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Research Article

Benefits and limitations of FNAC in thyroid diseases: our institutional experience

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ABSTRACT

Background: To assess sensitivity and specificity of FNAC as a preoperative diagnostic tool for thyroid pathology.
Methods: Relevant clinical data (demographic- age, sex, place, occupation) including history was obtained from the patient. A detailed clinical examination was performed. All these patients were subjected to various investigations which include thyroid function test and FNAC. Then the patients were subjected to routine line of management and followed up. The main component of this study FNAC was performed as per prescribed standard technique; these findings were then correlated with histopathological diagnosis.
Results: Out of 150 patients, Eighty eight percent of the patients (132 cases) in our study were females and the rest 12% of the patients were males (18 cases). 72.73% of the females had benign swellings and 27.27% had malignant tumours of thyroid gland whereas 61.11% of male patients in our study had benign swellings and 38.89 % had malignant tumours of thyroid gland. The sensitivity and specificity of FNAC were 84.48%and 78.26%respectively. The positive and negative predictive values were 90.74%and 66.67% respectively.
Conclusion: FNAC is safe, simple with economical and cost effective procedure. It gives a reliable pre-operative cytological diagnosis based on which surgical procedures can be confidently executed. An attempt is made hereby to compare our results with worldwide documented literature. The primary purpose is to avoid the false negative cytological reports in thyroid carcinoma as negative report gives a clinician a false sense of security that is harmful in the interest of both the patient and surgeon.

Keywords: FNAC, Thyroid diseases, Sensitivity, Specificity, HPE

INTRODUCTION

The thyroid gland is the host to many disease processes which range from benign and malignant neoplasm and metabolic derangements to infectious and inflammatory disorders. The successful diagnosis and treatment of thyroid disease is based on a thorough understanding of the normal anatomic, physiologic and pathologic features of the thyroid gland.

Success in the surgical management of a patient can be conveniently divided into three phases–pre, intra, and postoperative. Vitally important is the preoperative decision making and planning. An expertly performed surgery for a wrong reason is still a bad surgery. The foundation for this success is a thorough knowledge of surgical anatomy and pathology.

In this study, patients presenting to our department of surgery with thyroid swellings were diagnosed clinically, taken up for FNAC and results were compared with postoperative histopathology of the specimens. The study on 150 patients with thyroid swellings confirms the accuracy, sensitivity and specificity of this technique.

The primary purpose of Fine Needle Aspiration Cytology (FNAC) is to provide the clinician with a reliable, rapid and inexpensive tissue diagnosis in most of palpable masses and sometimes non palpable swellings with image guidance. The principal advantage of this procedure is that it requires no hospitalization/anaesthesia. But the results are sometimes misleading in hands of poorly qualified examiners.

The aim of this study is to understand the correlation between FNAC and histopathology of surgically operated specimens. An attempt is made to know the real efficacy of this routine procedure in arriving at a fairly reasonable diagnosis before treatment.

METHODS

As the scope of the study is too vast, we have limited ourselves to 150 cases of thyroid enlargement diagnosed over a period of past 3 years.

Smears obtained by FNA were routinely stained with by both MGG and Papanicolaou stains. Resulting smears were fixed in ethyl alcohol. Aspiration in all cases was performed using a 23 gauge disposable needle attached to 20 ml plastic syringe. In some cases, representative sampling was attempted by aspirating 2 or 3 different areas of the lesion.

Informed consent was obtained in all cases.

Cytopathologic Interpretation

Fine needle aspiration cytology diagnoses were placed in four categories:

1. Benign, meaning aspirates that were benign cysts. Colloid nodules, adenomatous hyperplasia or thyroiditis.
2. Malignant, meaning aspirates suggestive of papillary, follicular, medullary or anaplastic carcinoma.
3. Suspicious, meaning findings suggestive of but not definitive for malignancy.
4. In-adequate means inadequate material for diagnosis.

Test performance parameters were calculated as follows.

Sensitivity = Ratio of Malignant lumps identified to the sum of Malignant lumps identified + False negatives

Specificity= Ratio of Benign lumps identified to the sum of Benign lumps identified + False positives.

Method of collection of data followed was a detail history, physical examination, investigations, operative procedure performed and follows up of patients with HPE reports. Inclusion criteria followed were all euthyroid patients, hypothyroid conditions, nodular goitres, colloid goitres and suspected malignancies.

RESULTS

The cytological features and diagnosis of 150 thyroid swellings subjected to FNA are represented below and correlated with histopathology findings. The sex ratio of study population was Male =18 patients & Female = 132 patients.

The results and observations of our study are depicted as follows:

Age Incidence

Most of the patients in our study were in the age group of 21-40 yrs and accounted for 54.66% of the patients. Least number of patients (1.33 %) were in the age group of 0-20 yrs. The mean age was 40.84 yrs.

Table 1: The Age distribution of the patients.

Age Group (Yrs)	No. of Patients	Percentage
0-20	02	01.33 %
21-40	82	54.66 %
41-60	55	36.66 %
61-80	11	07.33 %
81-100	Nil	

Sex Incidence

Out of 150 patients, Eighty eight percent of the patients (132 cases) in our study were females and the rest 12% of the patients were males (18 cases). 72.73% of the females had benign swellings and 27.27% had malignant tumours of thyroid gland whereas 61.11% of male patients in our study had benign swellings and 38.89 % had malignant tumours of thyroid gland.

Table 2: Sex wise distribution of benign and malignant pathologies.

Gender	Benign	Malignant	Total
Males	11 (61.11 %)	07 (38.89%)	18 (12 %)
Females	96 (72.73 %)	36 (27.27 %)	132 (88 %)

The FNAC and histopathological reports were grouped under benign and malignant conditions and the true positives, true negatives, false negatives and false positives were calculated.

Table 3: Summary of results.

	HPE Benign	HPE Malignant/ Otherwise
FNAC Benign	98 cases (true positives)	18 cases (false negatives)
FNAC Malignant	10 cases (false positives)	36 cases (true negatives)

Sensitivity of FNAC = 84.48 % Specificity of FNAC = 78.26 %

Positive predictive value= 90.74 % Negative predictive value= 66.67%

Out of 150 cases of thyroid swelling subjected to FNAC in the present study, all patients underwent surgical operation and final HPE confirmation and sensitivity of FNAC in diagnosing benign conditions was almost cent percent for colloid or nodular goitres and almost 70% diagnostic in malignancy of papillary nature, especially presenting with solitary nodule.

In this study we have evaluated its sensitivity and specificity with respect to each disease process, by comparing it with clinical diagnosis and histopathology reports, determining its efficiency as first priority investigation in patients with thyroid disease.

Table 4: Comparison of the histopathological diagnosis with fine needle aspiration reports.

	MNG	Colloid goitre	Thyroiditis	Papillary carcinoma	Follicular neoplasm	Hyperplastic goitre
FNAC	80	28	06	16	18	2
HPE	68	22	10	24	Follicular Adenoma = 8 Follicular Ca= 6 cases Papillary Ca with Thyroiditis = 2 Papillary Ca = 4	6

Table 5: Comparison of our study with documented literature.

Authors	No. of cases	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Luish Lopez et al[1]	872	90%	99.8%	98%	99%
Mojghan Amrikachi et al[2]	6226	93%	96%	92%	99%
Muhammad Saddique et al[3]	90	75%	95.83%	81.81%	93.81%
Our study	150	84.48 %	78.26 %	90.74 %	66.67 %

DISCUSSION

Numerous Investigations like radio iodine scan, ultrasound scan, Thyroid suppression tests, hormone analysis and many others while leading the Surgeon along a uncertain path towards the diagnosis and thus towards a surgical strategy have proven to be unreliable to a large extent when the final diagnosis of histopathology is obtained, all in spite of the cost the patient incurs. Fine needle aspiration cytology examination introduced by our Scandinavian Colleagues in the nineteen fifties is a reliable, cost effective and simple procedure which has stood the vigorous assault of all its critics among both the surgeons and the physicians and has proved to be the single most important factor in achieving a pre-operative diagnosis there by aiding or altering the surgical strategy or in other forms of management of thyroid pathology (Charles V. Mann et al, Ikram M. et al 1999, Harsoulis P. et al 1986).[4]

The accuracy of fine needle aspiration was found to be the same as large bore needle (16-18 gauge) and true cut needle (14 gauge) (Aschcraft et al 1981) while the latter two are associated with more complications.[5]

Cases of needle tract implantation have been reported in literature (Block et al 1980) but need not be given importance in view of their rarity.[6]

Sampling error occurs in 7.5% to 46%of cases documented in literature. This is high in cases where the size of nodule is more than 4 cm or less than 1cms, when there is haemorrhage into a nodule, or, MNG.

The true value of FNA lies in patient selection and case identification. It can also prevent surgery on benign nodules and thyroiditis. The results of this study highlight its utility in diagnosis of neoplasms and its differentiation from cellular goitre. Patients with long history of thyroid enlargement, family history of goitre, bilateral lobe affection, have a low probability of malignancy and can be treated conservatively.

Smears from non neoplastic nodules as a rule contained much colloid and few cells. In contrast, aspirates from neoplastic lesions there was little colloid but high cellularity (Low Hagen T, Springer E et al 1974).[7]

Silverman et al described aspirations from 309 patients of whom only 60 were treated surgically. Of these 60 patients 72 % of resected lesions were neoplastic. This very high surgical yield was possible because most non-neoplastic lesions were safely excluded by pre operative confirmative cytological diagnosis.[8]

Thyroid cysts can be safely aspirated and aspirate examined cytologically. As per Backdahls M, Walter G, and Low Hagen T et al, analysis of DNA content in aspirated cells was found to be helpful in delineating benign from malignant cells.[9] An unsatisfactory representative specimen occurs in 7% to 18% of patients in a reported series, but when repeated 50 % of these aspirates are diagnostic (Mazzaferri E. L et al 1993).[10]

As per one series (Van Hearle A.J., Ljung S et al) sensitivity of FNAC was 92 % and specificity was 74%.[11] In another review of 177 cases (EinhornJ, Franzen S et al 1962) good correlation was found between cytologic and histological findings. Of the 52 histologically proven carcinoma, 48 (92%) had cytological reported evidence.[12]

FNAC is the procedure of choice in solitary thyroid nodule (Bertil Hamberger et al 1982) but the report of benign disease in FNAC has to be viewed with suspicion in three settings namely first when a nodule appears in a graves thyroid, secondly when a nodule appears with previous history of radiation to head and neck and lastly when the nodule looks clinically malignant.[13] But in view of the efficiency of needle biopsy in recognizing clinically malignant tumours it should be used routinely in diagnosis of all thyroid nodules (George Crile et al 1979).

Not only is FNAC very reliable in differentiated cancer, but it is equally faithful in cases of anaplastic carcinoma and thyroiditis (George Crile et al, 1979).[14]

FNAC can help in the diagnosis of metastatic deposits in the thyroid which can be diagnosed cytologically giving a clue to area of primary and also in management of generalised enlarged thyroid with dominant nodule which is suspicious (Hilal M. Alsayer et al, 1985).[15]

FNAC diagnosis is reliable to such an extent that frozen section used extensively can be limited to for pathologies detected as suspicious on FNAC. While follicular neoplasm definitely needs histological examination to rule out carcinoma, rest of the FNAC confirmed pathologies do not need frozen section routinely and surgical management can be planned based on FNAC report alone (Chow et al, 1999).[16]

FNAC proved to be useful in thyroid lesions, especially to distinguish neoplasms from non-neoplastic conditions. The results were fairly reliable in colloid and nodular goitres and in solitary nodules. The results vary in different series, but in most of large series, the overall accuracy rate exceeds 90 % with 5% - 10 % frequency of false positive and false negative diagnosis.

The common causes of false negative reports are:

a) Follicular adenoma mistaken for adenomatous goitre.
b) Cystic changes can occur in papillary carcinoma.
c) Chronic Thyroiditis can co-exist with many types of thyroid malignancy.
d) Inadequate cell sampling.

A false positive diagnosis can be given if

a) Cellular colloid goitre is mistaken for neoplasms.
b) Chronic Lymphocytic thyroiditis can be misdiagnosed as malignant lymphoma.

Fariba Binesh, Ali Akbar Salari in their cross-sectional study, reviewed reports of 600 fine needle aspiration cytology of the thyroid and found no false-positive results between malignant FNA and histopathology and so positive predictive value was 100%. They concluded that Fine-needle aspiration of the thyroid gland is highly accurate and has a low rate of false-positive diagnosis in case of malignant results.[17]

Al-Hureibi Khalid A.et al evaluated the correlation between fine needle aspiration cytology and the histopathological findings in cases of the thyroid swellings. They concluded that sensitivity of FNA cytology is very low compared to published studies, which had adversely affected the surgical decision making as well as the outcome.[18]

SangalliG, Serio G, Zampatti C, Bellotti M, Lomuscio G evaluated the efficacy of fine needle aspiration cytology (FNAC) of thyroid with histological control. Their study confirmed the great efficacy of thyroid FNAC, failure to recognize the follicular variant of papillary carcinoma was the main problem in the interpretation of thyroid FNAC.[19]

Chowdhury, Jyothi Das, Sulekha, Maji, Debas, evaluated the effectiveness of fine needle aspiration of thyroid nodules to reliably diagnose thyroid malignancy, using histopathology as the 'gold standard'. The sensitivity, specificity and positive predictive value of fine needle aspiration cytology to diagnose a papillary carcinoma in their study were 80.7%, 96.5% and 87.0%respectively. The accuracy of fine needle aspiration cytology was 80.9%.[20]

Oktay Irkorucu et al. reviewed their own experience with fine needle aspiration biopsy (FNAB) and frozen section (FS) in thyroid surgery and to assess the value of FNAB and FS in predicting malignancy in patient with thyroid disease. Their data supported the use of FNAB in the confirmation of malignancy and the need for operation. The routine use of FS is not warranted. Selective use of FS when FNAB is non diagnostic or indeterminate may provide additional information. Both FNAB and FS failed to reveal occult carcinomas ofthyroid.[21]

Mojghan Amrikachi, Ibrahim Ramzy, Sheldon Rubenfeld, Thomas M. Wheeler conducted a study to determine the accuracy of fine-needle aspiration biopsy diagnosis and to discuss the possible pitfalls. They concluded that Fine-needle aspiration of the thyroid gland is highly accurate and has a low rate of false-negative and false-positive diagnoses.[22]

Rima Bakhos et al evaluated the accuracy of thyroid FNA and causes of cytohistological discordance in their institution. Cytohistologic correlation was achieved in 88% of the cases. The false-negative rate was 4% and the false-positive rate was 8%. They concluded that most common pitfalls for false-negative diagnoses consisted of suboptimal material and under diagnosis of papillary carcinoma due to cystic degeneration. The most common pitfall for false-positive cases was over diagnosis of follicular neoplasms.[23]

CONCLUSIONS

The following conclusions are drawn from the study:

1. FNAC is safe, simple with economy of cost and time.
2. FNAC does not require aid of another diagnostic test to maintain its high level of accuracy.
3. FNAC gives a reliable pre-operative cytological diagnosis based on which surgical procedures can be confidently executed.
4. It helps to filter out cases which can be successfully treated by conservative methods and thus reduce unnecessary thyroid surgery. Thus the overall management of thyroid nodules improves by a reduction in the number of operations for benign lesions without a decrease in the number of surgeries for malignant lesions.
5. Thus in terms of cost effectiveness and time economy, cytohistological diagnosis has important advantages over the compared data with less decisive conventional clinical work up and the greater cost and morbidity of various other diagnostic procedures, while maintaining high degree of specificity and sensitivity.
6. Cytological diagnosis of FNAC need not be treated with hesitation and required treatment can be instituted based on FNAC alone.
7. In case of benign lesions as per FNAC few cases of malignancy detected later on should not raise alarm keeping in mind the limitations of the procedure.

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