

# Fine- needle aspiration cytology of thyroid lesions: A four year study

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## Abstract

**Aim:** To study the spectrum of thyroid lesions and to evaluate the efficiency of fine needle aspiration cytology (FNAC).

**Materials and Methods:** Retrospective study of 221 patients who underwent FNAC of thyroid lesion in our hospital from January 2010 and December 2014 were studied and the results were correlated with histopathological diagnosis.

**Results:** Majority of the cases were in the age group of 21-40 years (56.19%) with female preponderance (M:F ratio of 1:11.2). Out of total 221 aspirates, 190 (85.97%) cases were non-neoplastic, 15 (6.79%) suspicious, 6 (2.71%) neoplastic, and 10 (4.5%) cases were unsatisfactory. The statistical analysis showed an overall diagnostic accuracy of 98%, with sensitivity of 80%, specificity of 100%, positive predictive value of 100% and negative predictive value of 97.8%

**Conclusion:** FNAC has high specificity and diagnostic accuracy in the evaluation of thyroid disorders.

**Keywords:** Diagnostic accuracy, FNAC, Histopathology, Specificity, Thyroid.

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## INTRODUCTION

Fine needle aspiration cytology is a simple, minimally invasive, cost effective procedure with high sensitivity, specificity and diagnostic accuracy. The diagnosis of thyroid lesions using aspiration cytology was first reported by Martin and Ellis in 1930.<sup>1,2</sup> It can categorize the various lesions of thyroid and hence guide therapeutic protocols. Introduction of FNAC into the field of thyroid diagnostic tests has reduced thyroid surgeries considerably.<sup>3</sup> However, limitations in FNAC due to scanty sample, vascularity of thyroid swelling, variation in sampling technique and skill of the performing expert as well as the experience of pathologist interpreting the aspirate do pose a problem in definitive diagnosis.<sup>4,5</sup> This

study aims to study the spectrum of thyroid lesions and to evaluate the efficiency of FNA.

## MATERIALS AND METHODS

The records of the 221 patients who had undergone FNA in Pathology Department in a Teaching Hospital, Puducherry, during the period between January 2010 and December 2014, were retrieved and information about the age, sex, thyroid function tests, FNAC, and histopathological diagnoses whenever possible, were extracted and the corresponding original slides were reviewed. Fine Needle Aspiration Cytology was performed by the pathologist, under aseptic precaution using 23 gauge needles attached to 10 ml disposable syringe. Two to three passes were made in each case. In the case of cystic nodules, the cysts' contents were aspirated, centrifuged, and slides made from the sediment for cytological analysis. Both air dried and wet fixed smears (fixed in 95% alcohol for 30 minutes) were made from the aspirated material, stained with May Grunwald Giemsa (MGG), Papanicolaou and Hematoxylin and Eosin (H and E) stains, respectively, and examined under a light microscope. Criteria proposed for adequacy of thyroid cytology is 5-6 groups of well-preserved follicular epithelial cells with  $\geq 10$  cell per group and the smear should be technically well prepared, the aspirate should

be properly smeared to avoid clotting and smears should be read in clinical context<sup>6</sup>. The cytological results were classified as non-neoplastic, suspicious, malignant and inadequate. Smears classified as “non-neoplastic” included adenomatous (colloid) nodule, Hashimoto’s and other types of thyroiditis. The “suspicious” category included follicular neoplasm, Hurthle cell tumor, and aspirates with a typical features suggestive of, but not diagnostic for malignancy. The smears with cytologic findings of primary or secondary malignancy were classified in the “malignant” category. Smears with insufficient cellularity or poor quality due to delayed or improper fixation and aspirates consisting only cyst fluid were considered “unsatisfactory” or “inadequate for diagnosis” The results were then correlated with clinical features, thyroid function tests, and histopathological examination. Histopathological correlation was available in only fifty nine out of 221 cases who underwent FNAC.

**Statistical Analysis**

(Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of FNAC) were done to evaluate the efficiency of FNAC. Cases with suspicious and inadequate cytological diagnosis were also excluded from the statistical analysis.

**RESULTS**

A total of 221 thyroid FNAC cases were done in our institution within 4 year study duration. The age distribution of the cases were from 5 years to 71 years with majority in the age group of 21-40 years(56.19%). The youngest case was a 8 year old girl and oldest was 70 year old man with the cytological diagnosis of colloid goiter and follicular neoplasm respectively. Majority were females (91.9%) with M:F ratio of 1:11.2. Out of total 221 aspirates, 190 (85.97%) cases were non-neoplastic, 15(6.79%) suspicious, 6(2.71%) neoplastic, and 10(4.5%) cases were unsatisfactory as shown in.

**Table 1:** Cytological diagnosis of thyroid lesions

Sr. No.	FNA categorisation	FNA diagnosis	Number of cases	Total	Percentage
1	Non- neoplastic	Simple/ Nodular colloid goitre	107	190	85.97%
		Thyroiditis	81		
		Thyroglossal cyst	2		
2	Suspicious	Follicular neoplasm	14	15	6.79%
		Hurthle cell neoplasm	1		
3	Malignant	Papillary carcinoma	5	6	2.71%
		Medullary carcinoma	1		
4	Inconclusive	Unsatisfactory / Inadequate	10	10	4.52%

Histopathological confirmation of diagnosis were available in 59 cases. The details of cytological and the corresponding histopathology are shown in Table.2.

**Table 2:** Cytohistological correlation of thyroid lesions

Cytology diagnosis	Histopathological Diagnosis						
	Simple /Nodular colloid goitre	Thyroiditis	Thyroglossal cyst	Follicular adenoma	Follicular carcinoma	Papillary carcinoma	Medullary carcinoma
Simple / Nodular Colloid goiter	22	3				2	
Thyroiditis	1	17					
Thyroglossal cyst			1				
Follicular neoplasm	4			2	1		
Papillary Carcinoma						3	
Medullary carcinoma							1
Inconclusive	2						

2 cases diagnosed as inconclusive on cytology were diagnosed as nodular colloid goiter on histopathology. Thyroid FNAC results, grouped malignant (positive results) versus the rest of the diagnoses (negative results) were compared with histopathological diagnosis to calculate the statistical values of the test. Unsatisfactory / inadequate aspirates and suspicious lesion groups that gave no definite opinion were excluded from the

calculations. There were two false negative case, given as nodular colloid goiter on cytology, but were diagnosed as nodular colloid goiter with papillary microcarcinoma and papillary carcinoma respectively, on histopathology. The statistical analysis showed an overall diagnostic accuracy of 98%, with sensitivity of 80%, specificity of 100%, positive predictive value of 100% and negative predictive value of 97.8% in our study.

**DISCUSSION**

Thyroid lesions are quite common with a prevalence of 4-7% in the adult population.<sup>4</sup> FNAC is the first line of investigation and other investigations like ultrasound examination, thyroid function tests, thyroid scan and antibody levels are done subsequently with the aim to select the patients who require surgery and those who can be managed conservatively.<sup>2</sup> In our study, the commonest age group of people with thyroid lesions were in the third

and fourth decade with female preponderance. Similar findings were seen in other studies<sup>4,2,7</sup>. Most of the thyroid nodules are benign and fewer than 5% of them are malignant.<sup>3</sup> The common non neoplastic diagnosis was simple / nodular colloid goiter (56.3%), followed by thyroiditis (42.6%) and the common malignancy diagnosed was papillary carcinoma of thyroid(83.3%), which were in accordance with other studies.<sup>2,3,4,8</sup>

**Table 3:** Comparison of FNAC diagnosis with other studies

Studies	Non- neoplastic	Suspicious	Malignant	Inadequate	Total
Uma Handa <i>et al</i> (2008)	381 (87.8%)	14 (3.2%)	17(3.9%)	22 (5.06%)	434
Sunita <i>et al</i> (2014)	284 (94.6%)	9 (3.1%)	5 (1.6%)	2(0.7%)	300
Heyder Ali <i>et al</i> (2012)	1054 (64.3%)	306 (18.66%)	128 (7.8%)	151 (9.2%)	1639
Bagga PK <i>et al</i> (2010)	228 (90.5%)	17 (6.7%)	3(1.2%)	4(1.6%)	252
Our study	190 (85.9)	15(6.8%)	6(2.7%)	10 (4.5%)	221

Inadequate FNA specimen could be resulted from technical problems, aspiration of sclerotic or calcified nodules, and also nodules with large areas of cystic degeneration or necrosis.<sup>3,9</sup> There were 10 (4.5%) inadequate cases in our study which were comparable with other studies<sup>2,3,4,8</sup> in Table.3., where the inadequacy rates were between 0.7 to 9.2 %. Subsequent HP diagnosis of the 2 cases were NCG. There were 15 cases (6.8%) under suspicious category, of which 7 underwent surgery and the HP diagnosis were : 4 nodular colloid goiter with adenomatous hyperplasia, 2 follicular adenoma, 1 follicular carcinoma. Suspicious category included follicular neoplasm and Hurthle cell neoplasm. Cytological differentiation between follicular neoplasm and adenomatous goitre is not only confusing but difficult at times. As a general rule, smears from a non-neoplastic adenomatous nodule show less cells and more colloid than those from follicular neoplasm.<sup>10</sup> Both Follicular neoplasm and Hurthle cell neoplasm may be benign (adenoma) or malignant (carcinoma). The distinction can be made with confidence only on histopathology by demonstrating capsular or vascular invasion. Nuclear atypia does not help to diagnose a carcinoma as some

nuclear atypia can be seen in an atypical adenoma which is benign.<sup>7,10,11,12,13</sup> Smears in follicular neoplasm are cellular and are usually devoid of colloid. The smears show many uniform-sized follicular cell clusters and microfollicles<sup>10</sup> False negative cases are of great concern because they indicate the potential to miss a malignant lesion. Four reasons for these low sensitivities have been identified: tumours missed at aspiration, microscopic misinterpretations, diagnoses of cellular atypia and indeterminate diagnoses.<sup>5,10</sup> In our study two false negative cases were: misinterpretation of Papillary carcinoma as NCG and missed aspiration in papillary microcarcinoma. According to WHO papillary microcarcinoma is defined as tumor measuring 1 cm or less<sup>15</sup>, which can be missed during aspiration. Increasing the number of passes<sup>10,11</sup> and use of ultrasonographic guidance minimises these problems.<sup>7,10,11,12,14,16,17</sup> Besides, since only a small percentage of patients with benign diagnosis on FNAC undergo surgery, it is difficult to establish the true frequency of false negative cases.<sup>7,10,14</sup> The false positive and false negative rates were 0% and 4.08% respectively in our study.

**Table 5:** Comparison of statistical analysis with other studies

Studies	Diagnostic accuracy (%)	Sensitivity(%)	Specificity(%)	Positive predictive value(%)	Negative predictive value(%)
Uma Handa <i>et al</i> (2008)	98.48	97	100	96	100
Sunita <i>et al</i> (2014)	94.2	50	100	100	93.8
Bagga PK <i>et al</i> (2010)	96.2	66	100	100	96
Nurismah MI <i>et al</i> (2007)	96.2	87.7	98.4	93.4	96.8
NR <i>et al</i> (2012)	94	91.66	97.29	91.66	97.29
Huzaifa N Tak 2014	97.8	72	93.5	78.3	91.1
Our study	98	80	100	100	97.8

The sensitivity and specificity in various studies<sup>2,4,7,8,10,18</sup> varied from 50-97% and 93.5-100% respectively. The main reason for such a wide range of sensitivity and specificity is how pathologists handle the category of “suspicious” and how they define the false-positive and false-negative results. Some authors include follicular lesion in the malignant/neoplastic category. Others categorize them in the negative group, whereas some exclude them from the calculations<sup>3,19,20,21,22,23</sup>. The sensitivity of 80% and specificity of 100% found in our study correlated with those of these studies.<sup>2,4,7,8,10,18</sup> The diagnostic accuracy of FNA in our study was 98%, which was comparable with other studies.<sup>2,4,7,8,10,18</sup> thus proving FNA to be a valuable diagnostic tool for distinguishing benign from malignant lesions. Limitation of FNA thyroid can be reduced by: strict adherence to the adequacy criteria, increasing the number of passes made and use of ultrasound guidance to detect suspicious nodules.

## CONCLUSION

FNA of thyroid is a simple, cost-effective, minimally invasive procedure which in addition to clinical, biochemical and radiological investigations aids in the management of patient with thyroid lesions.

## REFERENCES

1. Martin HE, Ellis EB. Biopsy by needle puncture and aspiration. *Ann Surg* 1930;92:169-81.
2. Uma Handa, Sukant Garg, Harsh Mohan, Nitin Nagarkar. Role of fine needle aspiration cytology in diagnosis and management of thyroid lesions: A study on 434 patients. *Journal of Cytology*, 2008; 25 (1): 13-17.
3. Heydar Ali Esmaili, Hassan Taghipour. Fine-Needle Aspiration in the Diagnosis of Thyroid Diseases: An Appraisal in Our Institution. *ISRN Pathology*, 2012; doi:10.5402/2012/912728.
4. Bamanikar S, Soraisham P, Jadhav S, Kumar H, Jadhav P, Bamanikar A. Cyto-histology and clinical correlation of thyroid gland lesions: A 3 year study in a tertiary hospital. *Clin Cancer Investig J* 2014;3:208-12
5. Pandey P, Dixit A, Mahajan NC. Fine-needle aspiration of the thyroid: A cyto-histologic correlation with critical evaluation of discordant cases. *Thyroid Res Pract* 2012;9:32-9.
6. S.P. Gulia, M. Chaudhury, E. Sitaramam, K.P. Reddy: Diagnostic Accuracy Of Fine Needle Aspiration Cytology In The Diagnosis Of Thyroid Lesions. *The Internet Journal of Pathology*. 2011 Volume 13 Number 1. DOI: 10.5580/11d5
7. N R, B V, T G. Comparative Study Of FNAC And Histopathology In The Diagnosis Of Thyroid Swelling. *The Internet Journal of Head and Neck Surgery*. 2012 Volume 5 Number 2.

8. Bagga P K, Mahajan N C. Fine needle aspiration cytology of thyroid swellings: How useful and accurate is it?. *Indian J Cancer* 2010;47:437-42.
9. L. Leenhardt, G. Hejblum, B. Franc et al. Indications and limits of ultrasound-guided cytology in the management of nonpalpable thyroid nodules. *Journal of Clinical Endocrinology and Metabolism*. 1999;84(1):24-28.
10. Prema Saldanha and Huzaifa N Tak. Pitfalls in the Diagnosis of Fine Needle Aspiration Cytology of the Thyroid. *IJBR*. (2014) ;05 (12):774-77.
11. Jayaram G, Orell SR. *Thyroid*. In: Orell SR, Sterrett GF, eds. *Orell and Sterrett's Fine Needle Aspiration Cytology*. Churchill Livingstone, Elsevier, China, 2012: 118-55.
12. Kini SR. *Thyroid Cytopathology. An Atlas and Text*. WoltersKluwer/ Lippincott Williams and Wilkins, 2008.
13. Akerman M, Tennvall J, Björklund A, Martensson H, Möller T. Sensitivity and specificity of fine needle aspiration cytology in the diagnosis of tumors of the thyroid gland. *Acta Cytol* 1985; 29: 850-5.
14. Gharib H. Fine-Needle Aspiration Biopsy of the Thyroid Gland. <http://www.thyroidmanager.org/wp-content/uploads/chapters/fine-needle-aspiration-biopsy-of-the-thyroid-gland.pdf>.
15. Zubair W. Baloch, Virginia A. Livolsi. 2004. Pathology of thyroid and parathyroid disease. In ed: Stacey E. Mills, Darryl Carter. 4<sup>th</sup> ed, *Sternberg's Diagnostic Surgical Pathology*. Philadelphia: Lippincott Williams and Wilkins.
16. Sinna EA, Ezzat N. Diagnostic accuracy of fine needle aspiration cytology in thyroid lesions. *J Egypt Natl Can Inst* 2012; 24: 63-70.
17. Poller DN, E. B. Stelow EB, Yiangou C. Thyroid FNAC cytology: can we do it better? *Cytopathology* 2008; 19:4-10.
18. Nurismah M.I et. al. Fine Needle Aspiration (FNA) Cytology of the Thyroid: A Cyto-Histopathological Study of 361 Cases in Hospital Universiti Kebangsaan Malaysia. *Med and Health* 2007; 2(1): 58-65
19. E. L. Mazzaferri. Management of a solitary thyroid nodule. *The New England Journal of Medicine*. 1993; 328( 8): 553-559.
20. H. Y. Chang, J. D. Lin, J. F. Chen et al. Correlation of fine needle aspiration cytology and frozen section biopsies in the diagnosis of thyroid nodules. *Journal of Clinical Pathology*. 1997; 50( 12): 1005-1009.
21. M. Ikram, J. Hyder, S. Muzaffar, S. H. Hasan. Fine Needle Aspiration Cytology (FNAC) in the management of thyroid pathology—the Aga Khan University hospital experience. *Journal of the Pakistan Medical Association*. 1999; 49( 6):133-135.
22. N. Afroze, N. Kayani, S. H. Hasan. Role of fine needle aspiration cytology in the diagnosis of palpable thyroid lesions. *Indian Journal of Pathology and Microbiology*. 2002; 45(3): 241-246.
23. Safirullah, N. Mumtaz, A. Khan. Role of fine needle aspiration cytology (FNAC) in the diagnosis of thyroid swellings. *Journal of Postgraduate Medical Institute*. 2004; 18(2): 196-201.

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