with thyroid nodules.

Key words: Fine needle aspiration cytology, histopathology, thyroid lesions

INTRODUCTION

Thyroid enlargement is a common problem especially in young population, causing pressure symptoms and obvious cosmetic deformity particularly in females. The prevalence of palpable thyroid nodules ranges from 4% to 10% in the general adult population and from 0.2 to 1.2% in children.[1] The majority of clinically diagnosedthyroid nodules arenon-neoplastic; only 5–30% are malignantand require surgical intervention.[2]

A battery of investigations available for identification and management of thyroid nodules, which includes thyroid function test, ultrasonography and fine needle aspiration cytology (FNAC), nuclear scan and estimation of tumour markers. FNAC is considered the gold standard diagnostic test inthe evaluation of a thyroid nodule, other tests used in conjunction with FNAC.

FNAC of thyroid is a rapid, simple, safer, painless, cost effective and minimally invasive screening procedure. FNAC has allowed a dramatic decrease in unnecessarysurgeries without thyroid nodular disease, enhancing the percentage of malignant operated nodules over 50%. It is relied upon to distinguish benign from neoplastic or malignant thyroid nodules, thus, influencing therapeutic decisions.[3]

The present study was undertaken to correlate the FNAC findings with histopathology so that rate of unnecessary thyroidectomise in benign pathologies could be avoided.

MATERIALS AND METHODS

The present study was carried out in the department of pathology, Sri Venkateshwara Medical College, Tirupathi, Andhra Pradesh. A retrospective and prospective analysis of 298 cases was done over a period of 12 years from August 2001 to July 2012. These cases were underwent FNAC followed by surgery. Retrospective data was retrieved from patient case records. All cases with thyroid swelling underwent FNAC followed by surgery were included in the study and other cases who don't underwent surgery were excluded.

All patients evaluated by thorough clinical examination followed by routine investigations. Relevant clinical history was taken from

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Table 1: Correlation of FNAC and histopathological diagnosis

Age	CC (%)	CG (%)	MNG (%)	HT (%)	FA (%)	HTA (%)	PCT (%)	FCT (%)	Total (%)
11–20	-	-	11 (8)	-	4 (4.9)	-	2 (5.7)	-	17 (5.7)
21–30	-	1 (20)	29 (21)	2 (6.9)	27 (33.4)	-	7 (20)	1 (16.7)	67 (22.5)
31–40	2 (66.7)	2 (40)	43 (31.2)	12 (41.4)	30 (37)	-	9 (25.7)	-	98 (32.9)
41–50	1 (33.3)	1 (20)	34 (24.6)	10 (34.5)	13 (16)	1 (100)	12 (34.3)	2 (33.3)	74 (24.8)
51–60	-	1 (20)	14 (10.1)	5 (17.2)	6 (7.5)	-	2 (5.7)	3 (50)	31 (10.4)
>60	-	-	7 (5.1)	-	1 (1.2)	-	3 (8.6)	-	11 (3.7)
Total	3	5	138	29	81	1	35	6	298

FNAC: Fine needle aspiration cytology, CC: Colloid cyst, CG: Colloid goiter, MNG: Multi nodular goiter, HT: Hoshimato's thyroiditis, HTA: Hyperplastic thyroid adenoma, PCT: Papillary carcinoma thyroid, FCT: Follicular carcinoma thyroid, FA: Follicular adenoma

Table 2: Sex wise incidence of thyroid lesions

Lesion	Sex		Total
	Female (%)	Male (%)	
CC	2 (66.7)	1 (33.3)	3
CG	5 (100)	-	5
MNG	129 (93.5)	9 (6.5)	138
HT	29 (100)	-	29
FA	75 (92.6)	6 (7.4)	81
HTA	1 (100)	-	1
PCT	27 (77.1)	8 (22.9)	35
FCT	5 (83.3)	1 (16.7)	6
Total	273 (91.6)	25 (8.4)	298

CC: Colloid cyst, CG: Colloid goiter, MNG: Multi nodular goiter, HT: Hoshimato's thyroiditis, HTA: Hyperplastic thyroid adenoma, PCT: Papillary carcinoma thyroid, FCT: Follicular carcinoma thyroid, FA: Follicular adenoma

the patients who presented with thyroid swelling. After obtaining informed consent FNAC of swelling was performed by using 23Gauze needle, smears were fixed with 95% isopropyl alcohol and stained with Haematoxylin and Eosin. Cytological diagnosis categorized according to Bethesda system like Non neoplasm, follicular neoplasm, malignancy, unsatisfactory diagnosis and indeterminate.

After FNAC, patients were subjected to surgery. The received surgically resected specimens were fixed in 10% buffered formalin for 24 h. These specimens are described by mentioning the measurement, nodularity, cut section, number of lesions, nature and size of each lesion. Sections from the lesion, adjacent normal thyroid and isthmus were taken and processed. The sections were stained with Haematoxylin and Eosin.

Correlation of histopathological findings was performedwith FNAC. Sensitivity, specificity, accuracy, positive predictivevalue, and negative predictive value were calculated forneoplastic and malignant lesions.

RESULTS

In this study age of patients ranged from 13 to 73 years. Of these lesions 175 non neoplastic lesions 59 (33.7%) occurred in the age group of 31–40 years, 46 (26.3%) in 41–50 years and 32 (18.3%) in 21–30 years. Out of 123 neoplastic lesions 39 (31.7%) occurred in the age group of 31–40 years, 35 (28.4%) in 21–30 years and 28 (22.8%) in 41–50 years [Table 1]. Out of 298 patients 273 (91.6%) were female and 25 (8.4%) were male [Table 2].

Out of 298 cases, 182 (61.1%) lesions were diagnosed as non-neoplastic and 116 (38.9%) as neoplastic by FNA. Out of 182 lesions diagnosed as non-neoplastic on cytology, 5 (2.7%) turned out to be papillary carcinoma, one (0.5%) follicular carcinoma; all the rest (176 [96.8%] cases) were confirmed as non-neoplastic on histopathological examination (HPE). Out of 116 lesions diagnosed as neoplastic by FNA only 7 (6%) were non neoplastic and remaining 109 (94%) cases were confirmed to be neoplasms on HPE. Of the 109 neoplasms 74 (67.9%) were benign neoplasms, 30 (27.5%) were papillary carcinoma, 5 (4.6%) were follicular carcinoma on HPE. Out of 30 papillary carcinomas diagnosed by cytology 21 (20%) were confirmed by HPE; 2 (6.7%) turned out to be multinodular goitre and one (3.3%) to be hashimoto thyroiditis on HPE. Of 13 cases reported as suspicious for malignancy on cytology, 4 (30.8%) were diagnosed as follicular adenoma and 9 (69.2%) as papillary carcinoma on HPE [Table 3].

Statistical analysis of neoplastic lesions [Table 4] showed sensitivity, specificity, accuracy, false positive rate, false negative rate, positive predictive values, negative predictive value of FNAC 88.6%, 96%, 92.9%, 4%, 11.4%, 94% and 92.3%, respectively whereas statistical analysis of carcinomatous lesions [Table 5] showed sensitivity, specificity, accuracy, false positive rate, false negative rate, positive predictive values, negative predictive value of FNAC 85.4%, 97.3%, 95.7%, 2.7%, 14.6%, 83.3% and 97.8%.

DISCUSSION

In the present study FNA diagnosed 88.7% were non neoplastic, 7.3% were follicular neoplasms, 1.7% were malignancies, 0.8% were indeterminate and 1.5% were unsatisfactory. The results were in concordance with the Uma *et al.*[4] and Ko *et al.*[5] 87.8% and 83.3% were non-neoplastic and 7.1% and 8.9% were neoplasms.

Our findings are consistent with that of Gupta *et al.*[6] and Sirpal[7] where majority of the lesions occurred in fourth decade of life, but at variance with that of Sarunya *et al.*[8] which states fifth decade as the commonest age of occurrence.

In our study majority of the lesions (91.6%) were present in females with a female to male ratio of 10.9:1.This is in concordance with the findings of Gupta *et al.*[6] (11.5:1) and higher than the values observed by Sengupta *et al.*[9] (4:1) and Sarunya *et al.*[8] (5.2:1).

In the present study sensitivity was 88.6%, specificity 96%, positive predictive value 94%, negative predictive value 92.3%, diagnostic accuracy 92.9% and discordance rate 7% for detection of neoplasms on cytology. These results were comparable with other studies of Ko *et al.*,[5] Gupta *et al.*,[6] Al-Sayer *et al.*,[10] Bouvet *et al.*[11] and Kessler *et al.*[12] [Table 6].

Table 3: Correlation of FNA and histopathological diagnosis

Cytological diagnosis	Histopathological diagnosis								
	CC	CG	MNG	HT	FA	HTA	PCT	FCT	Total
CC	3	1	2	1	-	-	1	-	8
CG	-	4	13	2	-	-	2	1	22
MNG	-	-	114	23	8	-	2	-	147
HT	-	-	3	2	-	-	-	-	5
FN	-	-	4	-	68	1	-	5	78
PCT	-	-	2	1	1	-	21	-	25
Malignancy	-	-	-	-	4	-	9	-	13
Total	3	5	138	29	81	1	35	6	298

FNA: Fine needle aspiration cytology, CC: Colloid cyst, CG: Colloid goiter, MNG: Multi nodular goiter, HT: Hoshimato's thyroiditis, HTA: Hyperplastic thyroid adenoma, PCT: Papillary carcinoma thyroid, FCT: Follicular carcinoma thyroid, FA: Follicular adenoma

Table 4: Statistical analysis for neoplastic lesions

Test being evaluated (FNAC)	Reference standard test (histopathology)	
	Positive	Negative
Positive+suspicious	109 (True positives)	7 (False positives)
Negative	14 (False negatives)	168 (True negatives)

FNAC: Fine needle aspiration cytology

Table 5: Statistical analysis for malignant lesions

Test being evaluated (FNAC)	Reference standard test (histopathology)	
	Positive	Negative
Positive+suspicious	35 (True positives)	7 (False positives)
Negative	6 (False negatives)	250 (True negatives)

FNAC: Fine needle aspiration cytology

Table 6: Comparison of efficacy of FNAC in diagnosing neoplasms

Study	Sample size	Sensitivity	Specificity	Diagnostic accuracy	Negative predictive value	Positive predictive value
Ko *et al.*[5]	206	78.4	98.2	84.4	66.3	99
Gupta *et al.*[6]	75	80	86.6	84	86.6	80
Al-Sayer *et al.*[10]	70	86	93	92	96	80
Bouvet *et al.*[11]	78	93.5	75	79.6	88.2	85.3
Kessler *et al.*[12]	170	79	98.5	87	76.6	98.7
Present study	298	88.6	96	92.9	92.3	94

FNAC: Fine needle aspiration cytology

Table 7: Comparison of efficacy of FNAC in diagnosing malignant lesions

Study	Sample size	Sensitivity	Specificity	Diagnostic accuracy	Negative predictive value	Positive predictive value
Sarunya *et al.*[8]	364	74.7	93.2	88.4	91.3	79.5
Uma *et al.*[4]	66	97	100	98.5	100	96
Gupta *et al.*[6]	75	80	95	92	95	80
Chandanwale *et al.*[13]	47	90	100	87.5	90	100
Present study	298	85.4	97.3	95.6	97.7	83.3

FNAC: Fine needle aspiration cytology

The sensitivity was 85.4%, specificity 97.2%, positive predictive value 83.3%, negative predictive value 97.7%, diagnostic accuracy 95.6% and discordance rate was 4.4% for diagnosing malignancy by FNA in this study. These results were nearer and better than the studies of Gupta *et al.*[6] and Sarunya *et al.*[8] whereas lower than that of Chandanwale *et al.*[13] and Uma *et al.*[4] This could be due to their small sample size [Table 7].

CONCLUSION

FNAC of thyroid nodules provides the most accurate pre-operative diagnosis than any other diagnostic modality. The positive influence of FNAC on the management of thyroid lesions is perhaps best highlighted in the low rate of surgical intervention in this study. Surgery was avoided mainly in colloid goiter and

thyroiditis. A benign FNAC diagnosis should be viewed with caution as false negative results do occur and these patients should be followed up and any clinical suspicion of malignancy even in the presence of benign FNAC

requires surgery. However FNAC is a valuable and minimally invasive procedure and hence considered as a gold standard for pre-operative assessment of patients with thyroid nodules.

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