Original Article

Role of FNAC before Thyroid Surgery

Comparative Study of Fine Needle Aspiration Cytology (F.N.A.C) Vs Tissue Biopsy in Thyroid Glands: Following Bethesda System

Nadeem Reyaz[1], Muhammad Bahadur Baloch[2], Muhammad Ejaz Butt[3], Shaukat Siddique[1], Sadia Hussain Malik[4] and Javeria Noor[2]

ABSTRACT

Objective: To appraise the diagnostic role of fine needle aspiration cytology (F.N.A.C) as preoperative tool in patients with enlarged thyroid glands to avoid unnecessary surgery.
Study Design: Descriptive study
Place and Duration of Study: Department of Histopathology, Gulab Devi Hospital Lahore during period of three years i.e. January 2012 to December 2015.
Materials and Methods: A total of 185 patients were recruited for study of fine needle aspiration. Smears were made with the aspirated material and were stained with Hematoxylin-Eosin stain.
Results: There were 138 (74.59%) females and 47 (25.41%) male patients. Smears from 32 (23.19%) female patients were classified as malignant-Bethesda VI, 84 (60.87%) as benign-Bethesda II, 4 (2.9%) as suspicious for follicular neoplasia-Bethesda IV, 2 (1.45 %) as suspicious for malignancy-Bethesda VI, 3 (2.17%) as atypical-Bethesda-III and 13 (9.42%) aspirates were considered as unsatisfactory-Bethesda I. In case of 47 male patients, smears from 3 (6.38%) were classified as malignant-Bethesda VI, 38 (80.85%) as benign and 6 (12.77%) were considered as unsatisfactory-Bethesda I.
Conclusion: F.N.A.C is a safe, rapid, reliable and a simple test for discriminating between malignant and malignant lesions in nodules of the thyroid. It is currently practiced worldwide and proves to be the most cost-effective and dependable diagnostic procedure.
Key Words: Thyroid gland, Fine Needle Aspiration Cytology, Nodule, Bethesda Classification System

Citation of article: Reyaz N, Baloch MB, Butt ME, Siddique S, Malik SH, Noor J. Comparative Study of Fine Needle Aspiration Cytology (F.N.A.C) Vs Tissue Biopsy in Thyroid Glands: Following Bethesda System Med Forum 2020;31(9):136-140.

INTRODUCTION

Fine needle aspiration cytology (F.N.A.C) has now become a widely accepted and invaluable diagnostic tool in the overall management of patients[1]. The thyroid enlargement is relatively common finding in clinical practice and one of the major problems in our country[2]. The thyroid is influenced by a various pathologic lesions following inflammation, neoplasia, dietary iodine deficiency and iatrogenic causes that are manifested by varied morphologies[3].

[1.] Department of Pathology, Al-Aleem Medical College, Lahore.
[2.] Department of Anatomy, Shalamar Medical and Dental College, Lahore.
[3.] Department of Pathology, Amna Inayat Medical College, Lahore.
[4.] Ghurki Teaching Hospital, Lahore.

Correspondence: Dr. Nadeem Reyaz, Associate Professor of Pathology, Al-Aleem Medical College, Lahore.
Contact No: 03004232570
Email: drnadeemreyaz@yahoo.com

Received: March, 2020
Accepted: July, 2020
Printed: September, 2020

Despite the large number of lesions, it is convenient to consider them as categorized into two major types one who reveal a diffuse pattern and those that produce nodules. Diffuse thyroid lesions are those that are related with conditions affecting the whole gland such as thyroiditis and hyperplasia.
Nodular lesion consists of non-neoplastic hyperplasia like in toxic multinodular goitre, benign tumors e.g. toxic adenoma, malignant tumors like papillary, medullary & follicular carcinomas, and anaplastic carcinoma[3].
F.N.A.C is one of the accepted methods due to its simple, a-traumatic and cost effective qualities. Its specificity is >80 % in benign and >90% in malignant pathology giving it high precision rate[4]. Its diagnostic assessment has been found to be superior to ultrasonography and CT-scan[5].
Nowadays, F.N.A.C is recommended for the all patients before going for invasive procedures and treatment[6]. The diagnostic accuracy of this simple out-patient procedure is best when an experienced cytopathologist or a fully trained aspirator performs the aspiration, smearing and preservation[7]. To overcome deficiency and discrepancy of diagnosis, Bethesda System for reporting thyroid cytopathology is currently practiced. This system was established in 2008 to ensure strict

diagnostic criteria for thyroid F.N.A.C samples[8]. This classification system facilitated effectual communication among cytopathologists, surgeons, endocrinologists, radiologists and other health care providers correlating with thyroid diseases[9].

The study was therefore designed to evaluate the efficiency of Bethesda system in cytological diagnosis of thyroid lesion and to correlate it with histologic findings.

MATERIALS AND METHODS

A total of 185 patients including 138 females and 47 males, who presented with clinically suspicious thyroid enlargement and subjected for excision biopsy, during January 2012 to December 2015, at the Department of Histopathology, Gulab Devi Hospital, Lahore, Pakistan were accrued into this study. After taking written informed consent, a detailed history and physical examination, they were selected for fine needle aspiration cytology before going for surgical biopsy of the thyroid gland. This study is approved from institutional review board for Ethical clearance. The aspiration was done using a syringe holder inserted with 10 ml syringe and 22 to 25gauge needle from three different areas of the nodule. From the aspirate, two smears were prepared by spread method, one air dried for Giemsa's stain[10]and one wet fixed for PAP stain[11].

The cytological diagnosis was reported in six categories using Bethesda system of Classification[8]:

Bethesda I	No diagnostic / Unsatisfactory
Bethesda II	Benign
Bethesda III	Atypia of undetermined significance or follicular lesion of undetermined significance
Bethesda IV	Follicular neoplasm or suspicious for follicular neoplasm
Bethesda V	Suspicious for malignancy
Bethesda VI	Malignant

For histopathological assessment, 4-6µm thick sections of paraffin embedded tissue blocks were cut and stained with H&E stain. The histologic findings were recorded. Definite diagnosis was established under two categories:

1. Benign
2. Malignant

Surgical biopsies of all 185 patients underwent histopathological assessment.

RESULTS

A total of 185 fine needle thyroid gland aspirations were performed in the period between January 2012 to December 2015 at the Department of Histopathology, Gulab Devi Hospital, Lahore. These include 138(74.59%) female and 47(25.41%) male patients.

Table-1 shows the results of gender distribution in palpable enlarged thyroid gland aspirations performed on 185 patients.

In 115 (62.16%) cases on which biopsy was executed, the lesion was a solitary nodule; in 48 (25.94%) cases, several nodules were present, and cytology was executed on the nodule which was dominant. In 22 (11.89%) cases, there was diffuse non-nodular enlargement of the thyroid gland. Lesion on which F.N.A.C was performed included 135 (72.97%) solid lesions, 26 (14.05%) partially cystic and partially solid lesions and 8 (4.32 %) cystic lesions (Figure-1). Data regarding consistency in 16 cases (8.64 %), was not available amongst the 22 cases of diffuse enlargement.

Sample Adequacy: Out of 185 fine needle aspiration cases, 179 (96.76%) of the cytology specimens were taken as sufficient for cytological diagnosis.

Female Thyroid Lesions: Malignancy-Bethes daVI comprised 32 cases (23.19%) out of 138 aspirates performed on the thyroid gland. Benign lesion-BethesdaII accounted for 84 cases (60.87%), most of them consisting of uniform looking follicular arranged cells and colloid background. 3 (2.17) cases showed atypia-Bethesda III with slight pleomorphism and disturbed uniformity. A total of 4 (2.9%) cases were found to be suspicious for neoplasia-Bethesda-IV, 2 (1.45 %) cases were suspected for malignancy-Bethesda IV, 13 (9.42%) were considered as unsatisfactory-Bethesda I and were characterized by poor cellularity and hemorrhage. Majority of benign cases fall in age group of 10-19 years where as malignant are in 50-59 years age group (Table-2)

Male Thyroid Lesions: This group included 47 cases (25.41%), these comprised 3 (6.38%) as malignant-Bethesda IV with majority in 60-69 years age group, 38 (80.85%) as benign-Bethesda II in 10-19 years age group and 6 (12.77%) were considered as unsatisfactory cases-Bethesda I. There was no false-positive diagnosis of malignant neoplasm of the thyroid gland. The fine needle aspiration cytology findings were accordant with the histologic findings of the tissue biopsy (Table-3& 4).

The specificity, sensitivity and precision of fine needle aspiration cytology in the distinction of non-neoplastic (benign) from neoplastic (malignant) lesions of the thyroid gland in patients with an ample cytology smear were 83.56%, 100% and 87.03% respectively. The positive predictive value is 100 % while the negative predictive value is 61.9 % (Table-4).

Applying Fisher Exact test, no significant association ($p = 0.05$) was seen between clinical variables and cytological as well as histological findings.

Table No. 1: Cytological Diagnosis & Sex Distribution in 185 Cases of Thyroid Lesions

Cytologic diagnosis	Bethesda classification	Gender		Total	Overall percentages
		Male	Female		
Unsatisfactory	Bethesda-i	06	13	19	10.27 %
Benign	Bethesda-ii	38	84	122	65.94%
Atypical	Bethesda-iii	Nil	03	03	1.63 %
Suspicious for Follicular Neoplasia	Bethesda-IV	Nil	04	04	2.16 %
Suspicious for Malignancy	Bethesda-V	Nil	02	02	1.08 %
Malignant	Bethesda-VI	03	32	35	18.92 %
Total		47	138	185	100 %

Table No.2: Correlation between cytological diagnosis, age group and gender

Age Group (yrs)	Total No. of Patients	Gender Distribution							
		Male				Female			
0-9	02	B-I	1	B-IV	0	B-I	1	B-IV	0
		B-II	0	B-V	0	B-II	0	B-V	0
		B-III	0	B-VI	0	B-III	0	B-VI	0
10-19	92	B-I	1	B-IV	0	B-I	7	B-IV	0
		B-II	17	B-V	0	B-II	67	B-V	0
		B-III	0	B-VI	0	B-III	0	B-VI	0
20-29	16	B-I	1	B-IV	0	B-I	2	B-IV	0
		B-II	5	B-V	0	B-II	8	B-V	0
		B-III	0	B-VI	0	B-III	0	B-VI	0
30-39	24	B-I	2	B-IV	0	B-I	1	B-IV	2
		B-II	8	B-V	0	B-II	8	B-V	1
		B-III	0	B-VI	0	B-III	2	B-VI	0
40-49	16	B-I	0	B-IV	0	B-I	1	B-IV	1
		B-II	4	B-V	0	B-II	0	B-V	1
		B-III	0	B-VI	0	B-III	1	B-VI	8
50-59	22	B-I	1	B-IV	0	B-I	1	B-IV	1
		B-II	2	B-V	0	B-II	1	B-V	0
		B-III	0	B-VI	1	B-III	0	B-VI	15
60-69	13	B-I	0	B-IV	0	B-I	0	B-IV	0
		B-II	2	B-V	0	B-II	0	B-V	0
		B-III	0	B-VI	2	B-III	0	B-VI	9

Table No.3: Histological Diagnosis of the Thyroid Lesions

Histological Diagnosis	Number of Cases	Percentage
Malignant	35	18.91%
Papillary Carcinoma	14	40%
Follicular carcinoma	12	34.29%
Medullary carcinoma	04	11.43%
Hurtle cell tumor	02	5.71%
Lymphoma	02	5.71%
Anaplastic carcinoma	01	2.86%
Benign	146	78.92%
Normal thyroid tissue	08	5.48%
Follicular adenoma	56	38.35%
Multinodular goiter	37	25.34%
Colloid nodule and/or Follicular hyperplasia	32	21.92%
Thyroiditis	12	8.22%
Fibrosis	01	0.68%

Table No.4: Comparison of Cytological Diagnosis with Histological Diagnosis

Diagnosis	Cytological	Histological
Malignant	35	35
Benign	122	146
Atypical	03	Nil
Suspicious	06	Nil
Unsatisfactory	19	4
Total	185	185

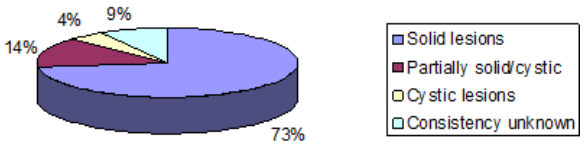

Figure No.1: Consistency of the thyroid swellings

DISCUSSION

F.N.A.C has a higher chance in detecting malignancies of the thyroid. Clinically visible thyroid gland nodules are common with an occurrence of 19%-67%[13]. In Pakistan, the incidence is more in females with male to female ratio 1:2.8[2].

In this study, the outcome supports the usage of F.N.A.C because of the higher rate of detection. There are various reasons for this

Firstly, there is a methodological difficulty of immobilizing the nodule while executing the biopsy, particularly for a mobile-smaller lump. It is uncomplicated to use 23G needle instead of using 18G spring-loaded trucut biopsy needle[13].

Secondly, the administrator (for F.N.A.C) would not waver to directly aim for the nodule even if the needle is perpendicular[14].

Thirdly, the F.N.A.C is able to accomplish a multi-directional lesion sampling. This is because the needle can be weaved in and out of the lesion to aim bigger part of the lesion and each time with a variation in direction or angle[15].

The series of Taki et al[16] and of Quinn et al[17]comprised of comparatively unselected nodular patients. The patients in our series were decidedly selected and encompassed patients in whom clinically guided F.N.A.C analysis was impracticable due to smaller lesion magnitude or in accessibility (18%). In spite of this, the 83.56% yields in our study are in comparison with the 90.1% and 96% yields in the investigation of Quinn et al. and Taki el al. respectively. However, our sensitivity of 100% for the recognition of malignancy is higher than 84% illustrated by Taki et al. The sensitivity of 87.1% in literature of Muratli, Erdogan[19] corresponds even well with our sensitivity.

Our accuracy 100% is perfectly matched with the series of Screaton et al[19] which shows 100% accuracy in the diagnosis of thyroid lesions by means of core-needle biopsy.

One of the five-year study by Parvez M[20] on 46 patients show 36.96% male and 63.04% female which is slightly incomparable with our study which shows 74.59% female patients. The malignant aspirate was only 4 while in our study the number of malignant aspirate are much higher (35 cases).

One methodology is to perform repetitive analysis, through this establishes a diagnosis in only half of cases taken into account as non-diagnostic at preliminary F.N.A.C analysis. In a further F.N.A.C analysis series, 6 to 8 aspirations were obligatory to acquire sufficient material in 23% biopsies[16].

Another approach is to practice US-guided F.N.A.C analysis, which enhances diagnostic outcome in palpable and particularly in non-palpable thyroid gland nodules[21,22]. The occurrence of non-diagnostic sampling may be decreased when F.N.A.C analysis is executed by a pathologist, enabling the pathologist to evaluate the lesion on clinical grounds.

One possible inadequacy of our investigation is the usage of concordant clinical follow-up findings as affirmation of the core-needle biopsy histologic findings. As the tumors of the thyroid gland grow slowly, there is theoretical possibility that a malignancy of the thyroid gland could remain undetected.

CONCLUSION

The results of this study revealed that F.N.A.C had 89.74% detection rate. In the setting of an outpatient clinic, the use of F.N.A.C for the diagnosis of suspicious thyroid nodules is highly recommended. F.N.A.C analysis, being low-cost, harmless and precise, has the potential to gain momentum as the screening tool of choice in the evaluation of patients with nodular disease of the thyroid gland. However, we would like to emphasize the significance of an excision biopsy to attain a conclusive histology before proceeding to definitive surgery in order to avoid cases of false positive results for F.N.A.C.

Author's Contribution:

Concept & Design of Study:	Nadeem Reyaz
Drafting:	Muhammad Bahadur Baloch, Shaukat Siddique
Data Analysis:	Sadia Hussain Malik, Javaria Noor
Revisiting Critically:	Muhammad Ejaz Butt
Final Approval of version:	Nadeem Reyaz

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Cappelli C, Pirola I, Agosti B, Tironi A, Gandossi E, Incardona P, et al. Complications after fine-needle aspiration cytology: a retrospective study of 7449 consecutive thyroid nodules. Br J Oral Maxillofac Surg 2017;55(3):266-9.
2. Zuberi LM, Yawar A, Islam N, Jabbar A. Clinical presentation of thyroid cancer patients in Pakistan-AKUH experience. J Pak Med Assoc 2004; 54(10):526-7.
3. Parry Z, Macnab R. Thyroid disease and thyroid surgery. Anaesth Intensive Care Med 2017; 18(10):488-95.
4. Joshi B, Khadgi K, Ghimire R. Determination of complications in computed tomography guided fine needle aspiration cytology of lung mass. J Inst Med 2017;40(2).
5. Eun NL, Son EJ, Kim JA, Gweon HM, Kang JH, Youk JH. Comparison of the diagnostic performances of ultrasonography, CT and fine needle aspiration cytology for the prediction of

lymph node metastasis in patients with lymph node dissection of papillary thyroid carcinoma: A retrospective cohort study. Int J Surg 2018;51: 145-50.
6. Iqbal A, Ismail M, Israr M, Ali N, Zaman J. Management of solitary thyroid nodule. J Postgrad Med 2011;19(1).
7. Cengic I, Tureli D, Ahiskali R, Bugdayci O, Aydin H, Aribal E. Thyroid fine needle aspiration biopsy: Do we really need an on-site cytopathologist? Eur J Radiol 2014;83(4):680-3.
8. Tuluc M, Solomides C. Thyroid Cytology. Otolaryngologic Clinics of North America 2014;47(4):475-89.
9. Cibas ES, Ali SZ. The Bethesda System For Reporting Thyroid Cytopathology. Am J Clin Pathol 2009;132(5):658-65.
10. BJB, S M Lewis : In. Dacie and Lewis Practical Hematology. 9 ed. London: Churchill Livingstone; 2002.
11. Alwahaibi NY, Alsubhi MS, Aldairi N, Alshukaili A, Bai UR. Comparison of ultrafast papanicolaou stain with the standard papanicolaou stain in body fluids and fine needle aspiration specimens. J Lab Physicians 2016;8(1):19.
12. Baldini E, Sorrenti S, Tartaglia F, Catania A, Palmieri A, Pironi D, et al. New perspectives in the diagnosis of thyroid follicular lesions. Int J Surg 2017;41:S7-S12.
13. Brennan PA, Mackenzie N, Oeppen RS, Kulamarva G, Thomas GJ, Spedding AV. Prospective randomized clinical trial of the effect of needle size on pain, sample adequacy and accuracy in head and neck fine-needle aspiration cytology. Head Neck J Sci Spec 2007;29(10): 919-22.
14. Hall TL, Layfield LJ, Philippe A, Rosenthal DL. Sources of diagnostic error in fine needle aspiration of the thyroid. Cancer 1989;63(4):718-25.
15. Dhankhar A, Gupta AK, Beg MF, Khandal PJ. A comparative study of fine needle aspiration cytology verus trucut biopsy in a palpable breast lumps. Int J Sci Res 2018;7(1).
16. Taki S, Kakuda K, Kakuma K, Annen Y, Katada S, Yamashita R, et al. Thyroid nodules: evaluation with US-guided core biopsy with an automated biopsy gun. Radiol 1997;202(3):874-7.
17. Quinn SF, Nelson HA, Demlow TA. Thyroid biopsies: fine-needle aspiration biopsy versus spring-activated core biopsy needle in 102 patients. J Vasc Interv Radiol 1994;5(4):619-23.
18. Muratli A, Erdogan N, Sevim S, Unal I, Akyuz S. Diagnostic efficacy and importance of fine-needle aspiration cytology of thyroid nodules. J Cytol 2014;31(2):73-8.
19. Screaton NJ, Berman LH, Grant JW. US-guided core-needle biopsy of the thyroid gland. Radiol 2003;226(3):827-32.
20. Parvez M, Malik A M, Anwar A. Solitary thyroid nodules: Incidence of thyroid cancers. Pak J Pathol 2001;12(2):25-9.
21. Accurso A, Rocco N, Palumbo A, Leone F. Usefulness of ultrasound-guided fine-needle aspiration cytology in the diagnosis of non-palpable small thyroid nodules. Tumori 2005;91(4):355.
22. Gill AS, Amdur R, Joshi AS. Importance of FNA Technique for Decreasing Non-diagnostic Rates in Thyroid Nodules. Head Neck Pathol 2017;1-6. 017-0844-8.