

Evaluation of fine needle aspiration cytology as a screening tool in thyroid lesions

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Abstract

Objective: To assess the efficacy of fine needle aspiration cytology in the evaluation of thyroid lesions.

Methods: The retrospective study comprised data of all patients who presented for fine needle aspiration cytology at the Shifa International Hospital, Islamabad, between January 2009 and April 2011. The data was retrieved from the departmental records and the results were recorded. All cases who underwent subsequent surgery were also retrieved and histopathology results were compared with the cytology results. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were calculated.

Results: Of the 327 patients, the results were inconclusive in 18 (5.5%), benign in 230 (70.3%), suspicious in 64 (19.6%) and malignant in 15 (4.6%) cases. Besides, 59 (18%) of these patients underwent subsequent surgery. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of fine needle aspiration cytology was calculated to be 85.7%, 73.3%, 50%, 94.2% and 76.2% respectively.

Conclusion: Fine needle aspiration cytology is a reasonably sensitive, specific and accurate initial diagnostic test for pre-operative evaluation of patients with thyroid swellings. The clinicians should be encouraged to use the procedure as it is minimally invasive and easily performed in an outpatient setting.

Keywords: Fine needle aspiration cytology, Thyroid. (JPMA 63: 1120; 2013)

Introduction

Fine needle aspiration cytology (FNAC) has been accepted as the first-line investigation^{1,2} in the management of thyroid lesions, especially solitary nodules. It is recommended as a screening tool basically to decide whether a patient requires surgical intervention or can be managed conservatively. Before the popularisation of FNAC, all cold nodules were subjected to surgery and the percentage of malignancy was only 14%³ but now in the developed countries it is about 50%.⁴

The aspiration is usually performed either by surgeons or pathologists and is highly operator-dependent. The accurate interpretation also requires an expert cytopathologist as there are a lot of overlapping features, especially in follicular lesions. To compound the confusion, previously pathologists used different diagnostic terminologies, but the recently published Bethesda system is an attempt at introducing a more uniform and objective system.⁵

The objective of our study was to document the spectrum of FNAC findings in our patient population and correlate the findings with histopathology to determine the diagnostic accuracy of FNAC of thyroid.

Patients and Methods

The retrospective study comprised data of all the patients who presented for FNAC at the Pathology Department of the Shifa International Hospital, Islamabad, with thyroid swellings from January 2009 to April 2011.

FNAC in all these patients was performed either by residents or consultants without local anaesthesia, using a 23-gauge needle. Smears were immediately fixed with 95% ethyl alcohol solution, and staining was performed using Papanicolaou, Hemacolor, and Haematoxylin and Eosin (H and E) stain. The cases were reported by different consultant pathologists depending on the departmental rota.

The cytology results were categorised into four groups: inadequate, benign, suspicious, and malignant. The histopathology results were classified as either benign or malignant. Criteria of adequacy for FNAC was the same as those that are universally accepted i.e. the presence of at least six groups of well-visualised follicular epithelial cells with at least 10 cells in each group.

Records of all patients undergoing thyroid surgery in the hospital were also retrieved and were cross-checked with those who had undergone FNA previously for correlation. A proforma was used for data collection, including registration number, age, gender, FNAC opinion, FNAC category, biopsy number and histology opinion.

Sensitivity, specificity, positive predictive value (PPV),

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negative predictive value (NPV) and diagnostic accuracy of FNAC were calculated using the formulae given below with the histopathology result taken as the gold standard. Follicular neoplasm was considered a positive diagnosis for statistical purposes as it is an indication for surgery.

Sensitivity= True positive X 100 / True Positive + False Negative

Specificity= True Negative x 100 / True Negative + False Positive

Negative Predictive Value= True Negative X 100 / False Negative + True Negative

Positive Predictive Value= True positive x 100 / False Positive + True Positive

Accuracy= True Positive + True Negative x 100 / True Positive + False Positive + True Negative + False Negative

Results

A total of 327 patients had undergone FNAC of thyroid swellings during the study period. The results were interpreted as inconclusive in 18 (5.5%), benign in 230 (70.3%), suspicious in 64 (19.6%) and malignant in 15 (4.6%) cases (Table-1).

Of the total, 59 (18%) patients were found to have subsequently undergone thyroidectomy and

neoplasm) versus the rest of the diagnoses (negative results) and compared with the results of the final histological study of the excised specimen in order to evaluate FNAC statistically, using histopathology as the gold standard to calculate the statistical values. Statistical analysis of the data demonstrated sensitivity, specificity, PPV and NPV of FNAC to be 85.7%, 73.3%, 50% and 94.2% respectively. Accuracy was 76.2% (Table-3).

Table-1: Distribution of cases on cytology (N = 327).

	Frequency	Percentage
Benign lesions (n=230)		
Adenomatous Colloid	207	63.3
Thyroiditis	19	5.8
Benign Cysts	4	1.2
Suspicious lesions (n=64)		
Follicular Neoplasm	27	8.3
Suspicious for Pap CA	19	5.8
Adenomatous nodule. Vs Foll. Neopl.	12	3.7
Hurthle cell Neoplasm	2	0.6
Thyroid Neoplasm (NOS)	4	1.2
Malignant lesions (n=15)		
Papillary carcinoma	9	2.8
Medullary carcinoma	1	0.3
Malignant	2	0.6
Lymphoproliferative disorder	3	0.9
Inadequate (n=18)		

Table-2: Comparison of FNAC and Histopathology results (N=59).

FNAC Diagnosis	Adenomatous colloid nodule/ goiter	Thyroiditis	Follicular adenoma	Papillary carcinoma	Other malignancy
Thyroiditis	1				
Adenomatous / cystic colloid nodule	23	1	1	2	
Adenomatous nodule vs Follicular neoplasm	6		1		
Follicular neoplasm	2	2	3	1	1
Suspicious for papillary carcinoma	4		2	3	
Papillary carcinoma				2	
Other malignancy				1	3
Total	36	3	7	9	4

histopathological examination of the specimens. Among them, 53 (89.83%) were females and 6 (10.16%) males. The mean age of these patients was 40.29±12.74 years (range: 16-80).

In terms of cytohistological correlation, histopathology confirmed, among others, 36 (61.0%) cases as adenomatous colloid goiter, 7 (11.8%) as follicular adenoma, and 9 (15.2%) as papillary carcinoma (Table-1).

Thyroid FNAC results were grouped as positive (malignant and suspicious results, including suspicious for follicular

Table-3: Evaluation of FNAC in thyroid lesions.

Category	No of cases (%)
True positives	12 (20.4%)
True negatives	33 (55.9%)
False positive	12 (20.4%)
False negative	2 (3.3%)
Sensitivity	85.7%
Specificity	73.3%
Positive predictive value	50%
Negative predictive value	94.2%
Accuracy	76.2%

A total of 13 cases were diagnosed as malignant on histopathology, and the most common malignancy was papillary carcinoma constituting 9 (69.2%) cases. Six out of the 9 (66.66%) were follicular variant of papillary carcinoma, and the remaining were of the conventional type.

Discussion

FNAC has changed the way thyroid nodules were managed and most clinicians rely on this tool for pre-operative assessment of thyroid nodules. The accuracy of the FNAC analysis approaches 95% in the best centres as regards differentiation of benign from malignant nodules of the thyroid.³ The sensitivity ranges from 65% to 98% and the specificity from 72 to 100%.⁴ In our study, the analysis of the data revealed a sensitivity of 85.7% and specificity of 73.3%, which translates into a diagnostic accuracy of 76.2%. The sensitivity, specificity, accuracy, PPV, and NPV in our study are comparable with other studies from different parts of the world.⁶ One study on 75 patients with enlarged thyroids reported a sensitivity of 80% and specificity of 86.6%.⁷ Similarly, a study conducted in Nigeria reported a sensitivity of 88.9%, specificity of 96.1%, and diagnostic accuracy of 94.2%.⁸

False negative FNAC results may occur because of sampling error or misinterpretation and depend largely upon the skills of the operator as well as the interpreter. However, it is difficult to calculate the true frequency of false negative results, because only a small percentage of patients with benign cytological findings undergo surgery. Most authorities are of the opinion that the true false negative rate is below 5%, even if all patients with thyroid FNAC have a histopathological examination.⁹ In the present study, two false negative cases were found with a rate of 3.3%. This is in keeping with reports in the literature that suggest a false negative rate of 2-7%.¹⁰

The false positive rate (FPR) was 20.4% in our study. However, this is not a good yardstick for FNAC of the thyroid as a large group falls in the category of suspicious or consistent with follicular neoplasm, out of which the majority turn out to be follicular adenomas or hyperplastic/adenomatous nodules. While evaluating our results not only all cases reported as malignant, but even those reported as suspicious for follicular neoplasm, papillary carcinoma or other malignancy were considered positive. This was because all the above need further surgical management. The PPV was 50%, while NPV was 94.2%, with a diagnostic accuracy of 76.2%, which was similar to the experience of others.⁶⁻⁸

We categorised our cytological results into Inadequate, Benign, Suspicious, and Malignant. However, the actual

terminologies used were different. As most of the benign conditions can be managed medically, it saves the patient from unnecessary surgery. In our study too, only 59 out of a total of 327 cases were found to have undergone surgery most likely for a cytologically suspicious or malignant diagnosis. However, compression symptoms or cosmetic reasons may also be the reason for surgery.

The Bethesda system recommends categorisation of results into six categories; I: inadequate; II: benign; III: atypical follicular cells of undetermined significance (FLUS); IV: follicular neoplasm (FN); V: suspicious for malignancy; and VI: malignant.⁵ Some researchers using this system have found considerable overlap in the categories and have proposed the use of a simplified four-category system, including inadequate/non-diagnostic, benign, FLUS/FN and suspicious for malignancy/malignant.^{11,12} This may be considered in the future, but currently the Bethesda system is in vogue.

Inconclusive FNAC results and diagnostic errors are unavoidable due to overlapping cytological features, particularly among hyperplastic adenomatoid nodules, follicular neoplasms, and follicular variants of papillary carcinoma. However, the use of stringent criteria and repetition can usually help in improving the accuracy which is also greatly dependent on the experience of the cytopathologist.¹³

In our study, among the suspicious group, only 5/25 (20%) cases were proven as malignant on histopathology. This is mainly due to the limitation of thyroid cytology in distinguishing follicular adenoma from carcinomas for which the diagnosis requires a detailed histopathological examination. Out of 16 cases in which suspicion of follicular neoplasm was raised, 14 (87.5%) turned out to be benign on histopathological examination. This is well known due to overlapping features of hyperplastic nodules and follicular neoplasms and is acceptable as the primary role of FNAC is as a screening tool for triage of patients.¹⁴

Inadequate samples in the study may have been because of sclerotic or calcified lesions or more commonly when there are large areas of cystic degeneration or necrosis. FNAC of 18 (5.5%) patients yielded inadequate samples in our study, which again corresponds to studies in which inadequate sampling has been reported from 1-5%.¹⁵ The advent of ultrasound (US)-guided FNA has improved sample acquisition from patients with small thyroid nodules that are difficult or impossible to detect on physical examination.

Though FNAC has a high NPV, which, in turn, is useful to

reassure the majority of patients presenting with thyroid enlargement, the possibility of sampling error must be kept in mind and findings must be correlated with clinical picture.

Conclusion

FNA cytology is a reasonably sensitive, specific, and accurate initial diagnostic test for the pre-operative evaluation of patients with thyroid swellings. The correlation of cytological and histopathological diagnoses is an important quality assurance method, as it allows cytopathologists to calculate their false positive and false negative results. The clinicians should be encouraged to use FNAC as the initial modality in the evaluation of thyroid lesions as it is minimally invasive and easily performed in an outpatient setting. A benign FNAC diagnosis should be viewed with caution as false negative results do occur and these patients should be followed up. Surgery must be performed if any clinical suspicion of malignancy exists even in the presence of benign FNAC report.

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