

Role of Cytology in Thyroid Lesions: A Comparative study of Fine Needle Aspiration and Non Aspiration Techniques

[Tayde Ashish](#)¹, [Kulkarni Vishal](#)², [Hiwale Kishore](#)³

^{1,2} Assistant Professor of Pathology, JN Medical College, Sawangi (Meghe), Wardha, M.S.

³ Professor of Pathology, JN Medical College, Sawangi (Meghe), Wardha, M.S.

<http://dx.doi.org/10.18049/jcmad/228>

Abstract

Objectives: To evaluate cytological diagnosis of thyroid lesions and compare the results of Fine Needle Aspiration Cytology (FNAC) and Fine Needle Non Aspiration Cytology (FNNAC) and correlate the findings with histopathology. **Materials and Methods:** A total of 123 patients with thyroid swelling were included, which were then subjected to Fine needle Non Aspiration followed by Fine Needle Aspiration technique. Cyto-histology correlation was done. **Results:** Out of 123 cases 114 (92.68%) and 117 (95.12%) were adequate for diagnosis on FNAC and FNNAC respectively. The study recorded adequacy rates by FNNAC technique to be more (95.12%) when compared to FNAC (92.68%). The overall correlation of benign and malignant lesions was 96.66% and 75% respectively. The overall Sensitivity was found to be 75%, and Specificity 96.66%. The positive predictive value was 75% and negative predictive value 96.66% with diagnostic accuracy of 94.11%. **Conclusions:** The cytomorphological appearances of thyroid lesions obtained by the technique of FNAC and FNNAC are equally appreciative with histomorphological appearances. The cellularity thus obtained by FNAC and FNNAC is near similar. FNNAC doesn't have the advantage of superior cell yield as compared to conventional technique of FNAC but the combination of both techniques can fill the gap of inadequacy in minor number of cases. Both are the complimentary diagnostic techniques for cytodiagnosis of thyroid lesions with simple maneuvers, economical, safe, quick procedure as their advantages, which can safely be applied in all types of thyroid lesions.

Key words: Fine needle aspiration cytology, Fine Needle Non-Aspiration Cytology, Thyroid lesions.

Address for correspondence: Dr. Vishal Kulkarni

Assistant Professor, Department of Pathology, JN Medical College, DMIMS University, Sawangi (Meghe), Wardha, M.S, Email: drvishalkulkarni@yahoo.com, Mob:08223840503

Introduction

Thyroid swellings are commonly encountered in the surgical practice and accurate preoperative evaluation of thyroid disorder become mandatory for proper management of the patient and to avoid unnecessary surgery. Fine needle aspiration cytology (FNAC) of thyroid gland is now firmly established as a first line diagnostic test for evaluation of goitre and the single most effective test for the preoperative diagnosis of a solitary thyroid nodule. ^[1] Fine needle aspiration can be safely performed on an outpatient basis. ^[2] Fine needle aspiration cytology of the thyroid has become increasingly popular over last four decades. Needle aspiration is especially valued

because it is an office procedure done without advance preparation or anesthesia, safe, painless and rapid with high diagnostic accuracy and also inexpensive.

There is another technique, however, Fine Needle Non-Aspiration Cytology (FNNAC) which avoids aspiration but still permits cytologic review of the masses. The new technique, fine needle nonaspiration cytology was originally developed in France and has been called as "Cyto-puncture" by French worker and then described by other names as "capillary suction technique", "needle puncture cytology" and "nonaspiration fine needle cytology". ^[3] This study was carried out to evaluate cytological diagnosis of thyroid lesions and compare the results of FNAC and FNNAC and

correlate the findings with those of histopathology, wherever any.

Materials and Methods

The present study was carried out in Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe), Wardha over a period of two years from June 2005 to May 2007. Patients presenting with various thyroid lesions attending outpatients department as well as indoor patients were included in this study.

A detailed history of patient was obtained and thorough clinical examination was done with particular emphasis on to the appearance, size, rate of growth, growth at any other site and associate changes in overlying skin and surrounding structures. In case of suspected malignancy any clinical evidence of metastatic spread was look for. The procedure was explained to the patient and verbal consent was obtained before the procedure was performed. For each patient Fine needle nonaspiration technique was performed first followed by fine needle aspiration technique. Smears were immediately fixed in 95% ethyl alcohol for Pap staining. Air dried smears were kept for MGG staining.

Histopathological Examination

Tissues for histopathology were obtained as biopsy or thyroidectomy specimens. The specimens received were studied macroscopically for size, shape, consistency, external surface, capsule and cut surface. All tissues were routinely fixed in 10 % formalin. Sections were taken which included the capsular portion as especially in case of adenomas and nodular goitre. Paraffin block sections were taken and stained with H and E. Cytology smears were classified as follows:^[4]

1. **Inadequate:** When the specimen contained insufficient material for cytological evaluation.
2. **Benign:** When the epithelial elements showed uniformity of cell size, shape and nuclear structures. Follicles lined by single layer of cuboidal cell were sometimes present. The colloid was present in large amount and cellularity was low.

3. **Suspicious:** When occasional epithelial cell showed marked cellular changes suggestive of malignancy or when cells were abundant but aggregated together in dense clumps.
4. **Malignant:** When large number of cohesive epithelial cells showed marked variation in size, shape and nuclear structure, frequently with irregular, enlarged multiple nucleoli. The colloid was scanty and cellularity was high.

Results

Age and Gender distribution

Total 123 patients were included in this study, out of which 101 (82.12%) were females and 22 (17.88%) were males. A clear predominance of females over males with female to male ratio of 4.6: 1 in thyroid diseases was noted. Out of 123 patients, 12 (9.75%) lied in between 10-20 years of age, 25(20.32%) were in between 21-30 years, 37(30.04%) were in between 31-40 years of age, 26 (21.13%) were in between 41-50 years of age, 14(11.38%) were in between 51-60 years of age and 9 (7.31%) were above 60 years. The majority of patients presenting with thyroid swelling were in 3rd decade of life. Incidence was low in children and old people.

Adequacy

All 123 patients were subjected to FNAC and FNNAC. Out of 123 cases 114 (92.68%) were adequate for diagnosis on FNAC. Out of 123 cases, 117 (95.12%) were adequate for diagnosis on FNNAC. This showed that more adequate smears were obtained by FNNAC when compared with FNAC.

Categorization of Cases

All the adequate cases were categorized as Benign, Malignant and Suspicious for malignancy. On FNAC, out of 114 adequate cases, 102 (89.47%) cases were benign, 8 (7.01%) cases were malignant and 4 (3.50%) cases were suspicious for malignancy. On FNNAC, out of 117 adequate cases, 105 (89.74%) cases were benign lesions, 8 (6.83%) cases were malignant and 4 (3.41%) cases were suspicious for malignancy (Table- 1).

Table- 1: Categorization and Distribution of Cytodiagnosis by FNAC and FNNAC and their Cytological and Histopathological correlation

| Cytological diagnosis | Cases | Histopathology Diagnosis available | Correlation with Histopathology | | |
|--|-------|------------------------------------|---------------------------------|----------------|-------------|
| | | | Correlated | Not correlated | |
| Benign | FNAC | 102 | 30 | 29 (96.66%) | 01 (3.34%) |
| | FNNAC | 105 | 30 | 29(96.66%) | 01(3.34%) |
| Nodular Colloid Goitre | FNAC | 79 | 27 | 25 (92.59%) | 02 (7.40%) |
| | FNNAC | 82 | 27 | 25(92.59%) | 02(7.40%) |
| Thyroiditis | FNAC | 20 | 01 | 01 (100%) | 00 |
| | FNNAC | 20 | 01 | 01(100%) | 00 |
| Follicular Neoplasm (probably benign) | FNAC | 03 | 02 | 01 (50%) | 01 (50%) |
| | FNNAC | 03 | 02 | 01(50%) | 01(50%) |
| Malignant | FNAC | 08 | 04 | 03 (75%) | 01 (25%) |
| | FNNAC | 08 | 04 | 03(75%) | 01(25%) |
| Papillary Carcinoma | FNAC | 07 | 02 | 02 (100%) | 00 (00%) |
| | FNNAC | 07 | 02 | 02(100%) | 00(00%) |
| Follicular Neoplasm (probably malignant) | FNAC | - | 01 | - | 01 (100%) |
| | FNNAC | - | 01 | - | 01(100%) |
| Medullary Carcinoma | FNAC | 01 | 01 | 01 (100%) | 00 |
| | FNNAC | 01 | 01 | 01(100%) | 00 |
| Suspicious for Malignancy | FNAC | 04 | - | - | - |
| | FNNAC | 04 | - | - | - |
| Total | FNAC | 114/123* | 34 (29.82%) | 30 (88.23%) | 04 (11.77%) |
| | FNNAC | 117/123# | 34 (29.05%) | 30 (88.23%) | 04 (11.77%) |

*92.68% Adequacy, #95.12% Adequacy

Distribution of Cases

Total 114 cases were diagnosed by FNAC, out of which 79 (69.29%) cases were nodular colloid goitre (Colloid Goitre, Multinodular Goitre, Colloid cyst), 20 (17.54%) cases were thyroiditis, 3 (2.63%) cases were follicular neoplasms (probably benign), 7 (6.14%) cases were papillary carcinomas, 1 (0.87%) case was medullary carcinoma and 4 (3.50%) cases were suspicious for malignancy. A total of 117 cases were diagnosed by FNNAC, out of which 82 (70.08%) cases were nodular colloid goitre, 20 (17.09%) cases were thyroiditis, 3 (2.56%) cases were follicular neoplasms (probably benign), 7 (5.98%) cases were papillary carcinomas, 1 (0.85%) case was medullary carcinoma and 4 (3.41%) cases were suspicious for malignancy.

Cyto-Histo Correlation

Out of 114 and 117 adequate cases on FNAC and FNNAC, histopathology was available in 34

(29.82%) cases and 34 (29.05%) cases respectively. Out of 34 cases, 30 (88.23%) cases were correlated with cytological diagnosis. Out of 27 cases diagnosed as nodular colloid goitre on cytology, 25 cases were confirmed by histopathology (92.59%). Out of 30 benign cases on FNAC and FNNAC, 29 (96.6%) were reported as benign (correlated) and 13.34% as malignant. Out of 4 malignant cases on FNAC and FNNAC, 3 (75%) were reported as malignant (Correlated) and 1 (25%) as benign. Out of 2 cases diagnosed as nodular colloid goitre on histopathology one was diagnosed as follicular neoplasm (probably benign) and other as papillary carcinoma on both FNAC and FNNAC. Out of 2 cases of follicular adenoma, 1 was confirmed (50%) and the other was diagnosed as nodular colloid goitre on FNAC and FNNAC. The 2 cases of papillary carcinoma were found to be well correlated (100%). One case of follicular carcinoma was

misdiagnosed as follicular neoplasm (probably benign) on FNAC and FNNAC. The correlation of thyroiditis and medullary carcinoma was 100% by both methods. No case was available for correlation of suspicious lesion.

Discussion

The present study recorded a high incidence in females with majority of patients in 3rd and 4th decades of life. Arda IS et al also found female predominance (9 male = 19% and 37 female 81%) in their study in which they compared fine needle aspiration biopsy (FNA) with thyroid ultrasonography and radionuclide scanning (RS) for evaluating thyroid nodules although their study population was 46 children with mean age of 9 years.^[5] Burch HB et al also found similar pattern of female dominance during their study from 1990 to 1993 in 422 patients in which they studied Fine Needle Aspiration of thyroid nodules.^[6]

In the present study, 9 of 123 aspirates were inadequate for opinion by FNAC method in which it was repeated in all 9 cases but each time yielded blood and cellularity was scant. The adequacy rate in the present study by FNAC was 92.68% which correlates with majority of studies which recorded adequacy rates between 90 - 93% as Friedman M et al in 1979^[7], Gagnetan CB et al in 1987^[8], Cap J et al in 1999^[9] found the almost similar adequacy rate of FNAC of thyroid.^[7, 8, 9, 10] As far as FNNAC is concerned, we found 117 (95.12%) samples were adequate for diagnosis out of 123 samples. The present study recorded adequacy rates by FNNAC technique to be more (95.12%) when compared to FNAC technique (92.68%). Santos JEC and Leiman G also found that nonaspiration fine needle cytology have some advantages over FNAC during their study on nodular thyroid disease.^[3] Raghuvver CV et al observed better adequacy rate with Fine Needle Sampling without aspiration in comparison to Fine Needle Aspiration cytology when they studied 200 cases during the year of 2002.^[11] Findings of Rizvi SAA et al was also similar to the observations of our study and study of some other authors. They compared Fine Needle Aspiration Cytology with Non-aspiration technique in thyroid lesions during the year of 2005.^[12]

The present study, categorized the lesions into benign, suspicious for malignancy and malignant by FNAC and FNNAC to access their prevalence. By FNAC, out of 114 adequate smears, 102 (89.47%) were benign, 4 (3.50%) were suspicious for malignancy depending on cytomorphological appearance (follicular neoplasm suggesting both benign and malignant features) and 8 (7.01%) were malignant. By FNNAC out of 117 adequate smears, 105 (89.74%) were benign, 4 (3.41%) were suspicious for malignancy and 8 (6.83%) were malignant. Gagnetan CB et al in 1987, Rizvi SAA et al in 2005 and Madrekar SRS et al in 1995 also found almost similar prevalence of thyroid lesions in their respective studies.^[8, 12, 13]

The cytological correlation is brought about by combination of the technique of FNAC and FNNAC with histopathological diagnoses of thyroid lesions. The cytodiagnoses obtained at application of FNAC and FNNAC did not differ in both the groups of benign and malignant cytodiagnoses. In the present study, total 34 patients underwent surgery. The overall correlation of benign lesions was 96.66%, 29 cases out of 30 were reported as benign on cytology, while only 1 case was reported as malignant (papillary carcinoma; false positive) on cytology. The overall correlation for malignant cases was 75%. Out of 4, 3 cases were diagnosed as malignant and 1 case was under diagnosed as benign (false negative). Out of the 4 cases which were suspicious for malignancy on cytology, no case was available for histopathology correlation, as 3 patients did not turn up for follow up and 1 patient refused surgery. In the present study after correlation there was 1 false positive and 1 false negative case each. The results of the present study, correlates well with the studies of Gershengorn MC et al and Mandreker SRS et al.^[4, 13] Mandreker SRS et al studied utility of fine needle aspiration (FNA) cytology for investigating thyroid lesions as the initial modality. They concluded that FNA biopsy of the thyroid can be used effectively as the initial modality in the evaluation of thyroid lesions, both nodular and diffuse. They also commented that FNA is a very useful tool in detecting neoplastic foci in multinodular goiter and also in evaluating solitary thyroid nodules.^[13] Sclabas GM et al observed FNA results as 76 (32%)

positive for malignancy, 53 (22%) negative for malignancy, 100 (42%) indeterminate for malignancy, and 11 (5%) nondiagnostic. There were 3 (4%) false-positive and 2 (4%) false-negative FNA results also observed.^[14]

As histopathological correlation was done in 34 cases and histopathology correlation was same for both FNAC and FNNAC, hence the values of comparison will be same for both the techniques. The overall Sensitivity was found to be 75%, and Specificity 96.66%. The positive predictive value was found to be 75% and negative predictive value 96.66% with diagnostic accuracy of 94.11%. The Sensitivity, Specificity, Positive and Negative predictive Values are comparable with Cap J et al, Sclabas GM et al and some other authors.^[9, 14, 15, 16]

Altavilla G et al when compared the histologic diagnoses with cytologic diagnoses to determine the accuracy of FNA cytology of thyroid lesions found a sensitivity of 71.43%, a specificity of 100% and an accuracy of 95.09%.^[17] Hawkins F et al concluded that correlation of cytologic findings with histological findings is possible as they observed that evaluation of their FNAB results yielded better results when suspicious cytologic findings were considered to be positive (2.4% false-negative, 86.3% sensitivity) rather than negative (6.5% and 65.7%, respectively) during their study about fine needle aspiration biopsy in the diagnosis of thyroid cancer and thyroid disease.^[18] Baloch ZW and LiVolsi VA concluded that fine-needle aspiration biopsy of thyroid nodules has proved to be sensitive, specific, and well accepted by patients because of minimal discomfort and complications.^[19] Klemi PJ et al commented that if only an unequivocally malignant cytologic finding is considered positive then FNA biopsy had a diagnostic specificity of 100%, a sensitivity of 55% and an accuracy of 95% among all the histologically confirmed cases after their study about fine needle aspiration biopsy in diagnosis of thyroid nodules.^[20]

Conclusion

Within the scope and the limitations and the study, it would be modest enough to state that the cytomorphological appearances of benign and malignant lesions of the thyroid obtained by the technique of FNAC and FNNAC are equally

appreciative with histomorphological appearances. The cell yield thus obtained by FNAC and FNNAC is found to be near similar. Therefore, it is concluded that FNNAC doesn't have the advantage of superior cell yield as compared to conventional technique of FNAC. The combination of both techniques can fill the gap of inadequate cell yield in minor number of cases. Both FNAC and FNNAC are suitable cellular diagnostic techniques in the thyroid to exclude the malignancies of it, as the negative predictive value is high and therefore can determine the treatment plan.

The high value of the specificity as observed in the present study is concluded for typing of the thyroid lesions as the convenient preoperative diagnosis which has a bearing in management of the thyroid lesions. Thus, FNAC and FNNAC are the complimentary diagnostic techniques for cytodiagnosis of thyroid lesions with simple maneuvers, economical, safe, quick office procedure techniques as their advantages, which can safely be applied in all types of thyroid lesions. Cytomorphological diagnosis obtained at FNAC and FNNAC has a high diagnostic accuracy, and hence is recommended as a necessary presurgical diagnostic procedure in the management of the patients with clinically enlarged thyroid.

Source(s) of support: Nil

Conflict of Interest: None declared

References

1. Orell SR, Sterrett GF, Walter MN, Whitaker D: Manual and atlas of Fine aspiration cytology: Churchill Livingstone, 3rd edition, 1999.
2. Suen KC, Quenville NF. Fine needle aspiration biopsy of the thyroid gland: a study of 304 cases. J Clin Pathol 1983; 36:1037-1045. [PubMed]
3. Santos JEC, Leiman G. Nonaspiration fine needle cytology- application of a new technique to nodular thyroid disease. Acta Cytologica 1988; 62 (3): 353-356. [PubMed]
4. Gershengorn MC, McClung MR, Chu EW, Hanson TAS, Weintraub BD, Robbins J. Fine needle aspiration cytology in the

- preoperative diagnosis of thyroid nodules. *Annals of Internal Medicine* 1977; 87(3): 265-269. [PubMed]
5. Arda IS, Yildirim S, Demirhan B, Firat S. Fine needle aspiration biopsy of thyroid nodules. *Arch Dis Child* 2001; 85: 313-317. [PubMed]
 6. Burch HB, Burman KD, Reed LH, Buckner L, Raber T, ownbey JL. Fine Needle Aspiration of Thyroid Nodules Determinants of Insufficiency Rate and Malignancy Yield at Thyroidectomy. *Acta Cytol* 1996; 40: 1176-1183. [PubMed]
 7. Friedman M, Shimaoka K, Getaz P. Needle Aspiration of 310 Thyroid Lesions. *Acta Cytologica* 1979; 23(3): 194- 203. [PubMed]
 8. Gagnetan CB, Roccatagliata G, Lowenstein A, Soto F, Soto R: The role of fine needle aspiration biopsy cytology in the evaluation of the clinically solitary thyroid nodule. *Acta Cytologica* 1987; 31(5): 595-595. [PubMed]
 9. Cap J, Ryska A, Rehorkova P, Hovorkova E, Kerekes Z, Pohnetalova D. Sensitivity and specificity of the fine needle aspiration biopsy of the thyroid: clinical point of view. *Clin Endocrinol* 1999; 51(6): 509-515. [PubMed]
 10. Bannur UC, Gowda KMS, Farrugia M. USG guided fine needle aspiration cytological analysis of thyroid lesion. *Lancet* 2006: 277-317.
 11. Raghuvver CV, Leekha I, Pai MR, Adhikari P. Fine Needle Aspiration cytology versus Fine Needle Sampling without aspiration. A prospective study of 200 cases. *Indian J Med Sci* 2002; 56(9): 431-439. [PubMed]
 12. Rizvi SAA, Husain M, Khan S, Mohsin M: A comparative study of fine needle aspiration cytology versus non-aspiration technique in thyroid lesions. *Surgeon* 2005; 3(4): 273-276.
 13. Mandreker SRS, Nadkarni NS, Pinto RGW, Menezes S. Role of fine needle aspiration cytology as the initial modality in the investigation of thyroid lesions. *Acta Cytol* 1995; 39(5): 898-904. [PubMed]
 14. Scwabas GM, Staerke GA, Shapiro SE, Fornage BD, Sherman SI, Vassilopoulou-Sellin R, Lee JE, Evans DB. Fine-needle aspiration of the thyroid and correlation with histopathology in a contemporary series of 240 patients. *Am J Surg* 2003; 186(6): 702-709. [PubMed]
 15. Lowhagen T, Williams JS, Lundel G, Sundblad R, Granberg P: Aspiration biopsy cytology diagnosis of thyroid cancer. *World J Surg* 1981; 5: 61-73. [PubMed]
 16. Gharib H. 6D- Fine needle aspiration biopsy of the thyroid gland, Thyroid function tests; 2005.
 17. Altavilla G, Pascale M, Nenci I. fine needle aspiration cytology of thyroid gland diseases. *Acta Cytologica* 1990; 34(2): 251-256. [PubMed]
 18. Hawkins F, Bellido D, Bernal C, Rigopoulou D, Valdepenas MPR, Lazaro E, Perez-Barrios A, De Agustin P. Fine needle aspiration biopsy in the diagnosis of thyroid cancer and thyroid disease. *Cancer* 1987; 59: 1206 – 1209. [PubMed]
 19. Baloch ZW, LiVolsi VA. Fine-needle aspiration of thyroid nodules. past, present, and future, *Endocr Pract*, 2004; 10(3): 234-241. [PubMed]
 20. Klemi PJ, Joensuu H, Nylamo E. Fine needle aspiration biopsy in diagnosis of thyroid nodules. *Acta Cytologica* 1991; 35(4): 434-438. [PubMed]