

Original Research Article

The reliability of fine needle aspiration cytology in the diagnosis of thyroid swelling

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ABSTRACT

Background: For a thyroid swelling, FNAC is the primary investigation. In most of the lesions, after excision, the Histopathology remains the same, but at times a few surprises do occur when FNAC reported benign lesions are found to be malignant on histopathology. The study aims to find reliability of FNAC in diagnosing Thyroid Lesions.

Methods: This prospective study was conducted on 111 patients with thyroid swelling attending IIMSR, Medical College, Jalna during a period of two years. These patients with thyroid lesions were subjected to FNAC and then following the surgery correlated with the histopathology report.

Results: Majority of the patients were in the age group of 30-50 years with female predominance. Out of 111 patients studied with FNAC, 1 sample was inadequate. Among remaining 110 cases 99 were benign thyroid lesions, 6 were malignant and 5 were highly suspicious of malignancy. HPE of thyroid specimen confirmed 101 cases as benign and 9 cases as malignant. Case in which inadequate material was obtained on FNAC was not included in study.

Conclusions: FNAC is about 98.18 % reliable in diagnosing thyroid lesions. FNAC is easy, reliable and accurate investigation for all thyroid swellings.

Keywords: Cytology, FNAC, Thyroid gland

INTRODUCTION

Thyroid swelling is one of the commonest presentations in surgical outpatient department. Fine needle aspiration cytology (FNAC) has played a pivotal role in diagnosing thyroid gland lesions. Fine needle aspiration cytology is a diagnostic tool in which cells are extracted from palpable swelling using FNAC gun, syringe and fine needle. It is a simple, speedy, safe, cost effective and accurate technique being used worldwide.¹

Thus, investigations are pulled out of the laboratory into the outpatient department. But, pitfalls come along either due to less pressure, inadequate specimen or due to excess pressure; the cells are flushed away with blood.

The success of FNAC is contingent upon several important contributing influences including aspirator's experience, skillful cytological interpretation and a rational analysis based upon a synthesis of cytological and clinical information in the context of an individual patient.² USG Guided FNAC is becoming increasingly popular. During this procedure, USG guidance instead of palpation seems to enhance the value of the FNA diagnostic accuracy.^{3,4}

Objectives of this study aims at correlating the cytological diagnosis and histopathological diagnosis to evaluate sensitivity and specificity of FNAC, there by its role in pre-operative diagnosis of thyroid swelling and planning proper management.

- To obtain adequate sample by the FNAC technique
- To study the various cytological features of aspirated material for making cytological diagnosis
- Comparing the FNAC with histopathological report, on the basis of diagnostic accuracy
- To study the reliability of fine needle aspiration cytology in the diagnosis of the thyroid swelling
- To study complications, if any, associated with FNAC.

METHODS

A prospective study comparing FNAC and HPE was performed on 111 patients who visited IIMSR Medical College and Hospital, Jalna over 2 years duration with the complaints of a thyroid swelling. Only the cases from which adequate material for FNAC was obtained were included in the study.

The other cases in which the material was not adequate or had some technical inadequacies were not included. All the patients were above 15 years of age. In all cases FNAC was done first using a 23G needle followed by surgery and histopathological examination.

Inclusion criteria

- All patients attending IIMSR Medical College and Hospital, Jalna with thyroid swellings
- Patients between the ages of 15 years to 60 yrs.

Exclusion criteria

- Patients who have been referred with other causes of neck swelling
- Age less than 15 years
- Those patients who are not undergoing surgery.

After a detailed clinical examination along with making note of any doubtful sites on the thyroid gland the patient was investigated with a thyroid function test. After taking consent of the patient, the patient was subjected to the FNAC. Procedure of FNAC- After making the patient comfortable on a couch a small pillow is placed below the shoulder blades of the patient to extend the neck. A hollow needle of fine gauge (21-23G) is attached to a syringe (10cc). After fixing the lesion with the fingers the patient is advised not to swallow.

The needle is inserted into the lesion and suction is applied by pulling back the plunger of the syringe. The needle is then passed back and forth through the lesion several times. On completion of aspiration, suction is released and pressure within the syringe allowed equalizing. The needle is then withdrawn; the contents of the needle are then sprayed onto a glass slide for examination. Some of the smears were fixed in methanol and stained by Papanicolaou stain, the others were air dried and stained by May-Grunwald-Geimsa stain. No special stains were used.

Staining methods

Papanicolaou staining method (by rapid PAP method)

The fixed smear was hydrated in tap water for 1 minute, then blotted and nuclear staining was done for 30 seconds. This was followed by blueing in tap water for 1 minute. The smear was then dehydrated briefly for 30 seconds and placed in cytoplasmic stain for 30 seconds, rinsed in water for 1 minute followed by final dehydration, clearing and mounting.⁵

May-Grunwald-Geimsa staining method

The smear was stained with working MGG stain for 3 minutes. It was rinsed in distilled water, blotted dry and then stained with working Geimsa stain for 30 minutes. After a rinse in distilled water, smears are dried, cleared and mounted using DPX.⁵



Figure 1: Technique of fine needle aspiration cytology (FNAC).

The FNAC smears of the patients included in the study were assessed by a single observer using a modified scoring system of Mair and colleagues.⁶ Diagnostically superior were those specimens in whom the cellularity was good, the architecture was not destroyed with least blood clots. The cytology results were categorized into four groups-inadequate, benign, suspicious, and malignant.

Ultrasonography of thyroid gland and thyroid hormone profile was done in all thyroid swelling. All patients underwent surgery and specimen was sent for histopathological examination. FNAC results were correlated with histopathological findings. The tissue was processed routinely, and paraffin embedded blocks was prepared. Sections cut at 4-6 μ m were stained with Haematoxylin and Eosin.

FNAC procedure

A hollow needle of fine gauge (21-23G) is attached to a syringe (10cc). After fixing the lesion with the fingers the patient is advised not to swallow. The needle is inserted

into the lesion and suction is applied by pulling back the plunger of the syringe. The needle is then passed back and forth through the lesion several times. On completion of aspiration, suction is released and pressure within the syringe allowed equalizing. The needle is then withdrawn; the contents of the needle are then sprayed onto a glass slide for examination. Some slides are air dried and some are fixative fixed.

Complications

- Local hemorrhage: It can be prevented or minimized by pressing over the aspiration site for several minutes
- Hematoma: This can cause some discomfort but can resolve over several days
- Pain: sometimes patient may experience pain for 24 hours after the procedure
- Transient bradycardia and fainting: these are noted in a few cases possibly due to vasovagal stimulation cases and respond quickly to conservative therapy
- Tracheal puncture: This can cause a coughing pause and small amounts of blood may be coughed up, however recovery occurs within minutes
- Transitory vocal cord paresis and tenderness have been reported
- Implantation and dissemination of tumour has been occasionally reported in FNAC of thyroid.

Data was analyzed by sensitivity, positive predictive value, frequency and percentage.

RESULTS

Majority of the patients were in the age group of 41-50 years (36.4%).

Table 1: Age distribution.

Age in years	Frequency	Percentage
20-30	18	16.4
31-40	28	25.5
41-50	40	36.4
51-60	24	21.0

Gender distribution

In this study out of the 110 patients, 92 were females (83.6%).

Table 2: Clinical break up of cases.

Diagnosis on clinical examination	Number of cases
Multi-nodular goiter	83
Solitary nodules	15
Toxic nodular goiter	3
Thyroiditis	4
Suspicious of malignancy	5
Total	110

Table 3: Cytological break up of cases.

FNAC findings	Number of cases
Benign	98
Malignant	7
Suspicious of malignancy	5
Inadequate sample	1
Total	111

Table 4: Pathological break up of benign lesions.

Benign lesions on FNAC	Number of cases
Colloid goitre or nodular goiter	90
Hashimotos Thyroiditis	3
Adenomatous hyperplasia	2
Hyperplastic nodule	2
Adenomatous nodule	1

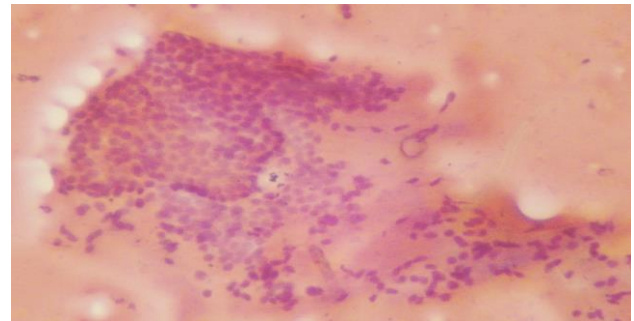


Figure 2: FNAC- nodular goitre, monolayered sheets of follicular cells (MGG 400X).

Cytopathological correlation of benign lesions

On final HPE Report, 85 specimens were diagnosed as Nodular/Colloid Goitre, 12 as Hashimoto’s thyroiditis, 7 as papillary carcinomas, 3 as follicular adenomas, 2 as follicular carcinomas and 1 as adenomatous hyperplasia.

Hashimoto’s thyroiditis as per cytological findings

In our study, 3 cases were diagnosed as Hashimoto’s Thyroiditis (HT) based on FNAC findings and all HPE reports were consistent with FNAC findings.

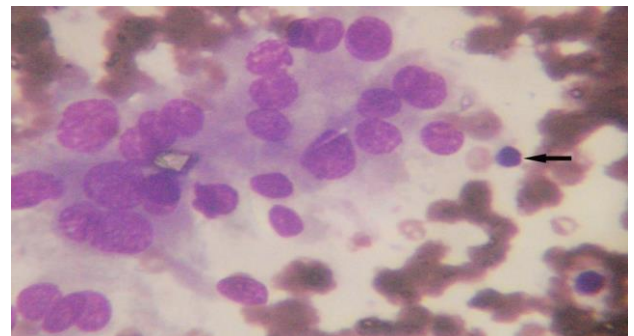


Figure 3: FNAC- Hashimoto’s thyroiditis, arrow showing a lymphocyte (MGG 400X).

Age and sex distribution of Hashimoto's thyroiditis based on histopathological report

On HPE total 12 specimens were reported as Hashimoto's Thyroiditis (HT). Out of 12, 11 patients were female and majority of them were in age group of 31-50 yrs of age.

Table 5: Cytological break up of malignant cases.

Malignant lesion on FNAC	Number of cases
Follicular neoplasm	4
Papillary carcinoma	3

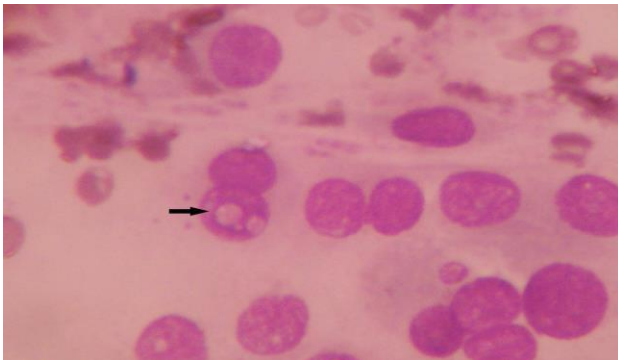


Figure 4: FNAC- papillary carcinoma, arrow showing an inclusion body (MGG 400X).

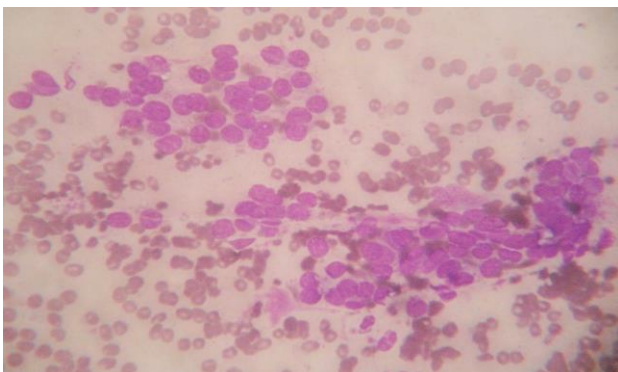


Figure 5: FNAC- follicular neoplasm, (MGG 400X).

Cytopathological correlation of malignant cases

On FNAC 7 cases were suspected of having malignancy and on HPE all cases were confirmed as malignant. Hence specificity of FNAC proved to be 100%. On FNAC 4 cases were suspected of follicular neoplasm, out of which 2 turned out to be follicular carcinoma, 1 encapsulated variant of papillary carcinoma and 1 follicular variant of papillary carcinoma.

Similarly, 3 cases were suspected of papillary carcinoma on FNAC and proved to be papillary carcinoma only on HPE. Among 98 benign cases, as per FNAC, 2 cases turned out to be papillary carcinoma after HP examination. Hence finally on HPE 7 cases turned out to

be papillary carcinoma and 2 cases follicular carcinoma as per HPE report.

Age and sex distribution of papillary carcinoma based on HPE report

In our study, 7 cases were proved to be of papillary carcinoma after HPE. Among these 5 patients were female and most of them belongs to age group of 31- 50 yrs.

Age and sex distribution of follicular neoplasm based on HPE report

On HPE 5 cases were follicular neoplasm. 3 cases were follicular adenoma and 2 cases follicular carcinoma. 4 of them were female.

Complications associated with FNAC procedure

In our study, we have come across not a single complication. This proves that FNAC is very safe procedure. Improved skill and experience has made FNAC a safe procedure.

Data was analyzed by sensitivity, positive predictive value, frequency and percentage. Sensitivity (in %) was found to be 77.78, Specificity was 100%, Accuracy was 98.18% and there were no False positives with 2 false negative cases.

DISCUSSION

Fine Needle Aspiration Cytology (FNAC) Thyroid disorders are varied in their presentations and characteristics. An established first line of investigation for any evident thyroid swelling is a 'Fine Needle Aspiration Cytology (FNAC) after a thyroid function test.^{7,8} It has gained popularity based on the facts that it is easy to perform, quick, has a high degree of sensitivity and specificity and is less painful.

Age incidence

In our study when we analyzed the demographic data the age group of 41-50 years (36.4%) constituted most of the cases with mean age group of 40 yrs. similar findings were seen in a study by Afroze et al in 2000, 40.2 years was found to be the mean age group when thyroid diseases were studied by them.⁹ In a study by Islam M S et al in 2010, 37.7 years was found to be the mean age group when thyroid diseases were studied.¹⁰ In another study by Sreeramulu et al in 2012, 35.4 was the mean age group.¹¹

Sex distribution

In a study by Kamal et al in 2002, 86.5% of patients were females, which was the similar to finding in our study where 83.6% of the patients were females.¹² While in a

study by Afroze, 71.76 % of patients were female.⁹ A study by Sreeramulu showed female percentage of 69 when thyroid swellings were studied.¹¹

Comparison of neoplastic to non-neoplastic

In our case series we analyzed the ratio of comparison of neoplastic to non-neoplastic lesions on FNAC we found that the ratio was 1: 14. In the reports by Safirullah et al in 2004 and Kamal et al ratio of neoplastic to non-neoplastic lesions were 1:7.6 and 1:7.2 respectively.^{12,13} Similarly, in study by Hyang-Mi Ko et al in 2003, ratio of neoplastic to non-neoplastic lesions was 1:19.2.¹⁴

Non-neoplastic group characteristics

Results obtained in a study by Rizvi and Khan, the non-neoplastic group consisted of 82% of patients with colloid goitre.¹⁵ In another study by Sengupta A and colleagues 76% of cases were diagnosed as colloid goitre based on FNAC.¹⁶ In our study 98 patients had benign lesions, out of which, 90 (91.83 %) patients had colloid goitre, 3 patients had hashimotos thyroiditis, 2 patients had adenomatous hyperplasia, 2 patients had hyperplastic nodule and 1 patient had adenomatous nodule on FNAC.

Neoplastic group characteristics

In a study by Islam and others on evaluation FNAC of the neoplastic thyroid swellings, papillary carcinoma was the most common with 14 of the 19 patients with malignancy having papillary carcinoma, followed by follicular carcinoma in 3 patients, follicular variant of papillary in 1

patient and one patient with high suspicion of malignancy which was contrast to our study, in which based on FNAC of the neoplastic thyroid swellings papillary carcinoma was detected in 3 patients and follicular neoplasm in 4 patients.¹⁰

Sensitivity and specificity of FNA smears

In a study by Islam, sensitivity and specificity of FNAC in the diagnosis of thyroid swelling was evaluated to be 73.68% and 97.26%.¹⁰ Similarly, Sengupta et al studied FNAC of patients with enlarged thyroid and their study demonstrated sensitivity around 90%, and specificity 100%. Agarwal et al.^{16,17} In their study evaluated thyroid nodules in 100 cases and in their study FNAC demonstrated a sensitivity of 76.5%, and a specificity of 95.9%.

FNAC diagnosis and histological diagnosis

The diagnostic accuracy of Correlation between FNAC diagnosis and final histological diagnosis was 88.8% in a study by Basolo et al.¹⁸ Same was demonstrated as 90.9% in a study by Agarwal S. Study by Islam had accuracy of 94.44% and Sengupta A and group had accuracy of 98.31%. In our study accuracy was 98.18%.^{10,16,17} In our study we correlated the cytological findings with HP findings for malignant lesions. In our study- we had Accuracy 98.18 %, Sensitivity 77.78%, specificity 100%, PPV 100%, NPV 98.05%, kappa statistics is 0.786 and p value for the comparison was <0.001. This shows that there is a significant co relation between FNAC diagnosis and final histological diagnosis.

Table 6: Comparison of the accuracy, sensitivity, specificity, false positives and false negatives in various studies in FNAC diagnosis and histological diagnosis.

Studies/ parameters	Islam et al ¹⁰	Sreeramulu et al ¹¹	Safirullah et al ¹³	Sengupta et al ¹⁶	Present study
Total cases	90	200	265	178	110
Mean age group (in yrs)	37.7	35.4	-	34.5	40
Female patients (%)	71.12	69	-	79.21	83.6
Neoplastic:non-neoplastic ratio	-	1:6.1	1:7.6	1:5.5	1:14
Sensitivity (in %)	76.68	74	94.7	90	77.78
Specificity	97.26	100	94	100	100
Accuracy	94.44	-	94.2	98.31	98.18
FP	2	0	5	0	0
FN	5	42	2	2	2

The presentations of the thyroid gland diseases are widely varied. The course of treatment and follow up rests on the proper diagnosis of the disorder with specific investigations. Surgical excision of all nodular thyroid lesions would entail a large number of unnecessary

procedures. Thus, FNA of thyroid is basically a technique that helps in differentiating lesions that require surgery from those can be managed conservatively. It can be used as initial modality in the evaluation of palpable thyroid nodules. FNA of palpable thyroid nodules allows for the identification of thyroid carcinoma and planning of

subsequent appropriate therapy. But Differentiation of follicular carcinoma from follicular adenoma is almost impossible on FNAC.

CONCLUSION

FNAC is a minimally invasive, highly accurate and cost-effective procedure for the preoperative assessment of patients with thyroid lesions. FNAC procedure is usually not associated with any complications. Improved skill and experience has made FNAC a safe procedure.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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